APPENDIX 3A-15

PHASE 1 ESA R-6

ENVIRONMENTAL SITE ASSESSMENT (ESA) REPORT SCVWD CONTRACT NO. A2327T

LOWER SILVER CREEK COYOTE CREEK CONFLUENCE TO ABORN ROAD SAN JOSE, CALIFORNIA

PROJECT 1445

Prepared for:

SANTA CLARA VALLEY WATER DISTRICT
COYOTE CREEK WATERSHED PROGRAM
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ENVIRONMENTAL SITE ASSESSMENT (ESA) REPORT
SCVWD CONTRACT NO. A2327T

LOWER SILVER CREEK
COYOTE CREEK CONFLUENCE TO ABORN ROAD
SAN JOSE, CALIFORNIA

EXECUTIVE SUMMARY

D&M Consulting Engineers, Inc. (DMCE) has prepared this Environment Site Assessment (ESA) Report for the Lower Silver Creek channel, extending from the confluence with Coyote Creek upstream to Aborn Road. The Santa Clara Valley Water District is planning projects on Lower Silver Creek as part of the flood protection improvement plans and activities within the Coyote Creek Watershed. Such projects require an analysis of hazardous material conditions for consideration during right-of-way acquisition, design and construction.

This ESA report provides DMCE's professional opinion on the potential current presence of "recognized environmental conditions" along Lower Silver Creek. The assessment included reviews of prior creek channel ESA work (including testing), stereoscopic aerial photographs, historic city business directories, regulatory files and environmental investigations for nearby sites. Regulatory agency database searches were performed to identify listed hazardous material sites up to one mile away. Field reconnaissance work was also conducted of the entire creek channel plus the immediate neighborhood. The compilation of information was evaluated with respect to potential environmental significance to the subject Lower Silver Creek channel. The only substantive issue identified in the prior creek channel ESA work was the special management excess sediments/soils were anticipated to require due to elevated (but non-hazardous) concentrations of pesticides, chromium and lead.

Two key aspects of assessing whether off-site contamination issues pose a threat to Lower Silver Creek were the identification of levels and gradients of first ground water. The extensive monitoring in the area has shown numerous instances of ground water levels shallower than 10 feet; in particular the Marburg/Las Plumas neighborhood, McKee between Highway 101 and King Road, and the Capitol/Story neighborhood. The shallower levels present a higher likelihood of ground water seepage into the creek and contact during channel improvement activities. Prior studies along Reaches 1 and 2 found strong indications of a hydraulic connection between the shallow ground water and creek water. Also, there is some evidence that local ground water exhibits an upward vertical gradient, which would enhance ground water to creek discharges.

Other than a couple exceptions at sites along Alum Rock Avenue, and in the immediate proximity of the creek, the natural prevailing lateral gradient direction of the local shallow ground water falls with a NW-SW arc. Contamination tends to migrate accordingly, so releases at sites on the eastern side of the creek represent greater concern than those to the west. However, we found no indication of plumes extending further than 200-300 feet.

The pre-1960 activities along Lower Silver Creek were predominantly agricultural. By the 1960's a few light industrial facilities began operations, particularly along Reaches 1 and 2. Several service stations have existed in addition to those operating currently, clustered along the commercial streets of McKee Road, Alum Rock Avenue, Story Road and S. White Road. At least nine dry cleaning businesses were identified but none are known to have released solvents. Some appear to not do the actual cleaning on-site. Other businesses of note include a bulk petroleum facility (2075 Alum Rock), trucking firms, painting contractors, and auto repair.

Of the 60+ identified sites within a 1/4-mile, the vast majority is deemed to be of little to no concern, primarily due to their distance from the creek channel. The only area DMCE believes warrants a moderate concern with respect to potential subsurface contaminant migration is the McKee/King intersection. Both a former gas station and an active station are close to the channel here. A total of 11 sites were deemed to warrant a low-moderate level of concern. Five of the 11 are included even though they are 300-1,000 feet away because they involve potential impacts from MTBE and PCE, which can migrate relatively long distances. The six other sites garnering a low-moderate concern are immediately adjacent to the creek channel, or less than 100 feet away. These involve a mixture of above-ground and under-ground issues. Of the six, only the Gummow/Royal Foods site has been tested as far as we have determined.

Conditions observed by DMCE during our site-walk included a few instances where drums or dumpsters were located in close proximity to the creek property. Exterior, uncovered storage areas and vehicle/equipment repair practices at a number of the adjacent properties also include equipment, containers and materials that appear likely to contact runoff ultimately leading into the creek, either by direct overland flow or via a storm drain. At least five of the local fuel leak cases have active remedial systems; all apparently involving low flow rate discharges of treated ground water to a storm drain (ultimately Lower Silver Creek). Between required monitoring and system safeguards, it is DMCE's opinion that these arrangements do not constitute a significant risk of environmental harm.

In some stretches there were fairly significant amounts of trash and debris immediately along the creek channel but essentially all of this material appeared to be of a non-hazardous nature – largely residential garbage, shopping carts and building materials. In many instances it appeared that the materials had been carried downstream some distance from an original entry point before coming to rest. The only five suspicious items observed were (1) part of a drum in the stream near the McKee Road culvert; (2) a half-dozen paint buckets on the maintenance road along Reach 4b; (3) a closed hydraulic oil bucket in the stream north of Eastridge Mall entrance; (4) a car battery near the end of Everdale; and (5) a fluorescent light fixture near the end of Everdale.

In conclusion, based on the information collected for this Lower Silver Creek ESA, DMCE identified the following 19 recognized environmental conditions in connection with the subject creek (organized in four categories):

- visible items -

1. dumpster adjacent to channel between Wooster and railroad
2. apparently empty drums adjacent to Reach 1b, left bank maintenance road
3. four drums along fence with DAP property
4. partial drum in the stream channel under the McKee-King intersection
5. restaurant trash bin with grease adjacent to creek at 1948 Alum Rock Avenue
6. discarded paint buckets on left bank maintenance road along Reach 4b
7. closed hydraulic oil bucket in stream channel north of Eastridge Mall
8. discarded car battery near end of Everdale
9. discarded fluorescent light fixture near end of Everdale

- potential subsurface migration items -

10. main Mrs. Smiths facility west of the railroad
11. Gummow/Royal Foods east of the railroad
12. existing Exxon at 1705 McKee and former gas station at 1696 McKee

- potential surface/runoff items -

13. DAP storage yard
14. truck maintenance/parts along Reach 1d
15. F&M Towing at 1948 McKee
16. Acme Refrigeration at 1941 Shortridge
17. Alum Rock outfall (due to likely historic Coast Oil discharges)

- general soil/sediment items -

18. creek sediments may contain elevated (non-hazardous) pesticides and/or metals
19. embankment soils may also contain such constituents

Figures 9 and 10 note the locations of items 1-17 above. Items 18 and 19 are not plotted as they apply to the creek channel as a whole. DMCE will develop recommendations for a Phase II evaluation of these items in concert with SCVWD staff based on the specific plans for the creek channel at each location.

ENVIRONMENTAL SITE ASSESSMENT (ESA) REPORT
SCVWD CONTRACT NO. A2327T

LOWER SILVER CREEK
COYOTE CREEK CONFLUENCE TO ABORN ROAD
SAN JOSE, CALIFORNIA

I. INTRODUCTION

As contracted by the Santa Clara Valley Water District (SCVWD), D&M Consulting Engineers, Inc. (DMCE) has prepared this Environment Site Assessment (ESA) Report for the Lower Silver Creek channel, extending from the confluence with Coyote Creek upstream to Aborn Road. Upstream of Eastridge Mall the watercourse is also known as Thompson Creek. The subject work involved a research level study incorporating a review of available records and visual observations.

A. Background

Figure 1 provides a Vicinity Map showing the current routing of the subject creek using a USGS topographic map as a base. Figure 2 is a Key Map from the December 1998 Watershed Project report (USDA, 1998) showing the numbered reaches up to Lake Cunningham. Upcoming projects on Lower Silver Creek are part of the many flood protection improvement plans and activities within the Coyote Creek Watershed. The projects are being designed to provide flood protection during the one percent (100-year) flood event. Currently planned channel improvements are summarized in Table 1 (USDA, 1998). In addition to these channel improvements along Reaches 1 through 6b, the District is implementing a sediment removal project along Lower Silver Creek from Lake Cunningham upstream to Aborn Road.

B. Scope/Objective

Both District projects mentioned above for Lower Silver Creek require an analysis of hazardous material conditions for consideration during right-of-way acquisition, design and construction. This ESA was prepared in general accordance with the American Society of Testing and Materials (ASTM) – Standard Practice for Phase I Environmental Site Assessments (E1527-97). A reconnaissance was performed along the entire creek length being evaluated to visually check for indications of "recognized environmental conditions." Also, a records search was performed for sites located up to 1 mile from the subject Lower Silver Creek channel. Sites of interest for follow-up file reviews were selected based on environmental concerns identified, distance from Lower Silver Creek, and location with respect to ground water flow direction and surface drainage patterns.

This ESA report provides DMCE's professional opinion on the potential current presence of "recognized environmental conditions" along Lower Silver Creek. The term "recognized environmental conditions," as defined by ASTM Designation E 1527-97, means:

> "the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, ground water, or surface water of the property. The term includes hazardous substances or petroleum products even under conditions in compliance with laws. The term is not intended to include *de minimus* conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies."

For purposes of this ESA, hazardous substances and petroleum products are jointly referred to as "hazardous materials."

C. Limitations

This report and the associated work have been provided in accordance with the general principles and practices currently employed locally in the environmental consulting profession. This is in lieu of all warranties, express or implied. No exploration, sampling or testing work was performed.

Our findings and opinions are based on information collected from historical photographs; maps; regulatory agency files, lists, and databases; interviews; and conditions at the time of our field reconnaissance work in May-August 2000. As explained later in this report there were only limited Fire Department records available for review. It is possible that other information exists or subsequently has become known, just as it is possible for conditions we observed to have changed after our observations. DMCE cannot warrant or guarantee that not finding indicators of hazardous materials means that hazardous materials do not exist on the subject creek channel property.

Any person who is aware of any recognized environmental conditions of the creek or surrounding areas that are different from those described in this report should report them immediately to this office for evaluation.

II. SUMMARY OF PRIOR ESA WORK

Phase I and II ESA work was performed for Lower Silver Creek Reaches 1 and 2 in 1991 and 1993. The District provided the corresponding reports (Emcon, 1991 and Harza Kaldveer, 1993), along with two associated SCVWD memoranda from 1993, to DMCE for review and evaluation. DMCE prepared a memorandum dated June 16, 2000 summarizing the findings and providing our comments.

The DMCE memorandum is provided in its entirety in Appendix A. Key aspects of the prior work are highlighted in this report section. Our comments are incorporated in *Section V – Conclusions*.

A. Sites Deemed of Potential Concern

The earlier studies identified a total of nine sites to be of potential concern for the channel improvement project planned at that time. Four of the sites were directly involved with the project's property acquisition process (Fearn, Gummow, and two portions of DAP). One other site was adjacent to the creek but not being acquired (Andrade Trucking). DMCE's recent reconnaissance work indicates continuing issues concerning potential surface runoff from these properties. Our research work uncovered information regarding recent investigations of multiple petroleum releases at the Gummow Property east of the railroad. Further, there appears to be no investigative information available regarding the Fearn (Mrs. Smith) Property west of the railroad, which has been light industrial for numerous years.

The remaining four sites were in the immediate neighborhood, potentially upgradient of this portion of the creek (Res-Com, San Jose Warehouse, Spartan Oil and Chevron). Subsequent information that DMCE reviewed for the new ESA work indicates that none of these four neighborhood sites constitute a recognized environmental condition for Lower Silver Creek.

B. Sampling and Testing

A total of 27 channel embankment locations received some soil sampling and testing, ranging from a single-depth scan for pesticides or solvents, to a broad suite of analyses at multiple depths. Five monitoring wells were installed and used for ground water sampling, plus six exploratory holes providing one-time samples. Various ground water testing was performed, but a key interest was solvents. Also, channel sediments were sampled and tested in 17 locations. The sediment testing was distributed along the two reaches. The other testing mainly focused on the four pieces of property being acquired by the District.

C. Analytical Results

Except for those samples collected from the vicinity of the eastern DAP property, embankment soil samples did not contain concentrations of contaminants such that the soils in the vicinity of the samples would require special management. The DAP embankment soils were categorized with a more widespread zone of sediments that contained elevated (but non-hazardous) concentrations of various chlorinated pesticides, chromium and lead. No ground water contamination problems were found.

D. Excess Soil/Sediment Disposal Issues

Although none of the levels of contamination technically classified the sediments and DAP embankment soil as hazardous waste for purposes of disposal in California, Harza Kaldveer reported that the local Class III (sanitary) landfills would not accept soil containing detectable pesticides. Accordingly, such sediments were deemed to require "special management" if offhauled. Extra project costs in excess of $350,000 (not including hauling) were estimated based on a volume of 11,000 cubic yards.

III. NEW ESA WORK TASKS

The work tasks for the subject ESA were set forth in DMCE's contract; Appendix ONE – Scope of Services, dated April 25, 2000. This report section describes the specifics of the new work.

A. Creek History and Setting

DMCE interviewed District staff about pertinent Lower Silver Creek history and any hazardous materials incidents utilizing questionnaires we have developed for ESA work (see Appendix B). The District's Project Manager – Jeff Tarantino – was provided a questionnaire. Mr. Tarantino forwarded copies to Carol Presley in the District's Environmental Compliance Division and Ken McKenzie in the District's Creek Maintenance Division, for them to complete as well as completing one himself.

Stereoscopic aerial photographs and historic topographic maps were reviewed for evidence of historic conditions and indication of environmental hazards. The documents span a time period of 1899-1987. A list of specific photos and maps we reviewed is included under *References*. A new search for Sanborn Fire Insurance Maps was made but we found no additional maps beyond those cited in prior ESA work for Reaches 1 and 2. Areas upstream of Reach 2 were outside the urban land uses covered by this type of map.

In-house DMCE files and reports containing pertinent information on the hydrogeologic setting of the creek channel area were reviewed. These mainly consisted of fuel leak follow-up investigations we have conducted.

A list of streets that cross or approach the creek channel was compiled so that we could review historic city business directories at the San Jose Main Library. The directory listings were checked at 5-year intervals over the years of 1927 to 1998-99. In a few instances we checked intervening years to establish listing periods for businesses of particular concern, such as service stations.

B. Drive-by Survey of Immediate Vicinity

A "drive-by reconnaissance" of properties in the immediate vicinity of the creek channel, within 1000 feet, was conducted by DMCE staff noting current businesses and facilities likely to use or store hazardous materials. For the intersecting major streets we also noted the addresses where the creek crossed through.

C. Regulatory Agency and Other Records Review

DMCE subcontracted with VISTA Information Solutions, a regulatory agency database search service, to provide an environmental records search for sites located up to 1 mile from the edges of the creek channel. The original report covered the creek up to Quimby Road, then a follow-up report covered the section from Quimby to Aborn. Both reports are presented in Appendix C. The records search included the following pertinent databases:

- U.S. National Priority List (Superfund);
- U.S. Comprehensive Environmental Response, Compensation, and Liability System (CERCLIS);
- U.S. Resource Conservation and Recovery Act (RCRA) Large Quantity Hazardous Waste Generators;
- U.S. RCRA Small Hazardous Waste Generators;
- U.S. RCRA Treatment, Storage, and/or Disposal Sites;
- U.S. RCRA Corrective Action Sites;
- U.S. RCRA Violations/Enforcement Action Sites;
- U.S. Emergency Notification System (ERNS);
- U.S. EPA Facility Index System (FINDS);
- Toxic Release Inventory System (TRIS);
- California State Deed Restriction Sites;
- California Toxic Pits Cleanup Facilities;
- California State Priority List (Calsites);
- California Leaking Underground Storage Tanks;
- California Registered Aboveground and Underground Storage Tanks;
- California State Regional Water Quality Control Board Spills List;
- Cortese Hazardous Substance Site List; and
- California Solid Waste Landfills, Incinerators, and Transfer Stations.

DMCE also reviewed the latest Quarterly Fuel Leak Activity Report downloaded from the District's Ground Water Protection Division – Leaking Underground Storage Tank Oversight Program (LUSTOP).

The compilation of listed sites was evaluated with respect to location and potential environmental significance to the subject Lower Silver Creek channel.

We reviewed LUSTOP files for sites deemed of interest and reviewed available San Jose Fire Department (SJFD) Hazardous Materials files for nearby sites of concern. Unfortunately, the SJFD is in the midst of converting their paper files into a computerized optical disk format using an outside contractor. Many of the files are out of the office (street names N-Z) and, as of the date of this Final Report, our review has been limited to those records already converted (street names A-M).

D. Creek Channel Reconnaissance/Site-Walk

DMCE staff performed a site reconnaissance along the entire length of Lower Silver Creek project alignment from the Coyote Creek confluence to Aborn Road. Most of the reconnaissance was conducted by a pair of personnel, each focusing on a respective bank of the channel.

The visual reconnaissance was primarily focused on any obvious evidence of potential contamination such as unusually stained soils, slabs, and pavements; suspicious outfalls, drains, sumps, drums, tanks, and electrical transformers; stressed vegetation; and discarded hazardous materials containers. Surface drainage patterns and areas around storm drain outfalls were particularly scrutinized for signs of contamination. We also observed, where possible, the

condition of adjoining public and private property. Noteworthy inspection observations were documented with photographs (see Appendix D).

IV. FINDINGS

A. Supplemental Historical Information

DMCE's compiled information concerning the historical conditions of the subject Lower Silver Creek channel and the immediate environs are presented on Tables 2A through 2H. The tables are organized by reach, working upstream from the Coyote Creek confluence. By standard convention, the left and right banks refer to a perspective facing downstream. The questionnaires completed by SCVWD representatives are presented in Appendix B.

The pre-1960 activities along Lower Silver Creek were predominantly agricultural, including a dairy and poultry operation along Reach 1 and a Mayfair Packing Plant along Reaches 3d and 3e. The few non-agricultural and non-residential land uses uncovered included a race track along Reach 3a, a drive-in along Reach 3b, a Geueral Electric facility at 1807 Alum Rock Avenue (also near Reach 3b) and a gas station at 1947 Alum Rock (~200 feet from Reach 3c). The GE building becomes a Civil Defense warehouse in the 1950's.

By the 1960's along Reaches 1 and 2 the light industrial facilities such as Mrs. Smith's, DAP, and Pollack Paper begin operations, plus several service stations and a dry cleaners along McKee. Gas station listings are also present for Alum Rock Avenue, Story Road and S. White Road.

Other businesses of note include the Coast Oil/Pacific Pride bulk petroleum facility at 2075 Alum Rock Avenue, trucking firms, painting contractors and auto repair. Several dry cleaning businesses are listed along S. White Road and Capitol Expressway but these historical records do not reveal whether the actual cleaning was done on-site or off.

The District's Project Manager for this ESA, Jeff Tarantino, had no specific knowledge of past hazardous material issues associated with the Lower Silver Creek channel. Carol Presley was familiar with the 1991-92 ESA work discussed in Section II and Appendix A. She offered no additional information of significance other than that two of the five monitoring wells installed and tested for the prior work were formally destroyed in 1995. Ken McKenzie was not aware of any additional items of pertinent note.

B. Hydrogeologic Setting

Most of the general aspects of this report section are taken from Harza Kaldveer (1993), Iwamura (1990) and state Water Resources Bulletin 118-1 (DWR, 1967).

The subject Lower Silver Creek channel is located within the limits of the City of San Jose, in the east-central portion of the Santa Clara Valley. The principal drainage in the Santa Clara Valley is Coyote Creek, which flows northwesterly out of the Coyote Valley and into San Francisco Bay. Lower Silver Creek has a watershed area of about 43 square miles, falls

approximately 50 feet over the length studied, and is a tributary to Coyote Creek. Smaller, seasonal creeks such as Migelita, Babb and Flint enter Lower Silver Creek from the uplands to the east. Upstream of Eastridge Mall, Lower Silver Creek is also known as Thompson Creek. Although the creek flows mainly in a northwesterly direction, there are sections flowing southwesterly and northeasterly (see Figures 1 and 2). Comments about how the current channel is different from historic routing are included where applicable in Tables 2A through 2H.

Santa Clara Valley is bordered on the east by the Diablo Range and on the west by the Santa Cruz Mountains. These ranges are composed of consolidated bedrock units that vary both in age and origin. The bedrock units are a minor, although unquantified, source of recharge to water-bearing alluvial valley fill and slowly release water to springs, and thus, may provide perennial flow to some streams that would otherwise be dry in summer. Bedrock units underlie the entire Santa Clara Valley at depths of 500 to 2000 feet.

The valley fill alluvium is the most important water-bearing unit in the Santa Clara Valley. The alluvium is composed of unconsolidated deposits of gravel, sand, silt and clay. In general, coarser materials are present toward the valley margins and, toward the valley center, the deposits become finer-grained. The latter materials tend to be more stratified, with alternating beds of fine-grained clays and sands. Quaternary age alluvial deposits of sand, silt and clay, and to a lesser extent gravel, underlie the subject Lower Silver Creek channel.

In plan view the Santa Clara Valley Basin is divided into two broad hydrographic units known as the "forebay", which occurs along the elevated edges of the basin where aquifer materials predominate, and the "confined zone", the flatter interior of the basin where aquifers are stratified and separated by significant aquitards. Historic supply wells that were not properly destroyed provide localized vertical conduits through the aquitards. Ground water generally flows from the elevated valley margins toward the valley center, generally reflecting surface elevation contours. At present, most useable ground water in the basin is pumped from the lower aquifer of the confined zone, and secondly the forebay. In general, the upper aquifer zone is only pumped for local domestic and industrial uses, agricultural/landscape uses, and chemical remediation projects.

Up to approximately Reach 4C (Capitol Expressway), Lower Silver Creek is located within the confined area of the Santa Clara Valley basin. From Reach 4C and upstream along the rest of Lower Silver Creek, the channel overlies the eastern forebay area.

During the Harza Kaldveer Phase II ESA work in the winter of 1992/93 the shallowest ground water zone was encountered in borings at depths ranging from 17 to 22 feet. When allowed to stabilize, ground water in monitoring wells was found to vary in depths from about 12 to 17 feet. The subsurface findings indicated stratigraphy under Reaches 1 and 2 consisting of sandy and silty clays to depths of about 20 feet, which then graded into interlayered silty sands and clays. The upper ground water zone appeared to be partially confined below the less permeable clayey soil that extended to a depth of about 20 feet.

The areal distribution of the five subject Phase II ESA monitoring wells did not allow a true triangulation of the shallow ground water gradient. However, since the ground water elevations in the monitoring wells were reportedly higher than the adjacent creek surface water, it is reasonable to conclude that the local creekside gradient at that time was toward the channel. The ground water elevations in the five wells also became lower in the downstream direction, roughly parallel to the fall in stream elevation.

Available reports of ground water studies at the DAP property showed that gradients varied across the site. Near the creek the ground water gradient was towards the stream channel (concurring with the Harza Kaldveer findings). On the other, northwestern side of the facility, some distance removed from the channel, the gradient was reportedly away from the stream, more consistent with the regional expectation (toward San Francisco Bay).

On the basis of these observations it was Harza Kaldveer's opinion that shallow ground water flow near Lower Silver Creek (at least between Wooster Street and North King Road) was from perimeter areas toward the creek with some vector component of flow in the downstream direction. Further, the consultant postulated that following wet or rainy periods the creek might provide ground water recharge, with a corresponding temporary change in flow gradient away from the creek. It is certainly reasonable to assume that the stream and immediately adjoining/underlying shallow ground water are in hydraulic contact.

During the course of our recent ESA work DMCE reviewed the LUSTOP files of many fuel leak sites in this area of the Santa Clara Valley. The predominant ground water gradient direction seen in the many years of monitoring falls within a NW-SW arc (see Figures 3 and 4). Only one site showed a consistent gradient that deviated from this – the Exxon at Alum Rock and Jackson. There, an ESE gradient has been documented. At another site on Alum Rock Avenue (EZ Fill) there is some indication of a NE trending gradient. The gradients themselves consistently fall between 0.01 and 0.001. Two reported transmissivity values from pump tests were 260 and 550 gpd/ft, typical of a silty sand.

The extensive monitoring of water (piezometric) levels in the shallow ground water zones generally has shown the levels to be higher in the past 3-4 years than they were in the late 1980's and early 1990's. Many areas, such as the Marburg/Las Plumas neighborhood, McKee between Highway 101 and King Road and the Capitol/Story neighborhood, have ground water levels shallower than 10 feet. Monitoring from most of the rest of the studied area showed ground water levels between 10 and 20 feet. The only consistent exception to this was the Exxon at Mount Vista and South White (~ 1,000 feet east of Lower Silver Creek) where water levels have generally been around 25 feet below grade. Very few sites have monitoring data from multiple depths. One that did, the Chevron at 1636 McKee, showed a consistently upward vertical gradient.

Five of the reviewed fuel leak cases indicated active remedial systems, with all apparently involving the discharge of treated ground water to a storm drain. At least two other sites appeared to be getting close to setting up similar systems. A general NPDES permit has been established by the San Francisco Bay RWQCB for this type of process. All of the active sites appear to be conducting regular testing of the effluent stream. While there is an inherent risk of discharges of contaminated water to the creek from these arrangements due to carbon breakthrough or other system failure, neither the volume nor fuel concentration of such a discharge would be high. Accordingly, a relatively rapid dissipation of the fuel residuals could be expected, with insignificant environmental harm.

C. Current Conditions in Immediate Vicinity

Lower Silver Creek flows through a predominately residential neighborhood, with commercial businesses clustered along the main streets (Alum Rock Avenue, King Road, McKee Road, Story Road, South White Road and Capitol Expressway). There are limited pockets of light industry, mostly along Reach 1.

An initial VISTA Site Assessment – Special Project report was prepared for the subject Lower Silver Creek channel up to Quimby Road on May 25, 2000. A supplemental report was prepared for the section between Quimby and Aborn Roads on August 14, 2000. Both reports are included in this ESA as Appendix C.

The VISTA reports present the results of a search of over 20 federal, State and regional databases, along with a description of each. The databases include addresses and a variety of information on sites of known hazardous material storage tanks; landfills; hazardous waste generation or treatment, storage and disposal facilities; and subsurface contamination in the surrounding area.

The VISTA reports identify 28 sites within 1/8 mile; 35 additional sites between 1/8 and 1/4 mile; 66 more sites between 1/4 and 1/2 mile; and one additional TSD site between 1/2 and 1 mile from the subject creek. Detail Maps 1-4 (Figures 5-8) display the locations of the listed sites relative to the creek. Based on our review of VISTA's "unmapped sites", most fall outside the study area and none of the others appear of significant concern.

DMCE's current knowledge about known releases (primarily fuel leaks) in the immediate area of Lower Silver Creek is summarized in Table 3. The criteria for a site being included in this table are proximity, likely upgradient position, and/or type of listing; all considered in the context of potential concern. The listing follows a general upgradient trending order.

Table 3 includes the distance and direction to the closest approach of Lower Silver Creek; the site name and address; highlights about the severity and status, plus ground water gradient information (if available); and DMCE's opinion on relative degree of concern. Since Fire Department records have not been fully available, the District's LUSTOP files were used as the primary information source for all sites with fuel leaks.

The only area DMCE believes warrants a moderate concern with respect to the Table 3 information is the McKee/King intersection. The former gas station site at 1696 McKee is not a listed fuel leak case and we uncovered no information about its condition, positive or negative. The Exxon station is an active fueling facility. The facility had a documented release but only soil was impacted and the matter was resolved to regulatory satisfaction.

The vast majority of the sites listed in Table 3 are deemed to be of low concern, primarily due to their distance from the creek channel. Five sites that warrant a low-moderate level of concern even though they are 500-1,000 feet away are the known fuel leak at 1655 McKee and four upgradient dry cleaners along South White Road. This is because the associated chemicals, MTBE and PCE, can migrate relatively long distances. The four other sites garnering a low-moderate concern are immediately adjacent to the creek channel. They involve a mixture of above-ground and under-ground issues. Of the four, only the Gummow/Royal Foods site has been tested as far as we have determined.

Tables 4A through 4G describe the conditions of surrounding locations as observed by DMCE during our site-walk and drive-by work. The tables are organized by reach, working upstream from the Coyote Creek confluence. By standard convention, the left and right banks refer to a perspective facing downstream.

Lower Silver Creek crosses under the McKee Road-North King Road intersection at a corresponding address location of 1700 McKee. At Alum Rock Avenue the approximate street address location for the creek is about 1950; at East San Antonio, it is about 2010; at Jackson Avenue, it is about 650; and at Story it is about 2900. At Cunningham, Tully and Quimby no specific nearby addresses were observed but the Santa Clara County Thomas Bros. Map indicates approximately 2700, 2500 and 2400, respectively.

Other than a few areas where drums or dumpsters were observed (see Photos 11, 12, 17 and 29), there were no point source items of note. In some stretches there were fairly significant amounts of trash and debris immediately along the creek channel but essentially all of this material appeared of a non-hazardous nature. Much of the material appears to be residential garbage. Exterior, uncovered storage areas and vehicle/equipment repair practices at a number of the adjacent properties include equipment, containers and materials that appear likely to contact runoff ultimately leading into the creek, either by direct overland flow or via a storm drain (see Photos 16, 19 and 28). A dry cleaning store was observed at 3281 South White Road, near where the creek crosses under Aborn Road, but this business apparently does not do the cleaning on-site and was not listed in the VISTA report.

D. Creek Channel Conditions

Tables 4A through 4H describe conditions observed by DMCE during our site-walk of the subject Lower Silver Creek channel. The tables are organized by reach, working upstream from the Coyote Creek confluence. By standard convention, the left and right banks refer to a perspective facing downstream. Noteworthy photographs from DMCE's site-walk (#1-45), also ordered in an upstream manner, are presented in Appendix D.

The creek channel contained varying degrees of mostly low-threat trash and debris such as shopping carts and building materials. In many instances it appeared that the materials had been carried downstream some distance from an original entry point before coming to rest. The only five suspicious items observed were (1) part of a drum near the McKee Road culvert; (2) a half-dozen paint buckets on the maintenance road along Reach 4b (see Photo 36); (3) a closed hydraulic oil bucket north of Eastridge Mall entrance; (4) a car battery near end of Everdale; and (5) a fluorescent light fixture near end of Everdale.

V. CONCLUSIONS

Based on the information collected to date for this Lower Silver Creek ESA, DMCE has identified the following 19 items as recognized environmental conditions in connection with the subject creek (organized in four categories):

- visible items -

1. dumpster adjacent to channel between Wooster and railroad
2. apparently empty drums adjacent to Reach 1b, left bank maintenance road
3. four drums along fence with DAP property
4. partial drum in the stream channel under the McKee-King intersection
5. restaurant trash bin with grease adjacent to creek at 1948 Alum Rock Avenue
6. discarded paint buckets on left bank maintenance road along Reach 4b
7. closed hydraulic oil bucket in stream channel north of Eastridge Mall entrance
8. discarded car battery near end of Everdale
9. discarded fluorescent light fixture near end of Everdale

- potential subsurface migration items -

10. main Mrs. Smiths facility west of the railroad
11. Gummow/Royal Foods east of the railroad
12. existing Exxon at 1705 McKee and former gas station at 1696 McKee

- potential surface/runoff items -

13. DAP storage yard
14. truck maintenance/parts along Reach 1d
15. F&M Towing at 1948 McKee
16. Acme Refrigeration at 1941 Shortridge
17. Alum Rock outfall (due to likely historic Coast Oil discharges)

- general soil/sediment items -

18. creek sediments may contain elevated (non-hazardous) pesticides and/or metals
19. embankment soils may also contain such constituents

Figures 9 and 10 note the locations of items 1-17 above. Items 18 and 19 are not plotted as they apply to the creek channel as a whole. DMCE will develop recommendations for a Phase II evaluation of these items in concert with SCVWD staff based on the specific plans for the creek channel at each location.

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U.S. Geological Survey, 1961, 15-minute topographic map of the San Jose Quadrangle, California: scale 1:62,500.

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U.S. Geological Survey, 1961, photorevised 1968 and 1973, 71/2-minute topographic map of the San Jose East Quadrangle, California: scale 1:24,000.

U.S. Geological Survey, 1961, photorevised 1980, 71/2-minute topographic map of the San Jose East Quadrangle, California: scale 1:24,000.

AERIAL PHOTOGRAPHS

DATE	AGENCY	PHOTOGRAPHER	ROLL & FRAME	SCALE
1939	USDA	Fairchild	284-1,2,3,4,5,28,29	1:20,000
1949	Mark Thomas & Co.	Fairchild	1-4,5,22,23,42,43, 44,45,55,56,57,82, 83,84	1:7,200
1950	USDA	Aero Exploration	16G-139,140,141; 17G-8,9	1:20,000
1960	USGS	Unknown	2-140,141,142	1:30,000
1963	USDA	Cartwright	6DD-58,59,124,125, 126IV-W-1-38,39	1:20,000
1968	USGS	Unknown	GS-VBZK 3-37,38; 2-9,10	1:15,000
1985	Unknown	WAC Corp.	12-226,227; 13-209,210	1:31,680
1987	USGS	USDA	511-22,23,24	1:40,000

Table 1
Summary of Currently Planned Channel Improvements
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach	Proposed Channel Type	Approx. Length
1a	Earth	770'
1b	Hybrid Concrete Block with Topsoil over Riprap	530'
1c	Trapezoidal Concrete	1400'
1d	Earth with Floodwalls	985'
2	Rectangular Concrete	1315'
3a	Earth	1600'
3b	Trapezoidal Concrete	975'
3c	Low Flow Retrofit of Existing Trapezoidal Channel	2095'
3d	Trapezoidal Concrete	655'
3e	Earth	655'
3f	Earth	900'
4a	Hybrid Concrete Block with Topsoil over Riprap	220'
4b	Hybrid Concrete Block with Topsoil over Riprap	2300'
4c	Hybrid Concrete Block with Topsoil over Riprap	1300'
5a	Hybrid Concrete Block with Topsoil over Riprap and Transition Structure	240'
5b	Hybrid Concrete Block with Topsoil over Riprap	860'
5c	Hybrid Concrete Block with Topsoil over Riprap	1830'
6a	Hybrid Concrete Block with Topsoil over Riprap	1480'
6b	Hybrid Concrete Block with Earth Bottom	2540'

Ref: Lower Silver Creek Project Update, December 1998, USDA/NRCS

No plans cited for upstream of Reach 6b

Table 2A
Summary of Historical Findings, Reaches 1a through 1d
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
1a-b	1939-1960	Right bank: 1939 aerial photos show agricultural fields and possible pasture. In 1949-1950 photos, lower terrace is occupied by scattered small structures, several intersecting roads, uneven vegetation, and small, rectangular objects or structures lined up along the bank. No city directory listings appear to correlate with this property. Left bank: Agricultural fields or pasture, with adjacent farm buildings apparent on aerial photos. Freitas Dairy listed at 339 Wooster in 1947 city directory. Neighborhood: Some apparent residential development on Wooster, supported by city directory listings. Contractor listed at 350 Wooster in 1942 directory. A relatively large building off McKee near the railroad tracks, may be Weil Paint Co., listed at 1304 McKee in 1952 and 1956 city directories.
	1960-1999	Right bank: Eggo Foods plant first appears in 1963 aerial photos and 1966 city directories; becomes Mrs. Smith's from 1981 through 1993, and Kellogg USA in 1998-99 directory. Left bank: Existing park site appears vacant in 1968 photos, possibly landscaped in 1985 and 1987 photos.
1c	1937-mid 1940s	Aerial photos show agricultural fields adjacent to both banks, with some apparent residential development in the neighborhood south of the channel. Small structures near the ends of East Court and West Court, adjacent to the left bank, may be Fisher Poultry, listed at 369 East Court in the 1942 city directory. Other listings for East Court and West Court in the 1932, 1937, and 1942 city directories are residential.
	1949-1960	Right bank: 1949 and 1950 aerial photos show large rectangular structures with a large pond or dark oval field, possibly an agricultural processing facility, on the DAP property; no city directory listings appear to correlate with this facility. Otherwise, agricultural fields and orchard. Left bank: West of Highway 101, a restaurant and motel are listed on East Court and West Court in the 1952 through 1966 city directories; these may correlate with the small-scale development apparent at the ends of these streets in the 1949, 1950, 1960, and 1963 aerial photos. East of Highway 101, continued agricultural fields. Neighborhood: Appears agricultural and residential, supported by primarily residential listings for East Court, West Court, and Marburg.

Table 2A
Summary of Historical Findings, Reaches 1a through 1d
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
1c	1960-1980	Right bank: Las Plumas, Nipper, and North Marburg first appear in the 1962 to 1965 aerial photos and city directories. The existing DAP building first appears in the 1960 photos, replacing the older complex, and DAP Glazing Compounds is first listed in the 1971and 1976 city directories at 520 North Marburg (all earlier listings for North Marburg are residential). Wells Flooring is listed at 545 Nipper in the 1965-1966 directories; subsequent directories list varied occupants of this address, including Cysco Sytems, Inc., a building materials business, a dredge manufacturer, a welding business, and a paint shop. International Paper and Pollack Paper at 1601 and 1608 Last Plumas, respectively, in the 1966 directories. The existing City of San Jose warehouse is listed at 1608 Las Plumas beginning in the 1971 directory. Keeler Industiral Arts and Crafts is listed at 1600 Las Plumas. Left bank: The motel/restaurant on East Court and West Court is replaced after 1966 with varied occupants; most appear to be office, except possibly STC Freight Lines, listed at 395 East Court in the 1971 city directory. Neighborhood: Increasing commercial and industrial development north of the channel, evident in aerial photos and city directory listings; area south of the channel is primarily residential, with small areas of agriculture remaining.
	1980s-1990s	Right bank: Varied commercial and industrial city directory listings for Las Plumas, North Marburg, and Nipper Left bank: West of Highway 101, continued varied occupants of the ends of East and West Courts, including various offices, American Painting, and J.M. Enterprises. Existing apartment buildings/condominiums east of Highway 101 first appear in the 1985 aerial photos. Neighborhood: North of channel, commercial and industrial. South of channel, Andrade Trucking, a pipeline construction business, and a dump truck association appear on Marburg.
1d	1939-1950	Orchard and row crops on both banks (no information for 1950-1959)
	1960-1980	Continued agricultural fields on right bank; exising condominiums/apartment buildings on the left bank first appear in the 1960 aerial photos, and 1966 city directories.
	1980-1998	Las Plumas Business Park appears on the right bank in 1985 aerial photos, with varied commercial, possibly light industrial city directory listings. Left bank and surrounding neighborhood appears residential, except Blu Dog Concrete at 1633 Melody Lane in the 1981 city directory.

Table 2B
Summary of Historical Findings--Reach 2
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
2	1939-1960	Agriculture on both banks and in surrounding area in 1939 photos. A small building on a large, cleared lot appears on the northeast corner of McKee and King in the 1949 photos.
	1950-1970	Right bank: Small structures appear on the existing PG&E substation site in the 1960 and all later aerial photos. Apparent residential development on the northeast side of King Rd. beginning in 1960 aerial photos, supported by city directory listings; city directories list a produce market on the northeast corner of King and McKee (1705 McKee, site of existing Exxon station). Left bank: apparent residential development in aerial photos beginning in 1960, supported by residential city directory listings for Melody Lane. Neighborhood: Commercial city directory listings for McKee, including gas station at 1651 McKee beginning in 1956 (through 1993); at 1655 McKee from 1961 (through 1998, now Dai Co Viet Motors); and 1604 McKee from 1961 through 1981. A dry cleaners is listed at 1641 McKee from 1961 through 1998.
	1970-1990s	Right bank: No change, except existing Exxon station first appears at 1705 McKee in the 1976 city directory. Left bank: No change except a large building appears on the northwest corner of King and McKee in the 1985 and 1987 photos, apparently the bowling alley listed at 1661 McKee in the 1971 through 1988 city directories. There is no city directory listing for that address in the 1993 and 1998 city directories (the building is no longer present; the site was under construction during our site walk in June 2000)

Table 2C
Summary of Historical Findings--Reaches 3a through 3f
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
3a	1939-1960	1939 aerial photos show agricultural fields on both banks and in the neighborhood, with an apparent race track near the left bank. The race track is no longer shown in the 1949 aerial photos, and residential development has begun in the neighborhood of the left bank.
	1960-1998	Aerial photos from 1960s show continued apparent agricultural use adjacent to both banks, with apparent residential development on the southeast portion of the left bank. By 1985, existing residential development on the right bank and existing park on left bank. Neighborhood residential, except for commercial development on McKee, including gas station at 1696 McKee (southwest corner of King and McKee) from 1960 through 1971).
3b	1939-mid-1940s	1939 aerial photos show agricultural use adjacent to and in the neighborhood of both banks, except the apparent race track near the left bank. City directory listings for Alum Rock Ave. are all residential and commercial.
	1949-1980	Right bank: A drive-in theater appears on the right bank in the 1950 through 1968 aerial photos, supported by city directory listings. Left bank: A large rectangular building appears in the 1949 through 1968 aerial photos, with a parking lot extending to Alum Rock Avenue. The 1949 photos show a small drainage channel from the northwest end of the building to the Silver Creek channel. City directory listings that appear to correlate to this facility include a General Electric Company plant at 1807 Alum Rock Ave. in1947, a Federal Civil Defense Administration warehouse at 1805 Alum Rock Ave. in the 1952 directory, with an address change to 1905 Alum Rock Ave. in 1956, and a grocery store in the directories from the 1963 through 1976. Neighborhood: Small-scale agricultural use, residential, and commercial development on Alum Rock Ave. (see 3c)
	1980-1998	Right bank: Existing residential development in the 1985 and 1987 aerial photos. Left bank: Apparent residential development. Neighborhood: Commercial development on Alum Rock Ave. (see 3c), residential elsewhere.

Table 2C
Summary of Historical Findings--Reaches 3a through 3f
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
3c	1939-1949	Right bank: North of Alum Rock, agricultural fields, with some small structures near the channel apparent on the aerial photos South of Alum Rock, small fields or vacant lots interspersed with small structures consistent with generally residential use. Acme Refrigeration is listed at 1941 Shortridge beginning in the 1941 city directory. Left bank: North of Alum Rock, agricultural fields, with some small structures and landscaping in the 1939 aerial photos. The large rectangular building (General Electric Company plant) appears in the 1949 photos. South of Alum Rock, small fields or vacant lots interspersed with small structures consistent with generally residential use. Neighborhood: City directory listings for Alum Rock Avenue are residential and commercial. Listings for 1947 include a gas station at 1947 Alum Rock Ave. (about 200 feet northeast of the channel on the 1949 aerial photos) and a used car lot at 1804 Alum Rock Ave. . Additional auto repair facilities and gas stations on Alum Rock but further away. Listings for Sunset and Shortridge (except 1941 Shortridge) are residential.
	1950-1980	Right bank: North of Alum Rock, drive-in theater in city directories and 1950 aerial photos. South of Alum Rock, increasing development consistent with generally residential use. City directories show residential use on adjacent properties, except ACME refrigeration at 1941 Shortridge (additional appliance service businesses are also listed at this address in the directories from the 1960s), and the existing upholstery business at 1966 Alum Rock Ave. beginning in the 1960s. Left bank: North of Alum Rock Ave., Federal Civil Defense Administration warehouse replaces General Electric Company plant (see 3b) on northwest portion of reach in the 1950s, succeeded by a grocery store in the 1960s. A used car lot is listed at 1941 Alum Rock Ave. in 1961, replaced by a garage in 1966, apparent adjacent to the channel near Alum Rock Ave. in the aerial photos from the 1960s. South of Alum Rock Ave., Lou's Gravel and Tractor Service and an auto glass business are listed at 1948 Alum Rock Ave., adjacent to the channel, in the 1960s; a body shop is listed at that address in 1971, and a tavern in 1976. Neighborhood: Commercial and residential listings on Alum Rock Ave., including a gas station, tire and battery shop at 1947 Alum Rock through 1956. Several other auto repair businesses and gas stations are listed on Alum Rock, further away from the channel. Listings on Shortridge and Sunset confirm generally residential and minor commercial use.

Table 2C
Summary of Historical Findings--Reaches 3a through 3f
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
3c	1980-1998	Right bank: North of Alum Rock, existing residential development appears on the 1985 aerial photos, replacing the drive-in theater. South of Alum Rock, the existing upholstery shop is listed at 1966 Alum Rock Ave., and an appliance service business at 1941 Shortridge. Aerial photos and city directory listings for Shortridge and Sunset indicate generally residential use. Left bank: North of Alum Rock Ave., Creekside Plaza, with several commercial occupants, and the existing residential development appear in the 1985 aerial photos. South of Alum Rock, a tavern/restaurant is listed at 1948 Alum Rock. Neighborhood: City directory listings for Alum Rock are generally commercial and residential, with numerous auto repair facilities and gas stations within a few blocks of the channel. The closest are an auto repair business at 1991 Alum Rock, a petroleum distribution facility and gas station at 2075 Alum Rock, and an auto repair business at 1865 Alum Rock. A cleaners is listed at 1891 Alum Rock in the 1988 directory (between Eastgate and McCreery).
3d	1939-1960	Aerial photos from 1939, 1949, and 1950 show agricultural use adjacent to the channel on both sides. Mayfair Packing is listed at 2000 San Antonio in the 1947 and all later city directories. Listings for San Antonio are residential with occasional commercial listings.
	1960-1998	Right bank: North of San Antonio, one small structure appears adjacent to the channel in aerial photos from the 1960s. The existing residential development first appears in the 1985 aerial photos. South of San Antonio, agricultural field or vacant lot. Left bank: North of San Antonio, existing residential development first appears in the 1985 aerial photos. South of San Antonio, the existing church first appears in the 1971 city directory and in the 1985 aerial photos. Neighborhood: Mayfair Packing at 2000 San Antonio. Other listings for San Antonio are residential and commercial.
3e	1939-1998	Right bank: Corner of large industrial facility adjacent to channel in aerial photos from 1939 through 1987; correlates with Mayfair Packing plant listed at 2000 San Antonio in 1947 and all later city directories. Southeast of the corner of the plant, the portion of the Mayfair property adjacent to the channel is generally vacant, with crates or boxes stored near the property line in some years. Left bank: Agricultural use in aerial photos from 1939 through 1950. The existing park and community center appear in aerial photos from the 1960s; the community center first appears in the 1976 city directory. Neighborhood: Aerial photos indicate agricultural use gradually replaced by residential development and schools. Some commercial city directory listings for San Antonio; listings for Kammerer include schools, churches and residences.

Table 2C
Summary of Historical Findings--Reaches 3a through 3f
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
3f	1939-1960	Aerial photos show agricultural use on both sides of the channel, with some apparent residential development to the northeast, off Jackson. 1956 city directory lists a garage at 380 Jackson, which appears to correlate with a facility about 1000 northeast of the channel on the 1950 aerial photos.
	1960-1998	Right bank: Existing residential subdivision under construction in 1960 aerial photos. Highway 680 first appears in the 1985 aerial photos. Left bank: The existing school appears in the city directories from the 1970s and in the 1985 aerial photos. A small area of orchard remains in the 1985 photos. Neighborhood: City directory listings for Kammerer and nearby portions of Jackson include schools and residences, supported by aerial photos.

Table 2D
Summary of Historical Findings--Reaches 4a through 4c
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
4a	1939-1960	Aerial photos show agricultural use on both sides of the channel and throughout most of the neighborhood from 1939 through 1950. Some residential development to the north, off Jackson; a garage is listed at 380 Jackson in the 1956 city directory. A small structure surrounded by trees, possibly the existing residence, appears on adjacent to the right bank in the 1960 aerial photos. By the 1960s, the neighborhood appears mostly residential in the aerial photos, supported by city directory listings for Jackson. The property adjacent to the left bank continues to be vacant.
4b	1939-1960	Aerial photos show agricultural use on both sides of the channel; the channel departs from the modern channel for a short stretch just west of Capitol Ave., taking a jog to the south. City directory listings for nearby portions of Capitol Ave. include a dairby, a stable, and a grocery store, as well as residences.
	1960-1998	The existing residential subdivision adjacent to the right bank is under construction in the 1960 aerial photos, supported by residential listings for Bambi Lane in the 1961 and all subsequent city directories. Apparent residential development also first appears adjacent to the left bank in the 1960 city directory. The neighborhood appears generally residential in aerial photos. City directory listings for Capitol Ave. support this; a few commercial listings appear, including a construction company at 580 Capitol in 1961 and 1966, and various businesses at 459, 461, and 500 Capitol in 1988, 1993, and 1998. USA Petroleum is listed at 1091 Capitol Expressway in the 1981 and 1988 directories, and AutoWest Dodge at 1050 Capitol Expressway in the 1988 directories, both about 2,300 feet west of Silver Creek.
4c	1939 through 1998	Channel: From 1939 through 1968, the channel departs from the modern channel at Capitol Expressway, meanders toward the southeast, meeting the modern channel near Murtha Drive. Right bank: Aerial photos show orchard from 1939 through 1950. Apparent residential development appears in the 1960 and all later photos. Granite Creek Place first appears in the 1981 directory, with residential listings. Left bank: Agricultural use, including orchard, is evident in the aerial photos from 1939 through 1960, with several clusters of structures, probably farm buildings, near the channel. The existing residential development first appears in the 1985 aerial photos. Mervyn's Way appears with no listings in the 1986 city directory, and with residential listings in 1993 and 1998. Neighborhood: Agricultural use appears on the aerial photos through 1950, followed by increasing apparent residential development, supported by city directory listings.

Table 2E
Summary of Historical Findings--Reaches 5a through 5c
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
5a-b	1939-1949	Aerial photos show orchard on both sides of the channel and in the neighborhood. No city directory listings.
	1950-1970	Right bank: Appears residential in aerial photos; supported by residential listings for Lyndale Ave. in city directories.
		Left bank: Vacant field with scattered trees.
		Neighborhood: Commercial city directory listings for Story Rd.; aerial photos show residential development elsewhere except for small areas of orchard. Gas stations are listed at 605 South White Rd. in the 1966 through 1998 directories, and at 595 South White Rd. in the 1966 directory, both about .25 mile northeast of Silver Creek.
	1970-1998	Right bank: Appears residential in aerial photos; supported by residential listings for Lyndale Ave. in city directories, except trucking business at 511 Lyndale in 1971 and roofing business at 10121 Lyndale in 1981.
		Left bank: Existing Mervyn's Department store first appears in 1976 city directory, apparent in 1981 aerial photos.
		Neighborhood: Commercial city directory listings for Story Rd.; aerial photos show residential development elsewhere. Gas stations are listed at 1095 and 1100 S. White Rd. (about .25 mile northeast of Silver Creek) in the 1993-1998 and 1975-1993 directories, respectively. An auto repair/sales business is listed at 595 S. White Road in the 1988 through 1998 directories, and a cleaners is listed at 1020 S. White Road in the 1988 through 1993 directories.
5c	1939-1949	Aerial photos show orchard and other agricultural fields on both sides of channel and in neighborhood, with scattered clusters o small buildings. No city directory listings.
	1950-1970	City directory listings for relevant portion of Story Rd. first appear in 1961.
		Right bank: Existing apartments at Story (2950) first appear in the 1960 aerial photos and the 1961 city directories. City directories show construction company at 1308 Farringdon in 1961, and a trucking company at the same address in 1966. Remaining listings for adjacent portion of Farringdon are residential, consistent with appearance in aerial photos.
		Left bank: Vacant lot or agricultural field at Story (no city directory listing for that property). City directory listings for adjacent portion of Sundown are all residential, consistent with appearance on aerial photos.
		Neighborhood: City directory listings for Story are commercial, including several gasoline service stations and automotive repair businesses to the southwest; the nearest is at 2790 Story, where a gasoline station is listed in city directories from 1961 through 1998.

Table 2E
Summary of Historical Findings--Reaches 5a through 5c
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
5c	1970-1998	Right bank: Existing apartments at 2950 Story, in city directories and aerial photos. City directories show painting contractor at 1221 Farringdon in 1976, and a trucking company at 1308 Farringdon through 1981. Remaining listings for adjacent portion of Farringdon are residential, consistent with appearance in aerial photos. Left bank: A liquor store appears at 2882 Story in the 1981 city directories; the 1985 aerial photos show a small structure in a parking lot. In the 1993 and 1998 directories, the existing fish market is listed at that address. City directory listings for adjacent portion of Sundown are all residential, consistent with appearance on aerial photos. Neighborhood: City directory listings for Story are commercial, including several gasoline service stations and automotive repair businesses to the southwest; the nearest is at 2790 Story, where a gasoline station is listed in city directories from 1961 through 1998. A cleaners is listed at 1432 S. White Road (about .25 mile northeast) in the 1970 through 1998 directories.

Table 2F
Summary of Historical Findings--Reaches 6a through 6b
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
6a	1939-1950	Aerial photos show orchard and agricultural fields on both sides of the channel and in the neighborhood. No city directory listings. No information for 1951 through 1959.
	1960-1970	Right bank: Apparent residential development with some remaining agricultural land on aerial photos; supported by residential listings and a few commercial listings for Farringdon Dr. in city directories. Left bank: Generally, apparent residential development on aerial photos with some remaining agricultural land; residential listings and a few commercial listings for Sundown Lane in city directories. Neighborhood: Appears residential and agricultural on aerial photos.
	1970-1998	Right bank: Generally, appears residential in aerial photos, supported by residential listings for Farringdon Dr. in city directories. Left bank: Generally, apparent residential development on aerial photos; supported by residential listings and a few commercial listings for Sundown Lane in city directories , including trucking business at 1583 Sundown in 1976 and 1981. Neighborhood: Appears residential on aerial photos.
6b	1939-1970	Aerial photos show orchard and agricultural fields on both sides of the channel and in the neighborhood through 1963. First residential development appears adjacent to right bank of channel northwest of Ocala in the 1968 aerial photos. No city directory listings.
	1970-1998	Ridgemont first appears in city directories in 1971 and Ocala in 1976, with residential listings only except the existing schools at 2999 Ridgemont and 2800 Ocala beginning in 1981. Schools and residential development appear in the aerial photos. Cleaners are listed at 1634, 1761, and 1775 Capitol Expressway, about 2,300 feet west of Silver Creek, in city directories from 1988 through 1998.

Table 2G
Summary of Historical Findings--Cunningham Avenue through Quimby Road
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
Cunningham to Quimby	1939-1968	Aerial photos show agricultural use on both sides of the channel and throughout most of the neighborhood, with small clusters of structures consistent with farm buildings and/or semi-rural residential development. A golf course appears on the site of Eastridge mall.
	1968 -1980	Reid-Hillview Airport first appears in 1968 photos, supported by city directory listings for various aviation-related businesses in the 1966 and later city directories. Eastridge mall first appears in the 1976 directory. Residential development appears to the east of Silver Creek beginning in the 1960s and 1970s, as does commercial development on Quimby, Tully, and Capitol Expressway.
	1980-1998	Lake Cunningham Park appears in the 1985 aerial photos. Silver Creek channel appears wide and heavily vegetated on the aerial photos. Nearby commercial city directory listings include an Arco station at 2375 Quimby (near Capitol Expressway) in the 1976 through 1988 directories, Z&M Manufacturing at 2280 Quimby in the 1993 and 1998 directories, and a Chevron station at 2801 S. White Road (at Quimby) in the 1993 and 1998 directories.

Table 2H
Summary of Historical Findings--Quimby Road through Aborn Road
Santa Clara Valley Water District-Lower Silver Creek Watershed Project
San Jose, California

Reach		
Quimby to Aborn	1939-1963	1939 aerial photos show agricultural use, mostly orchard, on both banks and throughout the neighborhood. Aerial photos from 1960 and 1963 show continued agricultural use on both banks, with scattered clusters of small structures, consistent with farm buildings.
	1968 -1987	1968 aerial photos show an apparent residential subdivision adjacent to a portion of the right bank, with continued agricultural use in other adjacent areas. An apparent gas station is visible on the southwest corner of Aborn and White, about 800 feet east of the channel. By the 1985 and 1987 aerial photos, residential use appears on both sides of the channel, except larger structures and parking lots suggestive of commercial use adjacent to the right bank near Aborn and on the west side of Capitol Expressway at Quimby.

Table 3
Summary of Regulatory Information About Listed Neighborhood Sites
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Proximity	Site Name, Address and Summary	Degree of Concern
NW bank	Mrs. Smith, 475 Eggo Way: broad hazmat use over the years, also 3 USTs (locations unclear), only limited prior ESA testing	**low-mod**
< 400' SE	Gummow/Royal Foods, 1325 E. Julian St: 3 areas of USTs, more investigation needed, mixed but not espec. high impacts	**low-mod**
< 200' SE	STC Freight Lines?, 395 East Ct: UST discovered on vacant site, no leakage found & SJFD closed case in April 2000	**low**
NW bank	DAP, 520 N. Marburg Way: no significant contamination remaining, case closed, prior ESA testing covered this area	**low***
SE bank	Andrade Trucking, 350 Marburg Way: closed fuel leak, one round of GW monitoring showed westerly gradient	**low***
~500' NW	American Drums, 545 Nipper Ave: relatively minor VOC plume apparently heading west, not toward Lower Silver Ck	**low**
~500' NW	San Jose Family Shelter, 1590 Las Plumas: moderately high, localized fuel impacts surrounded by MWs; NW gradient mostly	**low**
~500' NW	City of San Jose Warehouse, 1608 Las Plumas: low-moderate impacts incl. VOCs, but prior ESA testing covered this area	**low**
~500' NW	Publishers Press, 1650C Las Plumas: large ink volumes, small solvent & waste oil volumes; no known releases	**low**
< 100' SW	Former Gas Station, 1696 McKee Rd: no SJFD or SCVWD file	**moderate**
NE bank	Exxon Station, 1705 McKee: closed fuel leak case that had soil impacts only but station is still active	**moderate**
~500' SW	Dai Co Viet Motors, 1655 McKee Rd: undefined MTBE plume, possibly heading north but more likely NW	**low-mod**
~600' SW	Beacon/Spartan Station, 1651 McKee Rd: localized, diminishing fuel residuals, NW gradient	**low**
~600' SW	S and S Cleaners, 1641 McKee Rd: no SJFD file, listed hazwaste generator; nearby MW shows no suspicious GW conditions	**low**
~700' SW	Chevron, 1636 McKee Rd: minor fuel residuals, variable but mainly NW gradient (19 MWs), evidence of upward GW gradient	**none**
> 1,000'	Arco, 1604 McKee Rd: moderately high MTBE in GW, no offsite plume def., gradient should be NW but not confirmed	**low**
~ 400' NE	Oliver De Silva, 12 N. Sunset Ave: relatively minor fuel residuals (incl. MTBE), mentions W gradient, no offsite plume def.	**low**
< 200' SW	General Electric Facility, 1807 Alum Rock Ave: no files, but GE use was >40 years ago and limited time period	**low**
SW bank	J & A Body Shop, 1948 Alum Rock Ave: above-ground, fairly minor hazmat issues-1976 inspection; (currently a towing yard)	**low-mod**

*Notes: (1) Listing follows a general upstream order but specific reaches are not cited. (2) VISTA sites within 1/8-mile at 1550 Las Plumas and 1908 Beverly Blvd, plus others further from creek, are deemed to be unimportant. * Visual observations indicate other creek channel concerns for these sites (see report text).*

Table 3 (con't)
Summary of Regulatory Information About Listed Neighborhood Sites
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Proximity	Site Name, Address and Summary	Degree of Concern
~500' NE	Cortez Property, 2055 Alum Rock Ave: very minor soil contamination from on-site activities, possible Coast Oil issues	**none**
~600' NE	Coast Oil, 2075 Alum Rock Ave: extensive history of releases & problems, historic discharges to storm drain system likely	**low**
~800' NE	U.S. Rentals, 2101 Alum Rock Ave: subsurface fuel impacts found in 1993 but no follow-up; overshadowed by Coast Oil	**low**
~1,000' NE	E Z Fill, 2149 Alum Rock Ave: undef. plume, fairly high benzene, minor MTBE, unusual NE gradient, pending remed. system	**low**
~ 1,000' SW	Golden Valley Plaza, 1855 Alum Rock Ave: high kerosene in GW (1993-94), no follow-up work, SCVWD upset	**low**
< 100' E	Mayfair Packing Co, 2000 E. San Antonio St: minor, diminishing fuel residuals; awaiting case closure; NW gradient	**low**
> 1,000' SE	Texaco, 2695 Story Rd: W gradient verified by many MWs, low fuel residuals, <200' plume; new MTBE issues (see next line)	**low**
> 1,000' SE	Capitol Car Wash, 2701 Story Rd: MTBE plume heading west into Texaco MW network, low levels under residences	**low**
> 1,000' SE	Chevron, 2710 Story Rd: WSW gradient, active remed. system, plan to explore deeper GW, offsite MTBE (see above)	**low**
> 1000' NE	Rotten Robbie, 605 S. White Rd: adjacent to Babb Ck., active remedial system, WSW gradient, low MTBE	**low**
~800' SW	Jet Gas, 2790 Story Rd: active pump & treat remediation, natural gradient unclear but seems westerly away from creek	**low**
~1,000' NE	Texaco, 3098 Story Rd: relatively minor residuals, no MWs, seeking case closure; GW problems see Unocal below	**low**
~1,100' NE	Unocal, 1100 S. White Rd: WSW gradient, active remedial system, plume <300' long, MTBE issues not fully defined, not high	**low**
> 1,000' NE	1020 and 1432 S. White Rd (two dry cleaners): not listed on searched databases, SJFD files not available (may be none)	**low-mod**
< 100' NE	1221, 1308 and 1577 Farrington Dr (painting contractor, trucking business & listed UST, respectively): no files	**low-mod**
> 1,000' NE	Exxon, 3110 Mount Vista Dr: ongoing remedial system, plume <300', WSW gradient, less than 200 ppb MTBE	**low**
> 1,000' SW	Reid Hillview Airport, 2500 Cunningham Ave: SW gradient, extensive remedial effort led to case closure	**none**
< 500' NE	"unknown", 2692 Glen Fenton Way: listed spill but address has no SJFD file	**low**
< 200' SW	Arco, 2375 Quimby Rd: closed fuel leak case, SJFD file not available; most likely downgradient from creek	**low**

Notes: (1) Listing follows a general upstream order but specific reaches are not cited.
(2) VISTA sites within 1/8-mile at 1898 Alum Rock, 68 N. Sunset, 2521 Abed and 2635 Cunningham, plus others further from creek, are deemed to be unimportant.

Table 3 (con't)
Summary of Regulatory Information About Listed Neighborhood Sites
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Proximity	Site Name, Address and Summary	Degree of Concern
> 400' SW	Z M Manufacturing, 2280 Quimby Rd: underground tank but no leakage reported and located downgradient of creek	low
> 1000' NE	Quimby Cleaners, 2821 S. White Rd: dry cleaner but no waste generation listed & no leakage reported, no available SJFD file	low-mod
> 500' SW	Greenbriar Dev., 3027 Calais de Los Flores: CalEPA-DTSC site (probably pesticide residuals) but well downgradient of creek	low
> 500' NE	Aborn Turnout Pump Station, 3285 S. White: underground tank but no leakage reported and over 1/8-mile away	low
~400' NE	Unocal/76/BP Gas Station, 3295 S. White: closed, minor fuel leak case but station still operating	low
> 500' NE	Evergreen Shell Gas Station, 3290 S. White: closed fuel leak case but station still operating	low
~400' NE	Exxon Gas Station, 3303 San Felipe Road: recently closed fuel leak case, NW gradient, station still operating	low
~300' NE	Evergreen Cleaners, 3311 S. White (San Felipe): dry cleaner w/waste generation but no leakage reported, no available SJFD file	low-mod
~1000' SW	SJ Fire Station 24, 2525 Aborn Road: closed fuel leak case and well downgradient of creek	none
~800' SW	Serpa Property, 2555 Aborn Road: closed fuel leak case and well downgradient of creek	none
>1000' NE	Mirassou Winery, 3000 Aborn Road: minor, closed fuel leak case, no remaining USTs	low

Notes: (1) Listing follows a general upstream order but specific reaches are not cited.
(2) VISTA site within 1/8-mile at 209 Eastridge Mall, plus others further from creek, are deemed to be unimportant.

Table 4A
Summary of Current Conditions, Reaches 1a through 1d
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
1a	Channel	Miscellaneous trash, including shopping carts, a few tires, an old water heater, piping, paper and plastic bags, and pay phone (Photos #1-4). No odor, soil staining, or discolored water associated with outfalls.
	Right bank	Kellogg plant adjacent, with parking lot draining into channel (Photo #5). No visible hazardous materials storage areas near channel. Trash associated with human habitation in woods near northeast end of reach (Photo #6).
	Left bank	Park adjacent and residential parking lot, with surface drainage to channel (Photos #7-8).
	Neighborhood	Commercial and industrial
1b	Channel	Miscellaneous low-threat trash includes bicycle tires, steel plate, piping, and plywood near Wooster Street bridge, plus concrete and metal pipe and lumber near railroad bridge (Photos #9-10). No odor, soil staining, or discolored water associated with outfalls.
	Right bank	Kellogg plant parking lot adjacent, with surface drainage to Reach 1b of channel. No hazardous materials storage visible near channel.
	Left bank	"JHM" dumpster storage adjacent to channel between Wooster Street and railroad (Photo #11). Three apparently empty drums at fence next to maintenance road (Photo #12). No specific surface drainage features apparent.
	Neighborhood	Commercial and light industrial
1c	Channel	Water flowing from outfall adjacent to Highway 101 (Photo #13). No evidence of significant dumping; no odors, soil staining, or discolored water associated with outfalls.
	Right bank	Vacant lot between railroad and Highway 101; chunks of masonry on adjacent bank (Photo #14). DAP loading dock, northeast of Highway 101 (Photo #15); outdoor storage area adjacent to northeast end of reach. Materials stored include lumber, pallets, packing materials, and 4 drums along the fence line labeled "831 Wilsonart Spray Adhesive" (Photos #16-17). Outfall adjacent to DAP property (Photo #18).
	Left bank	Residential development adjacent.
	Neighborhood	Commercial, industrial, and residential.

Table 4A
Summary of Current Conditions, Reaches 1a through 1d
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
1d	Channel	No evidence of significant dumping; no odors, soil staining, or discolored water associated with outfalls.
	Right bank	Southwest end, unpaved truck maintenance yard adjacent. Small piles of asphalt, possible waste oil drum about 30 feet from maintenance road, scattered truck parts (Photo #19). Central portion, piles of sawdust adjacent to maintenance road, with parking lot for large industrial or commercial building beyond (Photo #20). Northeast end, parking lot for Las Plumas Business Park (Photo #21). Much miscellaneous trash accumulated on terrace above active channel; no hazardous materials observed (Photo #22). Manhole in maintenance road with stagnant pool beneath (Photo #23). No specific surface drainage features observed.
	Left bank	Residential development adjacent. Water flowing from culvert (Photo #24).
	Neighborhood	Commercial, industrial, and residential.

Table 4B

Summary of Current Conditions--Reach 2
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
2	Channel	Channel is narrow and steep-sided, with dense reeds preventing thorough observation. Much low-threat trash along right bank, no hazardous materials observed (Photos #25-26). No odors, stained soil, or discolored water associated with outfalls. Under McKee-King intersection, near downstream end, the top of an open drum was observed in a pool of uncertain depth. Bubbles were observed, likely indicative of anaerobic degradation of organic materials.
	Right bank	PG&E substation adjacent to maintance road at northwest end of reach; catch basin visible within substation, outlet not evident. King Rd. residential except at McKee, where there is an Exxon station. Water flowing from outfall or culvert, source across King Rd. (Photo #27).
	Left bank	Residential development adjacent, not easily visible from maintenance road. Construction site at McKee.
	Neighborhood	Commercial at McKee, otherwise residential.

Table 4C
Summary of Current Conditions--Reaches 3a through 3f
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
3a	Channel	Strong odor of human waste in vicinity of channel. Miscellaneous low-threat trash; no hazardous materials visible.
	Right bank	Residential development adjacent.
	Left bank	Park and residential development adjacent. Apparent former fuel dispenser islands observed at produce market on southwest corner of King and McKee (1696 McKee).
	Neighborhood	Commercial and residential.
3b	Channel	Concrete channel. No stains, odors, or discolored water associated with outfalls.
	Right bank	Residential development adjacent
	Left bank	Residential development adjacent
	Neighborhood	Residential
3c	Channel	Concrete channel. No stains, odors, or discolored water associated with outfalls.
	Right bank	Northwest of Alum Rock, residential development adjacent, southeast of Alum Rock, mixed commercial and residential, adjacent businesses include an upholstery shop at 1966 Alum Rock, and Acme Refrigeration at 1941 Shortridge. Surface drainage from Acme Refrigeration yard into channel (Photo #28).
	Left bank	Northwest of Alum Rock, residential and commercial development adjacent. Southeast of Alum Rock, restaurant and towing yard at 1948 Alum Rock, residential to southeast. Restaurant trash enclosure with grease container on edge of channel (Photo #29). Towing yard in rear of property, not visible from channel. No specific surface drainage features observed.
	Neighborhood	Commercial and residential. Possible small auto repair business in front yard of residence at 136 Sunset.
3d	Channel	No evidence of significant dumping. No stains, odors, or discolored water associate with outfalls.
	Right bank	Northwest of San Antonio, residential subdivision. Southwest of San Antonio, vacant lot, within SCVWD fenceline.
	Left bank	Northwest of San Antonio, residential. Southwest of San Antonio, church, and one mobile home.
	Neighborhood	Residential.

Table 4C
Summary of Current Conditions--Reaches 3a through 3f
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
3e	Channel	No evidence of significant dumping. No stains, odors, or discolored water associate with outfalls. Old metal pipe (from former Mayfair plant property) opening to right side of channel.
	Right bank	Residential development adjacent
	Left bank	Park
	Neighborhood	Residential
3f	Channel	No evidence of significant dumping. No stains, odors, or discolored water associated with outfalls.
	Right bank	Residential development adjacent, except at east end, where there is an unpaved vacant lot with evidence of dumping near gate, about 120 feet from maintenance road. The type of materials dumped could not be identified from the property line.
	Left bank	School adjacent.
	Neighborhood	Residential development.

Table 4E
Summary of Current Conditions--Reaches 5a through 5c
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
5a	Channel	No evidence of significant dumping or hazardous materials. No stained soil, odor, or discolored water associated with outfalls.
	Right bank	Residential.
	Left bank	Residential.
	Neighborhood	Residential.
5b	Channel	No evidence of significant dumping or hazardous materials. No stained soil, odor, or discolored water associated with outfalls.
	Right bank	Residential, except office building on Lyndale at Story Rd.
	Left bank	Residential and commercial (Mervyn's Department Store at Story Rd.)
	Neighborhood	Residential
5c	Channel	Miscellaneous low-threat trash in channel, particularly at Murtha Drive bridge, and at confluence with South Babb Creek; no hazardous materials observed (Photos #37-38). No odor, soil staining, or discolored water associated with outfalls.
	Right bank	Apartment buildings at Story Rd., single-family residential elsewhere. Minor low-threat dumping along bank adjacent to apartment buildings.
	Left bank	Restaurant at 2882 Story Rd., otherwise residential.
	Neighborhood	Commercial on Story Rd., otherwise residential.

Table 4F
Summary of Historical Findings--Reaches 6a through 6b
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

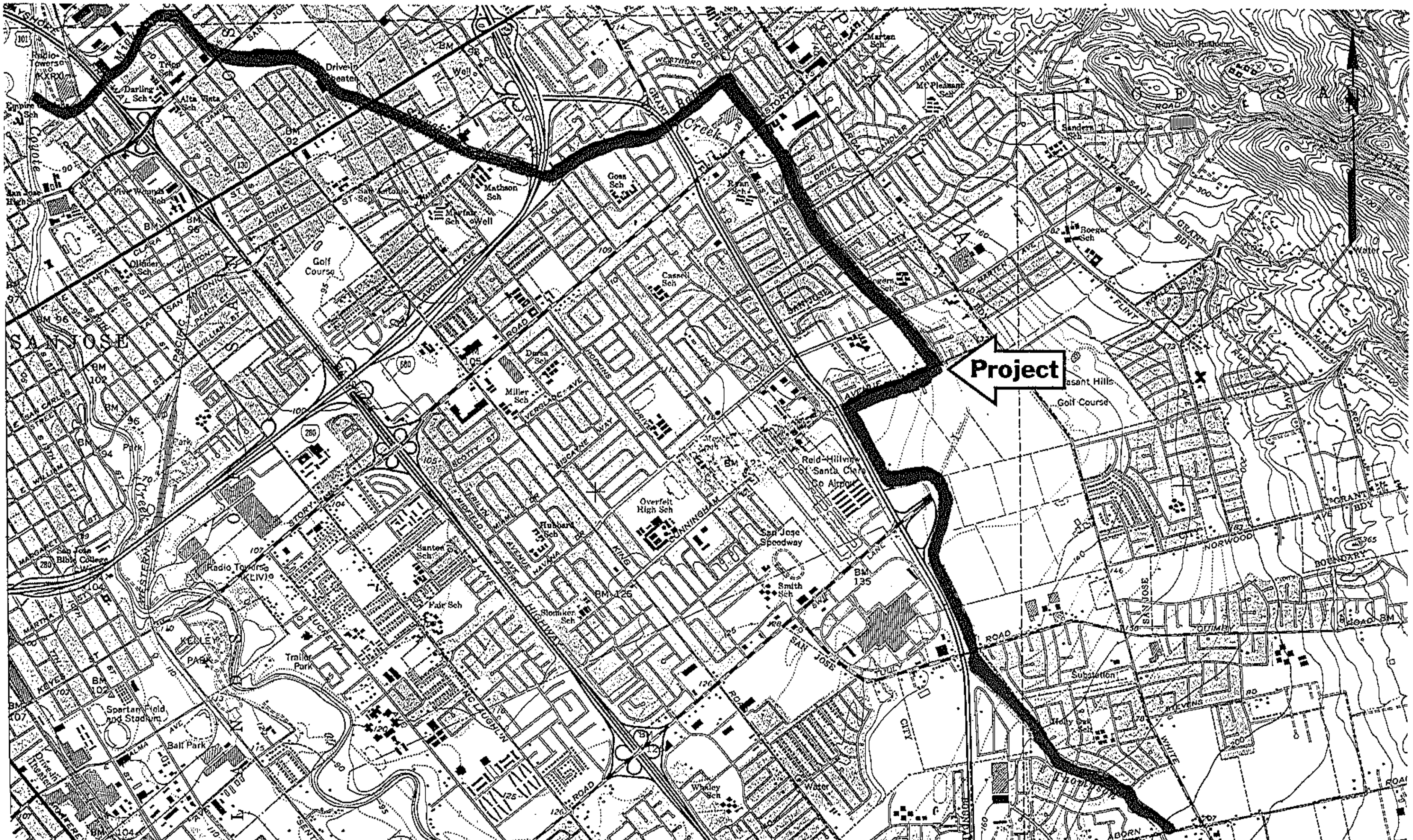
Reach		
6a	Channel	No evidence of significant dumping or hazardous materials. No stained soil, odor, or discolored water associated with outfalls.
	Right bank	Residential.
	Left bank	Residential.
	Neighborhood	Residential.
6b	Channel	No evidence of significant dumping or hazardous materials. No stained soil, odor, or discolored water associated with outfalls.
	Right bank	Residential and school
	Left bank	Residential and school
	Neighborhood	Residential and schools

Table 4G
Summary of Current Conditions--Cunningham Avenue through Quimby Road
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
Cunningham to Quimby	Channel	Channel is broad, densely vegetated, and swampy preventing thorough observation. Minor low-threat trash observed at Eastridge, near left edge of channel. North of Eastridge, trash included lumber and a closed hydraulic oil bucket. Near Quimby, several shopping carts and a newspaper vending machine had been dumped.
	Right bank	Raging Waters park. Water flowing from parking lot toward channel (Photo #39).
	Left bank	Cunningham Road and Capitol Expressway.
	Neighborhood	To southwest, airport, and shopping mall, to northeast, residential and vacant land.

Table 4H
Summary of Current Conditions--Quimby Road to Aborn Road
Santa Clara Valley Water District-Lower Silver Creek ESA
San Jose, California

Reach		
Quimby to Aborn	Channel	Channel dry. Inflow from unseen source under Quimby Road bridge. Car battery and flourescent light fixture near end of Everdale Road. Miscellaneous low-threat trash beneath Aborn Road bridge and at junction with Thompson Creek. No odors or stained soil associated with outfalls.
	Right bank	No evidence of significant dumping.
	Left bank	Low-threat trash beneath footbridge at Everdale Road.
	Neighborhood	Three gas stations at intersection of Aborn and White Road (Exxon on southwest corner, Shell on northwest corner, Union 76 on northwest corner); shopping centers on both sides of Aborn east of Silver Creek. Neighborhood is otherwise residential.



SCALE: 1" = 3,000'

MAP REFERENCE: San Jose East Quadrangle 1961, Photorevised 1980

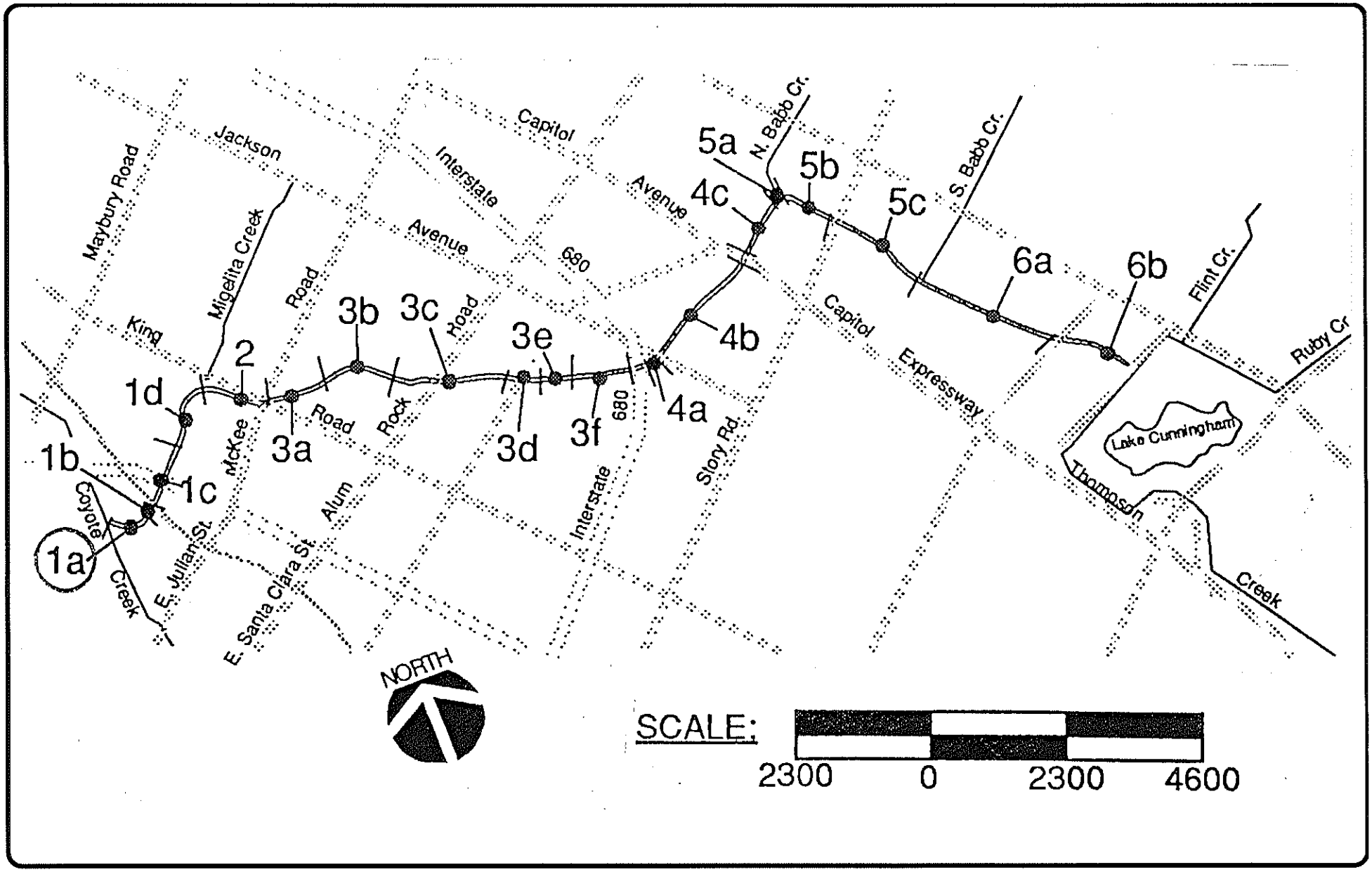
D & M Consulting Engineers, Inc.
A URS Corporation Company
GROUP

SEPTEMBER 2000

VICINITY MAP
SANTA CLARA VALLEY WATER DISTRICT
LOWER SILVER CREEK ESA
SAN JOSE, CALIFORNIA

FIGURE 1

PROJECT 1445

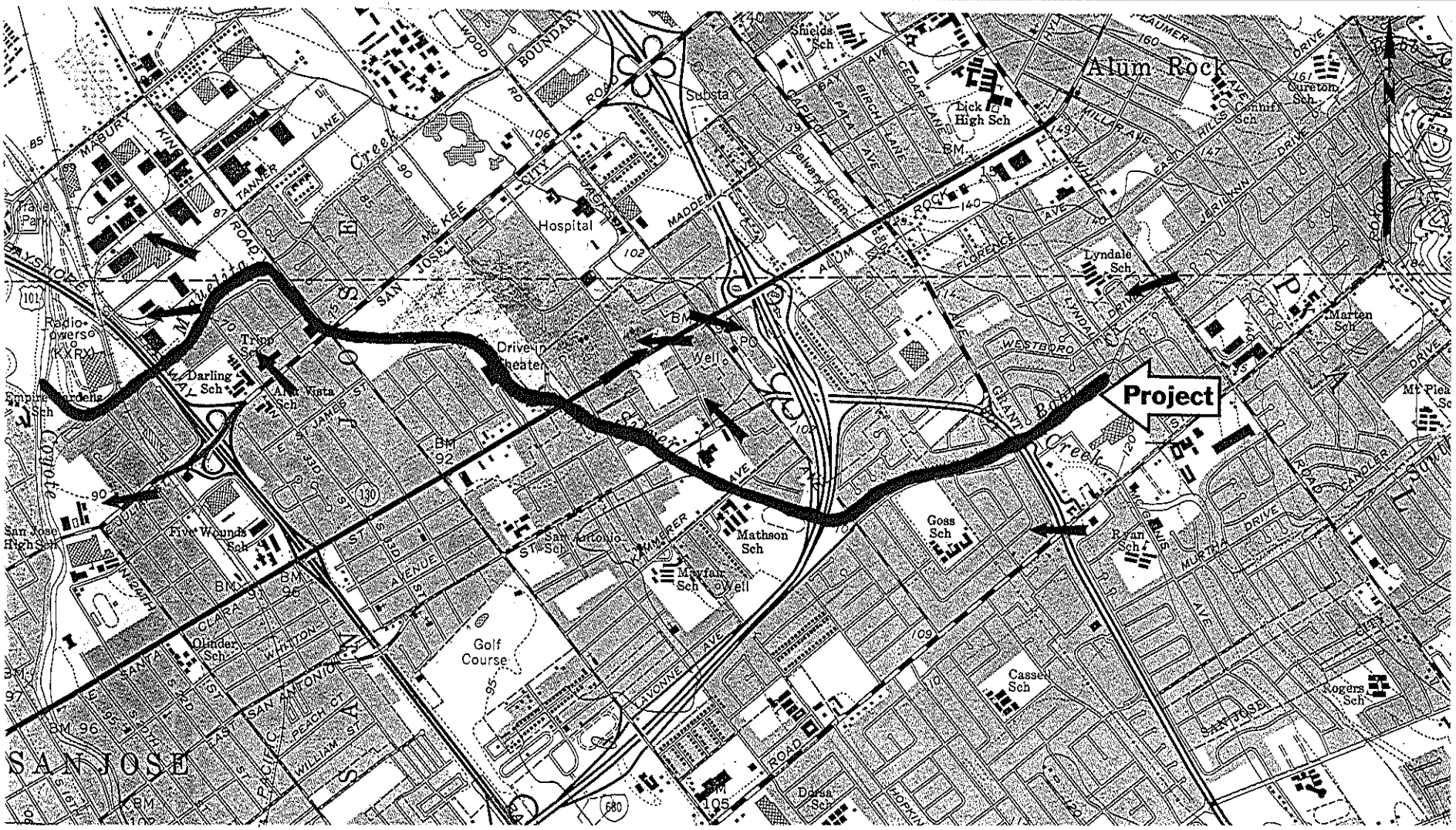


D & M Consulting Engineers, Inc.
A URS Corporation Company
SEPTEMBER 2000

KEY MAP

SANTA CLARA VALLEY WATER DISTRICT
LOWER SILVER CREEK ESA
SAN JOSE, CALIFORNIA

FIGURE 2
PROJECT 1445



GROUND WATER GRADIENT DIRECTION

SCALE: 1" = 2,000'

MAP REFERENCE: San Jose East Quadrangle 1961, Photorevised 1980

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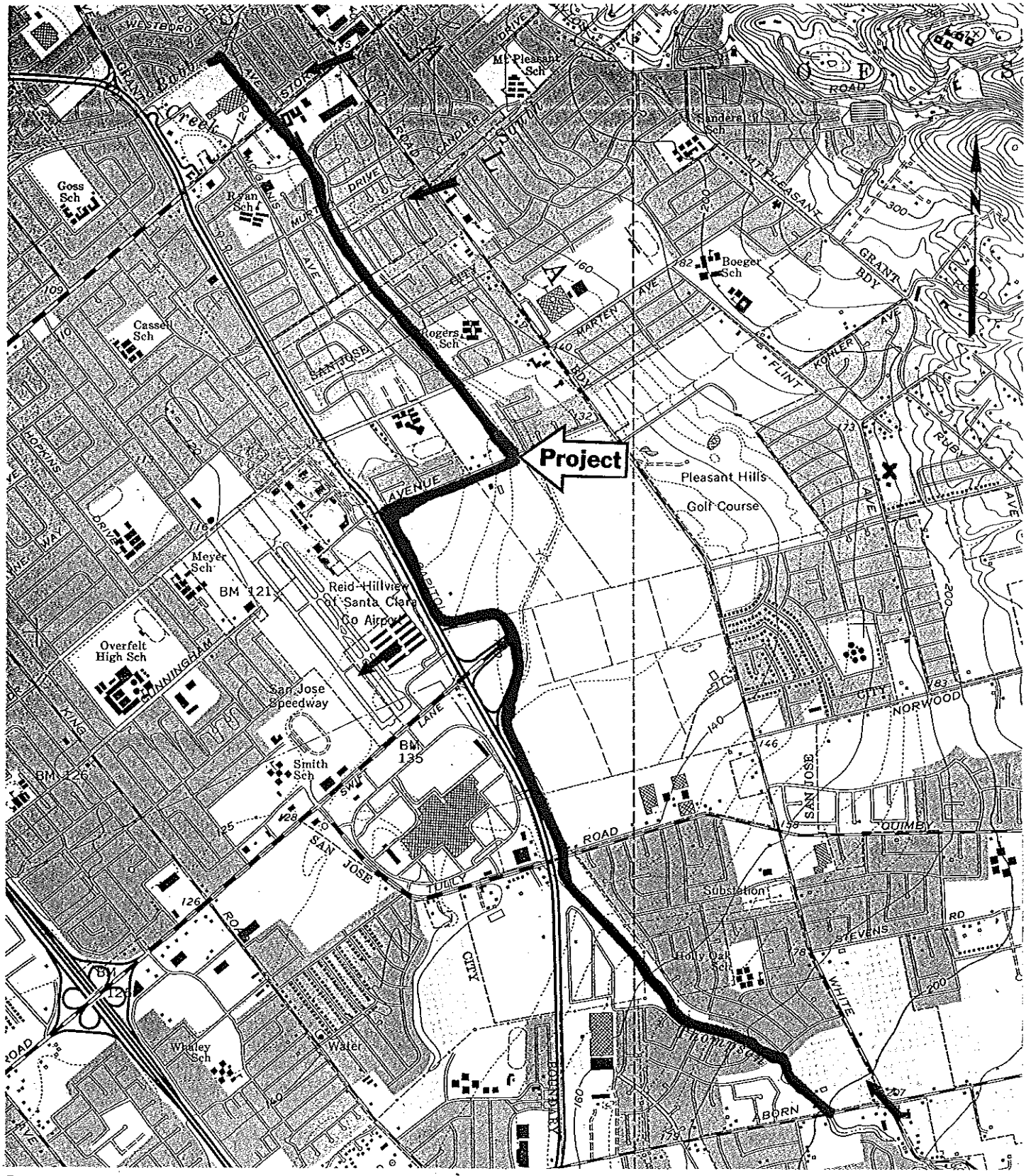
SEPTEMBER 2000

GROUND WATER GRADIENTS AT FUEL LEAK SITES
COYOTE CREEK THROUGH REACH 4C
SANTA CLARA VALLEY WATER DISTRICT
LOWER SILVER CREEK ESA
SAN JOSE, CALIFORNIA

FIGURE 3
PROJECT 1445



GROUND WATER GRADIENT DIRECTION

SCALE: 1" = 2,000'

MAP REFERENCE: San Jose East Quadrangle 1961, Photorevised 1980

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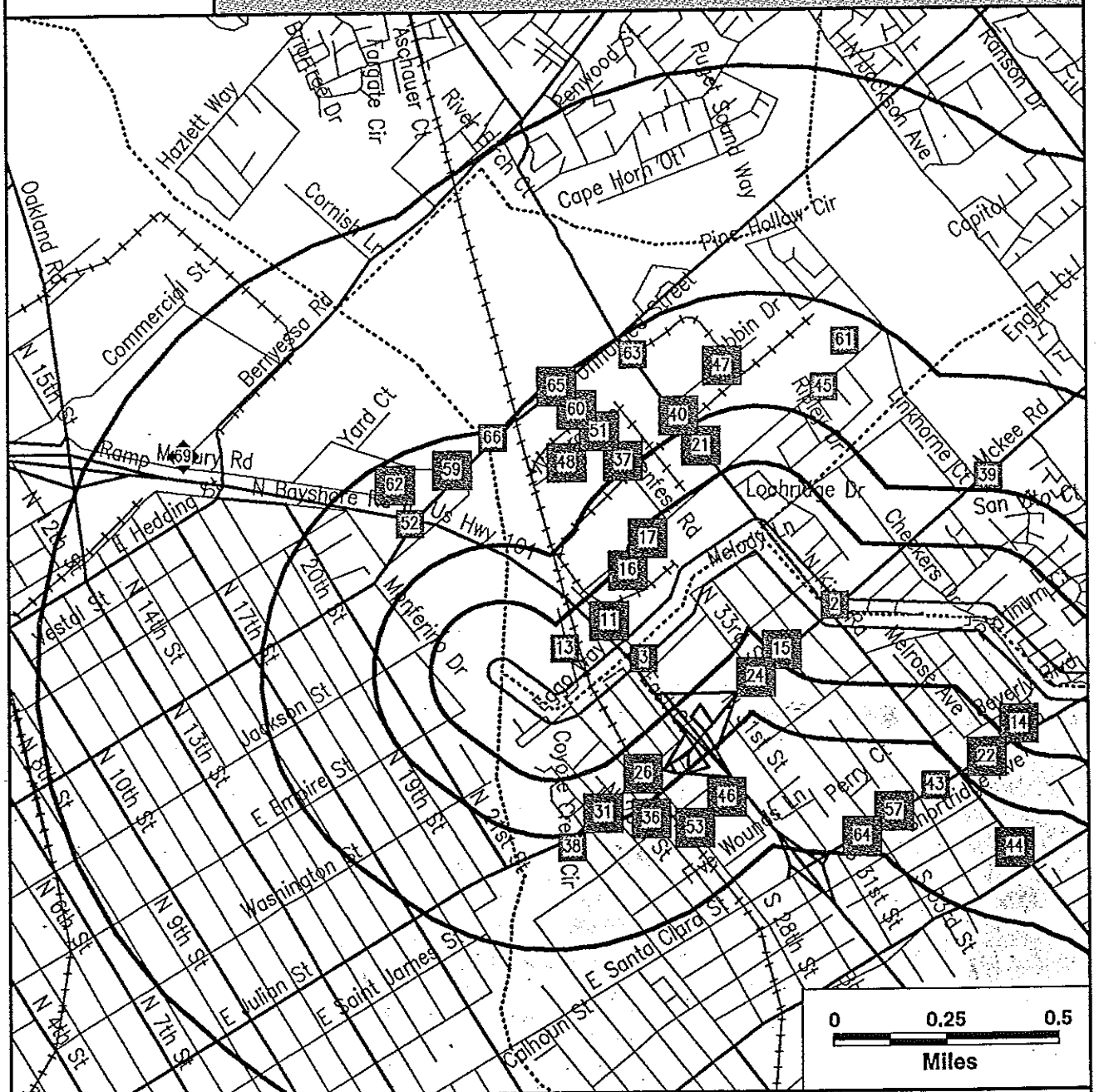
SEPTEMBER 2000

GROUND WATER GRADIENTS AT FUEL LEAK SITES
REACH 5A THROUGH ABORN ROAD
SANTA CLARA VALLEY WATER DISTRICT
LOWER SILVER CREEK ESA
SAN JOSE, CALIFORNIA

FIGURE
4
PROJECT
1445

SITE ASSESSMENT - SPECIAL PROJECT

Detail Map 1



Subject Centerline	Category:	A	B	C	D	Risk Sites Plotted as Polygons
Search Area	Single Sites	◆	■	▲	●	▦
	Multiple Sites	◆	■	▲	●	

- Highways and Major Roads
- Roads
- Railroads
- Rivers or Water Bodies
- Utilities

Categories correspond to database searches described in the Site Distribution Summary, beginning on Page #1.

For More Information Call VISTA Information Solutions, Inc. at **1 - 800 - 767 - 0403**

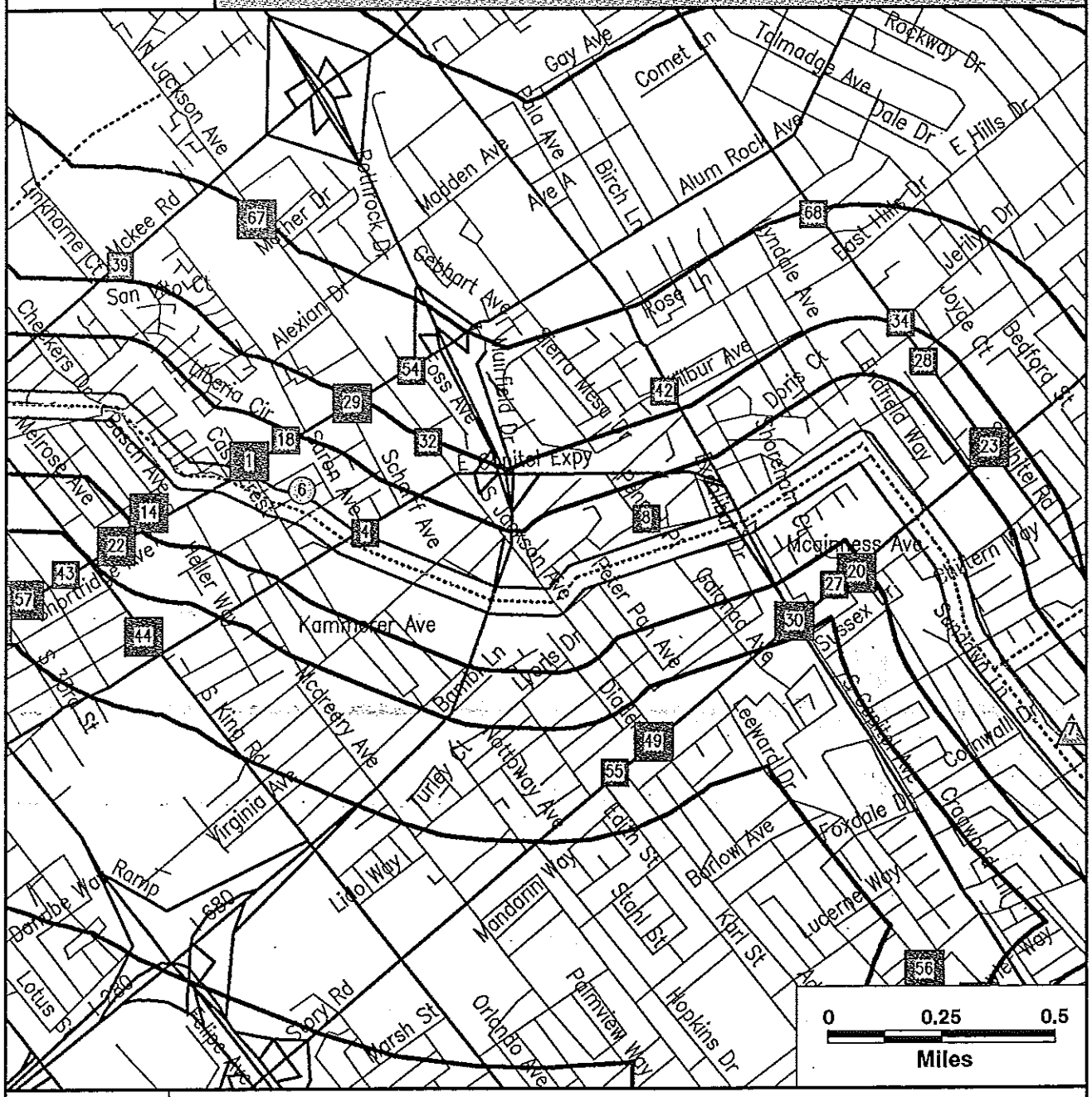
Report ID: **328355001**

Date of Report: **May 25, 2000**

FIGURE 5

SITE ASSESSMENT - SPECIAL PROJECT

Detail Map 2



Subject Centerline	Category:	A	B	C	D	Risk Sites Plotted as Polygons
Search Area	Single Sites	◆	■	△	●	
	Multiple Sites	◆	■	△	●	

- Highways and Major Roads
- Roads
- Railroads
- Rivers or Water Bodies
- Utilities

Categories correspond to database searches described in the Site Distribution Summary, beginning on Page #1.

For More Information Call VISTA Information Solutions, Inc. at **1 - 800 - 767 - 0403**

Report ID: **328355001**

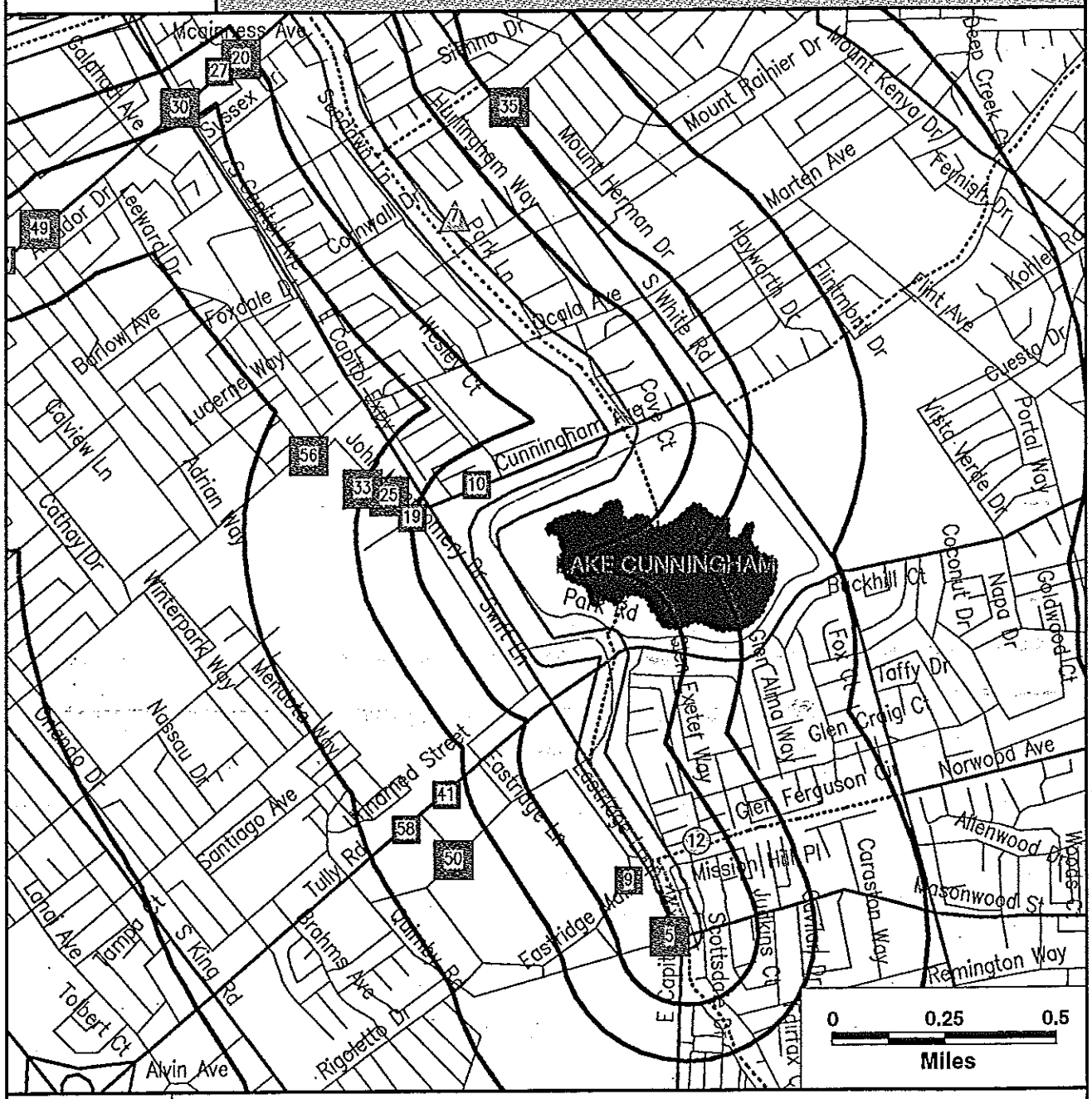
Date of Report: **May 25, 2000**

Page #4b

FIGURE 6

SITE ASSESSMENT - SPECIAL PROJECT

Detail Map 3



Subject Centerline	Category:	A	B	C	D	Risk Sites Plotted as Polygons
Search Area	Single Sites	◆	■	▲	●	
	Multiple Sites	◆	■	▲	●	

- Highways and Major Roads
- Roads
- Railroads
- Rivers or Water Bodies
- Utilities

Categories correspond to database searches described in the Site Distribution Summary, beginning on Page #1.

For More Information Call VISTA Information Solutions, Inc. at **1 - 800 - 767 - 0403**

Report ID: **328355001**

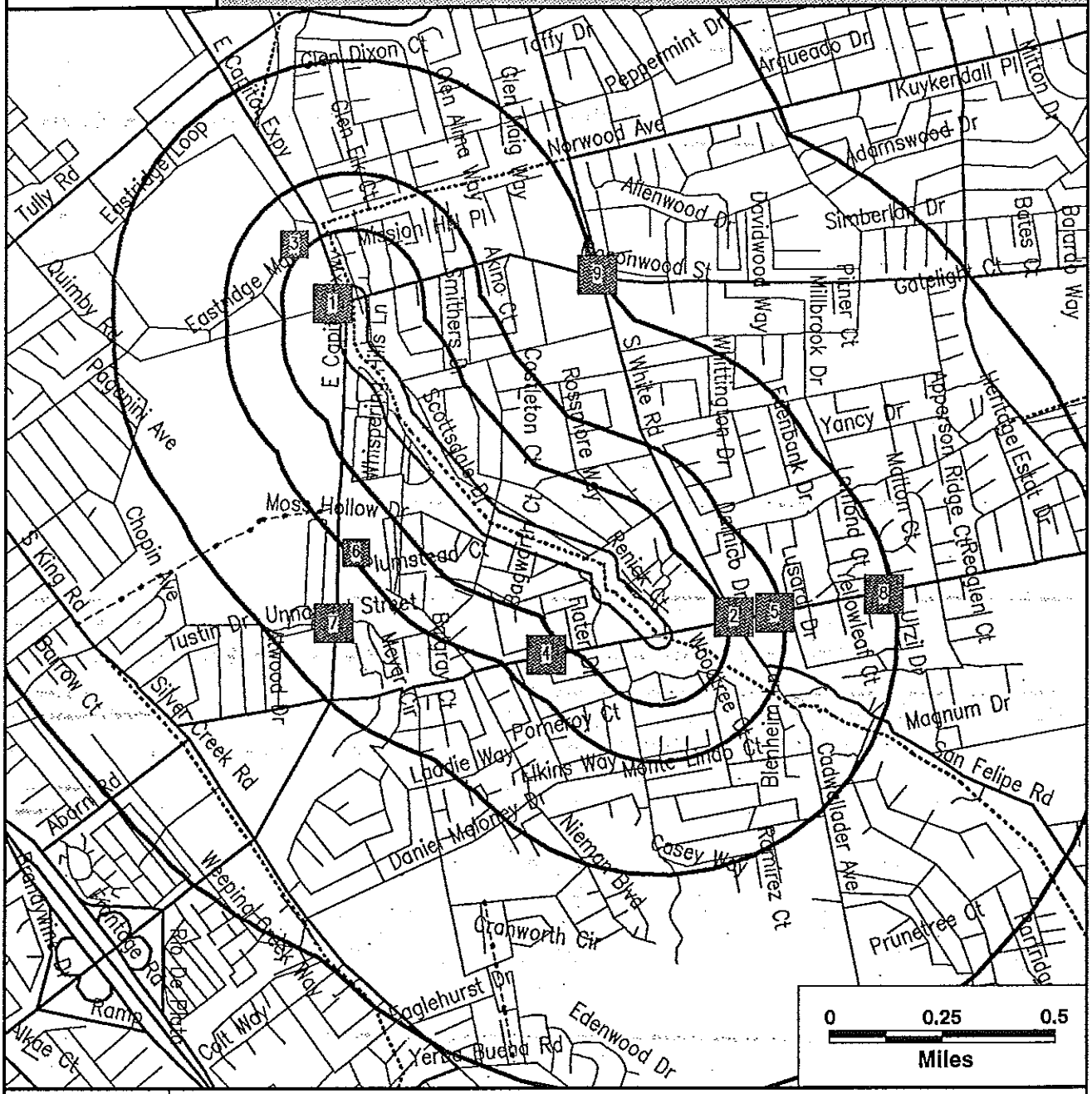
Date of Report: **May 25, 2000**

Page #4c

FIGURE 7

SITE ASSESSMENT - SPECIAL PROJECT

Detail Map 4



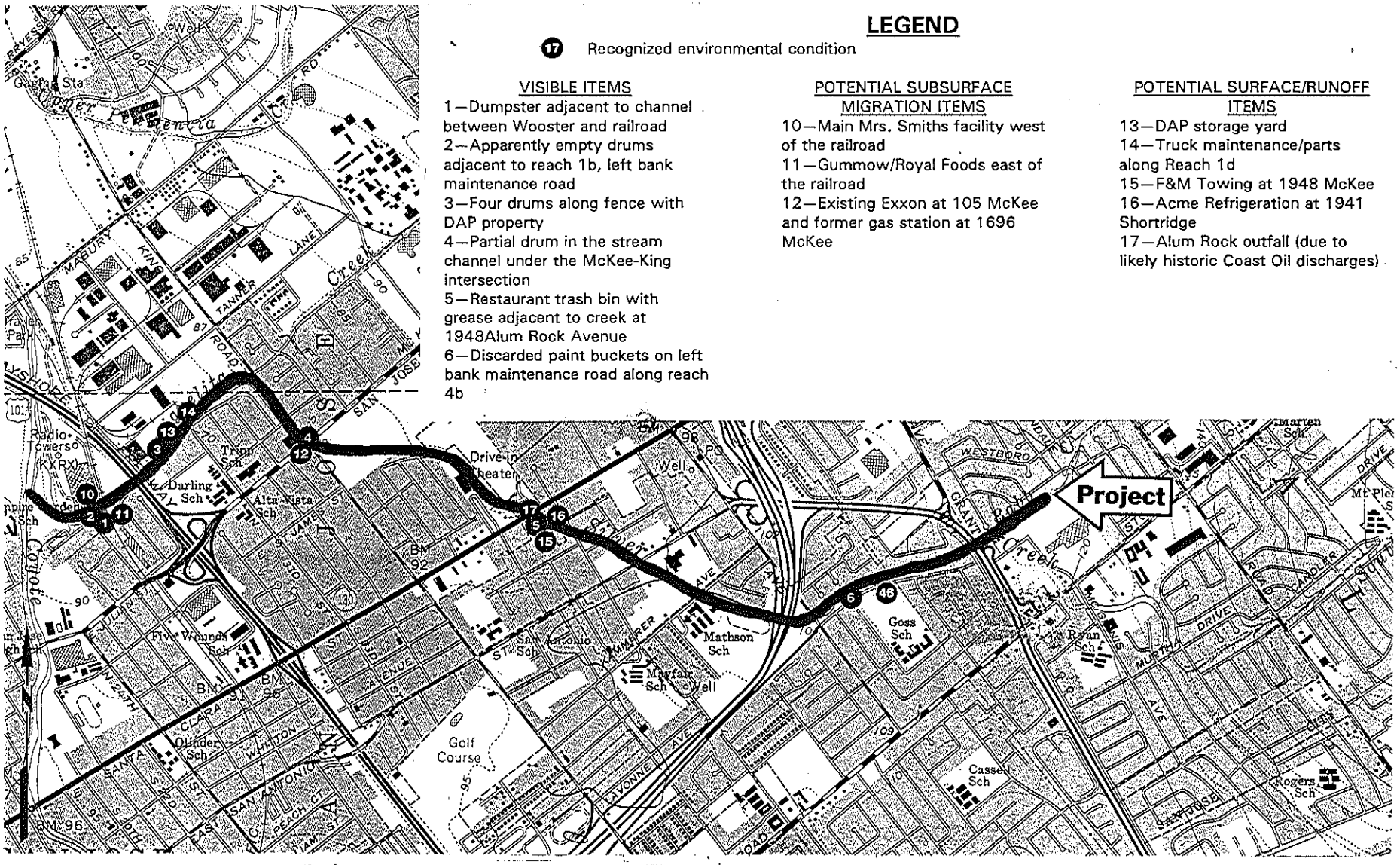
Subject Centerline	Category:	A	B	C	D	Risk Sites Plotted as Polygons
Search Area	Single Sites	◆	■	▲	●	▨
	Multiple Sites	◆	■	▲	●	

Highways and Major Roads
Roads
Railroads
Rivers or Water Bodies
Utilities

Categories correspond to database searches described in the Site Distribution Summary, beginning on Page #1.

For More Information Call VISTA Information Solutions, Inc. at **1 - 800 - 767 - 0403**
Report ID: **344137001**
Date of Report: **August 14, 2000**

FIGURE 8



LEGEND

17 Recognized environmental condition

VISIBLE ITEMS

1—Dumpster adjacent to channel between Wooster and railroad
2—Apparently empty drums adjacent to reach 1b, left bank maintenance road
3—Four drums along fence with DAP property
4—Partial drum in the stream channel under the McKee-King intersection
5—Restaurant trash bin with grease adjacent to creek at 1948Alum Rock Avenue
6—Discarded paint buckets on left bank maintenance road along reach 4b

POTENTIAL SUBSURFACE MIGRATION ITEMS

10—Main Mrs. Smiths facility west of the railroad
11—Gummow/Royal Foods east of the railroad
12—Existing Exxon at 105 McKee and former gas station at 1696 McKee

POTENTIAL SURFACE/RUNOFF ITEMS

13—DAP storage yard
14—Truck maintenance/parts along Reach 1d
15—F&M Towing at 1948 McKee
16—Acme Refrigeration at 1941 Shortridge
17—Alum Rock outfall (due to likely historic Coast Oil discharges)

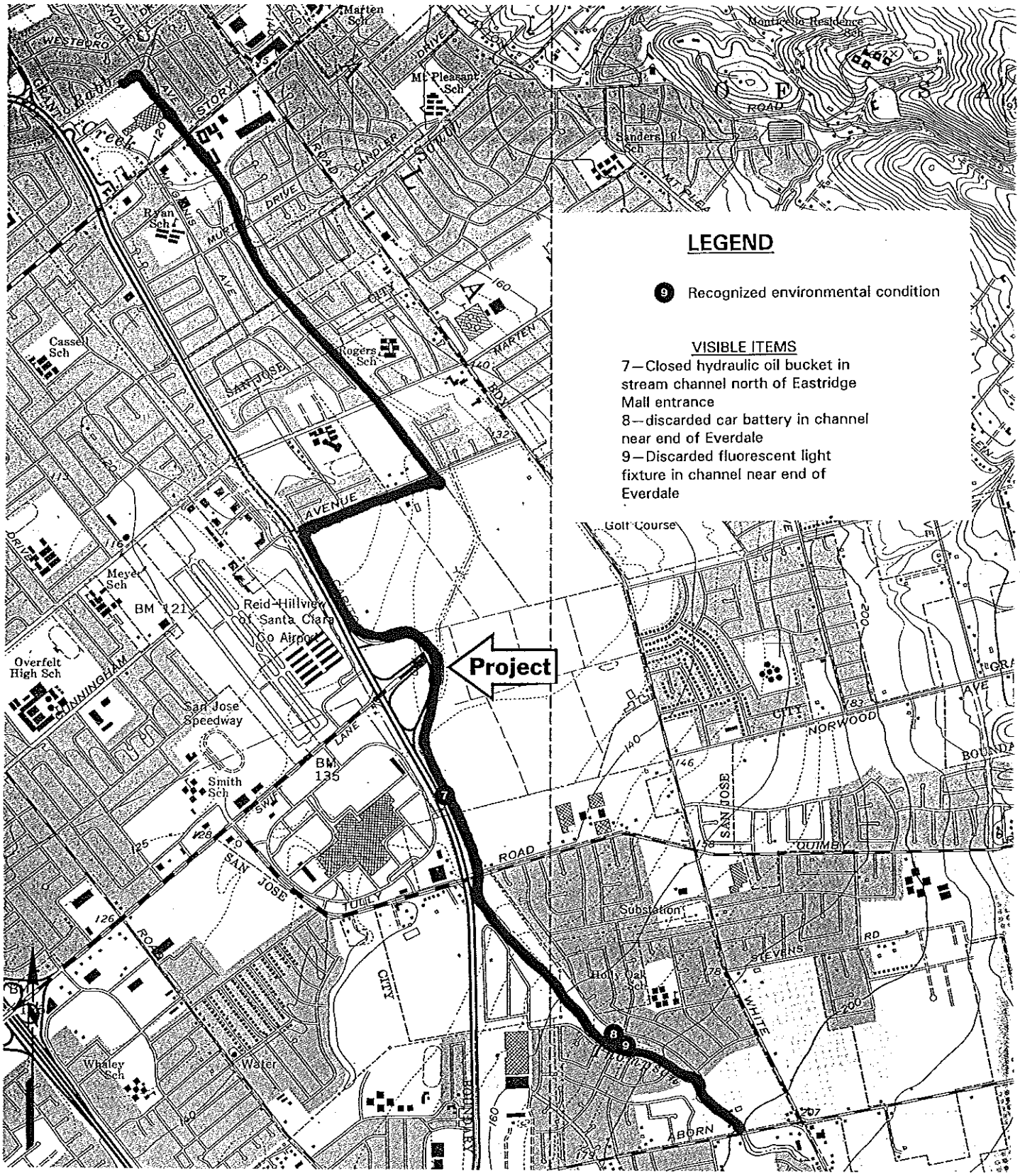
SCALE: 1" = 2,000'

MAP REFERENCE: San Jose East Quadrangle 1961, Photorevised 1980

D & M Consulting Engineers, Inc.
A URS Corporation Company
SEPTEMBER 2000

RECOGNIZED ENVIRONMENTAL CONDITIONS
COYOTE CREEK THROUGH REACH 4C
SANTA CLARA VALLEY WATER DISTRICT
LOWER SILVER CREEK ESA
SAN JOSE, CALIFORNIA

FIGURE 9
PROJECT 1445



SCALE: 1" = 2,000'

MAP REFERENCE: San Jose East Quadrangle 1961, Photorevised 1980

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A URS Corporation Company
SEPTEMBER 2000

RECOGNIZED ENVIRONMENTAL CONDITIONS
REACH 5A THROUGH ABORN ROAD
SANTA CLARA VALLEY WATER DISTRICT
LOWER SILVER CREEK ESA
SAN JOSE, CALIFORNIA

FIGURE 10
PROJECT 1445

APPENDIX 3A-16

LSC R4 HAZMAT REPORT

DRAFT

SITE INVESTIGATION REPORT
LOWER SILVER CREEK, REACH 4
SAN JOSE, CALIFORNIA

PREPARED FOR:

PARIKH CONSULTANTS, INC.
MILPITAS, CALIFORNIA

PREPARED BY:

GEOCON CONSULTANTS, INC.
2356 RESEARCH DRIVE
LIVERMORE, CALIFORNIA

JULY 2001

Project No. E8004-06-04
July 5, 2001

Mr. Gary Parikh
Parikh Consultants, Inc.
481 Valley Way, Building 1
Milpitas, California 95035

Subject: TRANSMITTAL OF DRAFT SITE INVESTIGATION REPORT
LOWER SILVER CREEK REACH 4
SAN JOSE, SANTA CLARA COUNTY, CALIFORNIA

Dear Mr. Parikh:

In accordance with Geocon's *Draft Hazardous Materials Sampling and Analysis Plan, Lower Silver Creek, Reach 4, San Jose, California* dated April 16, 2001, Geocon has performed environmental engineering services at the above-referenced project site. The project site consists of Lower Silver Creek from approximately 300 feet west of Jackson Avenue to 0.5 mile east of East Capitol Expressway in San Jose, California.

The accompanying report summarizes the services performed, including the advancement of soil borings, the collection of soil and groundwater samples, and chemical analyses.

If there are any questions concerning the contents of this report, or if Geocon may be of further service, please contact the undersigned at your convenience.

Sincerely,

GEOCON

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EXECUTIVE SUMMARY

In accordance with the *Draft Hazardous Materials Sampling and Analysis Plan, Lower Silver Creek, Reach 4, San Jose, California* dated April 16, 2001 and comments received from Brian House of CH2M Hill, dated May 8, 2001, Geocon performed environmental investigation at the project site. The project site consists of Lower Silver Creek from approximately 300 feet west of Jackson Ave to 0.5 mile east of East Capitol Expressway in San Jose, California.

The purpose of the investigation was to characterize soil and groundwater that may be encountered during construction activities. The investigation was accomplished through the advancement of soil borings, the collection of soil and groundwater samples, and the performance of laboratory analyses. The investigative results will be used to evaluate health and safety issues, appropriate soil re-use/disposal measures, and appropriate groundwater disposal measures.

Creek Sediment

Sediment samples were collected at five locations (SD1 through SD5) from the existing creek channel. While TPHmo and TPHd were detected, only TPHmo was detected above 100 mg/kg in one sample. TPHg or BTEX were not detected above laboratory reporting limits in any of the sediment samples.

Pesticides, PCBs, SVOCs, VOCs and BTEX compounds were not detected above laboratory reporting limits.

Total metal concentrations were less than respective Title 22 TTLC values and less than 10 times their respective STLC.

Embankment Soil

Soil samples were collected and analyzed from 11 borings (B1 through B11) advanced along the creek banks. Three four-part composite samples (SF1 through SF3) from surface soil were also collected and analyzed.

TPHd were detected in most soil samples. With the exception of 280 mg/kg TPHmo and 100 mg/kg TPHd at SF2, the reported TPHmo and TPHd concentrations were less than 100 mg/kg.

TPHg, BTEX, MTBE, VOCs, or SVOCs were not detected above laboratory reporting limits in any of the soil samples.

The pesticides DDT, DDE, DDD, and chlordane were detected at low concentrations in the surface soil samples. The reported pesticide concentrations are much less than California and Federal hazardous waste thresholds and less than PRGs established by USEPA.

Total metal concentrations were less than respective TTLC values and less than ten times their respective STLC values.

Groundwater

Petroleum hydrocarbons and an associated analyte (MTBE) were detected in sample locations between East Capitol Expressway and South Jackson Avenue. The samples exhibited relatively low concentrations of TPHmo and TPHd. TPHmo was reported at concentrations ranging from less than 0.05 milligrams per liter (mg/l) to 0.4 mg/l. TPHd was reported at concentrations ranging from less than 0.050 mg/l to 0.18 mg/l.

TPHg was not detected in any of the grab-groundwater samples. MTBE (2.6 ug/l in B5, 2.6 ug/l in B6, and 4.7 ug/l in B8) was the only gasoline-related analytes detected in grab-groundwater samples. All MTBE concentrations were below their Primary Health Goal.

VOCs or SVOCs were not detected in groundwater.

With the exception of mercury, dissolved total metal were not detected in groundwater above their respective MCLs. Mercury was detected at 0.0081 mg/l in B4, 0.0045 mg/l in B8, and 0.0063 mg/l in B9. The MCL for mercury is 0.002 mg/l. Chromium was detected at its MCL of 0.050 mg/l in B4 and B11.

Discussion

Based on the investigation results, the concentrations detected in sediment, soil, and groundwater do not pose a human health risk but may require special handling and disposal practices during construction as discussed below.

Sediment

The low levels of TPHmo TPHd detected in sediment is likely due to storm water runoff entering the creek from nearby streets and storm drains. The detected concentrations should not restrict sediment reuse or disposal. It is anticipated that the sediment should be accepted by most landfills, as only one detected petroleum hydrocarbon concentration was greater than 100 mg/kg (in a discrete sample). It is likely that the representative disposal concentration following excavation and inherent mixing will be less than 100 mg/kg.

It is recommended that the excavation contractor obtain acceptance for sediment reuse/disposal from the receiving location(s) prior to construction.

Soil

The low levels of TPHmo and TPHd detected in embankment soil are also likely due to storm water runoff entering the creek from nearby streets and storm drains. While heavy petroleum hydrocarbons were reported in one soil sample (SF2), it is anticipated that the representative disposal concentration will be less than 100 mg/kg due to the inherent mixing that will occur during construction. This mixing (and associated dilution) is allowable as part of typical construction activities. It is anticipated that the soil should be accepted by most landfills, as the representative petroleum hydrocarbon concentrations should be less than 100 mg/kg.

The low levels of pesticides detected in surface soils are likely due to the agricultural history of the Santa Clara Valley. The detected concentrations are less than regulatory thresholds and the soil is not considered a hazardous waste based on pesticide concentrations. The low pesticide levels may however restrict the acceptance of the soil by landfills.

It is recommended that the excavation contractor obtain acceptance for soil reuse/disposal from the receiving location(s) prior to construction.

Groundwater

At four locations, the detected TPHmo concentrations in groundwater exceed the instantaneous maximum limit of 0.05 mg/l established in *Discharges of Extracted and Treated Groundwater Resulting From the Cleanup of Groundwater Polluted by Fuel Leaks and Other Related Wastes at Service Stations and Similar Sites* (RWQCB Order No. 96-078). The concentrations of TPHmo ranged from 0.072 to 0.4 mg/l.

At two locations, chromium was detected at its MCL of 0.05 mg/l. At four locations, mercury was detected above its MCL. All other dissolved metals concentrations were below respective MCLs. The dissolved metal concentrations detected in groundwater may restrict the discharge of water encountered during construction.

Based on the investigation results, sampling and analysis may be required to monitor heavy petroleum hydrocarbon concentrations in soil and groundwater and chromium and mercury concentrations in groundwater.

Geocon recommends that engineering controls (i.e., sediment traps, settling tanks) be implemented during construction to regulate water discharge. The controls will serve to 1) allow for the retention, sampling, and potential treatment of water prior to discharge and 2) reduce the suspended sediment load and suspended sediment discharge rate.

The contractor should implement appropriate health and safety measures as required by relevant regulations for construction activities scheduled to occur within the project boundaries. The health and safety plan should include a discussion of the constituents of concern, routes of exposure, permissible exposure limits, and personal protective measures. The health and safety plan should be reviewed and signed by the on-site construction workers prior to the commencement of field activities.

Based on the findings of this investigation, sediment, soil, and groundwater at the site are not classified as "Hazardous Waste" due to contaminant concentrations. However, the low levels of petroleum hydrocarbons and pesticides detected may restrict the reuse or disposal of excess soil. Additionally, low levels of petroleum hydrocarbons and dissolved metals detected in the groundwater, may restrict the discharge of the water.

Geocon anticipates that the contractor will be required to complete a waste profile and may be required to perform additional sampling and analysis to prior to acceptance for offsite reuse or disposal. The analytical methods and sample frequency will be dependent on the volume of material to be exported and facility-specific acceptance criteria. Analytical methods may include, but are not limited to, the analytical suite used in this investigation, soluble metals, and oil and grease.

Geocon further recommends that the investigation results and recommendations be forwarded to the appropriate regulatory agencies (i.e., US Army Corps of Engineers and Regional Water Quality Control Board) for their review and concurrence during project certification.

SITE INVESTIGATION REPORT

1.0 INTRODUCTION

This Site Investigation Report presents the results of a limited subsurface soil and groundwater investigation performed at Lower Silver Creek Reach 4. This Site Investigation Report was prepared in accordance with Geocon Consultants, Inc. (Geocon) *Draft Hazardous Materials Sampling and Analysis Plan, Lower Silver Creek, Reach 4, San Jose, California* dated April 16, 2001 and comments received from Brian House of CH2M Hill, dated May 8, 2001. The project location is depicted on the attached Vicinity Map, Figure 1.

The areas investigated included the existing surface and subgrade soil on the Creek bank, sediments in the creek, and groundwater that may discharge to the creek during construction efforts. The sampling locations are depicted on the Site Plans, Figure 2.

1.1 Proposed Improvements and Project Description

Lower Silver Creek drains a watershed in the southeastern portion of the City of San Jose, is approximately five miles long, and empties into Coyote Creek. Flood protection improvements are planned for all segments of Lower Silver Creek from the Coyote Creek confluence to Lake Cunningham. This investigation focuses on Reach 4that extends from approximately 300 feet west of Jackson Ave to 0.5 mile east of East Capitol Expressway, in San Jose, California.

The project includes the following improvements:

- Removal of existing fences, slope protections, outfall structures, and other minor structures.
- Removal of existing reinforced concrete box culvert, inlet and outlet structures, and street improvements at Jackson Avenue.
- Construction of approximately 3,900 lineal feet of creek modifications including floodwalls, slope protection, all weather maintenance road, low flow channel, and landscaping.
- Construction of a new triple reinforced concrete box culvert, inlet and outlet structures, and street improvements at Jackson Avenue.
- Removal and replacement of concrete confluence structure at North Babb Creek.
- Construction of weirs and/or check dams if determined to be necessary by final hydraulics

1.2 Purpose

The purpose of the investigation and reporting is to identify hazardous materials that may impact project construction, project personnel, the public and/or the environment. The results of this investigation will be used to evaluate hazardous materials impacts, provide recommendations for soil and groundwater monitoring during construction, and prepare a plan for managing the disposal of wastes generated during construction.

2.0 BACKGROUND

Geocon reviewed the following sources of information to develop the proposed scope of work:

- *Environmental Site Assessment Report, SCVWD Contract No. A2327T, Lower Silver Creek, Coyote Creek Confluence to Aborn Road, San Jose, California.* Prepared by D&M Consulting Engineers, Inc., September 2000.

2.1 Sampling Plan

Based on a review of the above documents, Geocon prepared the *Draft Hazardous Materials Sampling and Analysis Plan, Lower Silver Creek, Reach 4, San Jose, California* dated April 16, 2001 (SAP). The SAP provided the proposed sample locations and rationale for the sampling and analysis.

In general, the anticipated contaminants of concern at the subject site included:

- Petroleum Hydrocarbons – gasoline (TPHg), diesel (TPHd)
- Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX)
- Methyl tertiary-butyl ether (MTBE)
- Volatile Organic Compounds (VOCs)
- Title 22 metals
- Semi-Volatile Organic Compounds (SVOCs)
- Organochlorine Pesticides
- Polychlorinated Biphenyls (PCBs)

The only comments to the SAP were received from Brian House of CH2M Hill. Mr. House commented that surface samples should not be composited for VOC and SVOC analysis, as proposed in the SAP. As discussed in a telephone conversation between Mr. House and Richard Day of Geocon, it was agreed that composite samples would be analyzed for SVOCs and that discrete samples would be analyzed for VOCs.

2.2 Hazardous Waste Determination Criteria

Regulatory criteria to classify a waste as "California hazardous" for handling and disposal purposes are contained in the *California Code of Regulations (CCR)*, Title 22, Division 4.5, Chapter 11, Article 3, §66261.24. Criteria to classify a waste as "Resource, Conservation, and Recovery Act (RCRA) hazardous" are contained in Chapter 40 of the Code of Federal Regulations (40 CFR), Section 261.

A waste is classified as "California hazardous" when: 1) the total content exceeds the Total Threshold Limit Concentration (TTLC); or 2) the soluble content exceeds the Soluble Threshold Limit Concentration (STLC) based on Waste Extraction Test (WET) analysis. A material is classified as "RCRA hazardous" when the soluble content exceeds the Federal Regulatory Level based on Toxicity Characteristic Leaching Procedure (TCLP) testing.

State and/or federal regulatory levels have been established for select metals, pesticides, VOCs and SVOCs. Currently, regulatory criteria for the classification of wastes containing petroleum hydrocarbons have not been promulgated.

The above regulatory criteria are based on toxicity. Wastes may also be classified as hazardous based on other criteria such as corrosivity and ignitability. However, for the purposes of this investigation, toxicity (i.e., concentration) is the primary factor considered for waste classification since waste generated during the construction activities would not likely warrant testing for corrosivity, ignitability or other criteria. Waste that is classified as either "California hazardous" or "RCRA hazardous" requires management as a hazardous waste.

3.0 SCOPE OF SERVICES

Geocon performed the following scope of services that included site meetings, on-site fieldwork, laboratory analyses, and preparation of this Site Investigation Report.

3.1 Pre-Field Activities

- Conducted the pre-work site visit on March 13, 2001. The site visit was performed by Geocon representative Richard Day. A second pre-work site visit was performed prior to drilling to locate and inspect the work areas and mark the proposed boring locations for Underground Service Alert (USA).

- Prepared a health and safety plan for the proposed field activities. The health and safety plan provided guidelines on the use of personal protective equipment and the health and safety procedures implemented during the field activities.

- Contacted the local public utilities via Underground Service Alert to attempt to delineate subsurface public and private utilities and conduits in proximity to the boring locations.

- Retained the services of Gregg Drilling to perform the drilling work and Advanced Technology Laboratories (ATL), a California certified hazardous materials testing, to perform soil and groundwater analyses.

3.2 Field Activities

The fieldwork for this project was performed under the direct supervision of Geocon's field supervisor and/or project manager. Sampling locations are depicted on Figure 2.

The investigation consisted of the following field activities:

- 11 borings were advanced at the subject site;
- 11 soil samples were collected from the borings;
- 10 grab-groundwater samples were collected from soil borings;
- 12 surface soil samples were collected from the creek banks; and
- 5 sediment samples were collected from the Creek bottom.

4.0 INVESTIGATIVE METHODS

The following presents the method of investigation for the boring advancement and sampling procedures and protocols.

4.1 Soil Sampling

Soil boring locations and sampling rationale were based on proposed project improvements where soil would be excavated and/or where groundwater might be encountered during future construction activities.

A truck-mounted direct-push sampling system was used to advance all borings on June __ and ___, 2001. Soil samples collected with the Geoprobe sampling system were retained in acetate sleeves to facilitate sampling handling and storage. Borings were advanced to total depths ranging from 20 to 33 feet bgs.

The acetate sleeve sections from the Geoprobe sampling system Teflon® sheets on each end, and capped. Each tube and jar prepared for sample handling and storage was labeled, placed in a chilled cooler, and transported to Advanced Technology Laboratory, a State certified laboratory in Signal Hill, California for chemical sample by washing the equipment with an Alconox wash solution followed by subsequent tap water and deionized water rinses All soil cuttings generated from the direct push soil borings were containerized in 5-gallon plastic buckets. The direct push borings were grouted with cement grout to the surface.

Twelve surface soil samples were collected at approximately 0.5 foot bgs from three areas (SF1 through SF3 [four samples from each area]). The samples were collected using pre-cleaned spade. The samples were analyses under standard chain-of-custody procedures.

The Creek sediment samples (SD1 through SD5) were collected from the Creek bottom utilizing a pre-cleaned, sampler. The sediment samples were transferred to laboratory supplied glass jars and capped.

Quality assurance/quality control (QA/QC) procedures provided during the field activities included cleansing/rinsing of the sampling equipment and the utilization of pre-cleaned samplers at each boring location. Cleansing/rinsing of the sampling equipment was performed prior to the collection of each soil transferred directly to laboratory supplied glass jars and capped.

4.2 Groundwater Sampling

Groundwater was encountered in the direct-push borings at approximately 25 to 30 feet bgs. Groundwater sampling was accomplished by advancing the borings to approximately 5 to 10 feet below groundwater. A 3/4-inch diameter polyvinyl chloride (PVC) slotted casing was placed into the open borehole and used as a temporary casing. The groundwater samples were collected from within the temporary casing using bailers. Groundwater samples were placed in appropriate laboratory-provided containers, labeled, placed in a chilled cooler, and transferred to ATL under standard chain-of-custody procedures. The PVC casing was removed following sample collection. The boreholes were abandoned by grouting.

Sample bottles from 8 of the 11 borings advanced on June 14 and 15 arrived broken at the analytical laboratory. Geocon remobilized the direct-push drilling equipment on June 21, 2001 to attempt to re-collect those samples broken during shipment. During the additional drilling efforts on June 21, refusal conditions were encountered in several of the boring locations and groundwater was not reached. Additionally, several of the borings produced a minimal volume of water, when it was encountered.

Due to the combination of refusal conditions, minimal water production, and broken sample containers, the following groundwater analyses outlined in the SAP were not performed:

- No groundwater analysis was performed on B1;
- SVOCs was the only analysis performed on B2 or B7;
- TPHg, BTEX, and VOCs were the only analyses performed on B3;
- SVOC analysis was not performed on B5; and
- TPHmo and TPHd analysis was not performed in B7 or B8.

4.3 Laboratory Analyses

Soil samples were submitted to the laboratory for the full suite or any combination thereof the following analyses:

- Title 22 metals following United States Environmental Protection Agency (EPA) Test Method 6010/7471
- SVOCs following EPA Test Method 8270
- VOCs following EPA Test Method 8260 or 8021B
- Organochlorine Pesticides and PCBs following EPA Test Method 8080/8081
- TPHg/BTEX/MTBE following modified EPA Test Method 8015/8020
- TPHd following modified EPA Test Method 8015

Due to a miscommunication between Geocon field personnel and the analytical laboratory, the composite samples from areas SF2 and SF3 were analyzed for VOCs, instead of a discrete surface sample from each of these areas as requested by CH2M Hill. While the sample analysis deviated from the agreed-upon SAP, it is not expected that VOCs would have been detected in any of the discrete surface samples as the discrete sample from area SF1 did not detect VOCs nor were VOCs detected in any of the other discrete soil samples collected from the site.

The groundwater samples were subjected to the following analyses:

- VOCs following EPA Test Method 8260B
- TPHg following modified EPA Test Method 8015
- TPHd following modified EPA Test Method 8015B
- Dissolved Title 22 metals following EPA Test Method 6010/7471.
- Organochlorine Pesticides and PCBs following EPA Test Method 8080/8081

The water samples analyzed for dissolved Title 22 metals were filtered by the analytical laboratory upon receipt, prior to preservation.

QA/QC procedures were performed for each method of analysis with specificity for each analyte listed in the test method's QA/QC. The laboratory QA/QC procedures included the following:

- One method blank for every ten samples, batch of samples, or type of matrix, whichever was more frequent.
- One sample analyzed in duplicate for every ten samples, batch of samples, or type of matrix, whichever was more frequent.
- One spiked sample for every ten samples, batch of samples, or type of matrix, whichever was more frequent, with the spike made at ten times the detection limit or at the analyte level.

The laboratory reports were reviewed for accuracy and consistency with the chain-of-custody documentation. In addition, the laboratory QA/QC summary reports were reviewed to determine if the laboratory results are within tolerance control limits. Based upon this review process, the data quality appears to be adequate.

5.0 INVESTIGATION RESULTS AND FIELD OBSERVATIONS

The investigation results from the soil and groundwater sampling are discussed below along with observations made in the field.

5.1 Soil Samples

A summary of the analytical laboratory test results for VOCs, BTEX, MTBE, SVOCs, Organochlorine Pesticides, PCBs, TPHg, TPHd, and TPHmo is presented as Table 1. Table 2 contains a summary of the test results for total Title 22 metals. Copies of the laboratory reports and chain-of-custody documentation for the soil samples are included in Appendix A.

5.1.1 Sediment Investigation

A total of five sediment samples (SD1 through SD5) were analyzed for the full suite of analysis. The results are summarized as follows:

- Title 22 metals were not detected at total concentrations greater than respective TTLC value or 10 times the their respective STLC value;
- No pesticides or PCBs were detected in sediment samples above the method reporting limit;
- TPHmo was detected in each sediment sample analyzed. The maximum TPHmo concentration was 110 mg/kg;
- TPHd was detected in four of the sediment samples analyzed. The maximum TPHd concentration was 20 mg/kg; and
- VOCs, BTEX, TPHg, or SVOCs were not detected at concentrations greater than the respective method reporting limits.

5.1.2 Surface Soil Investigation

A total of three four-part composite surface soil samples (SF1 through SF3) were collected and were analyzed for the full suite of analysis. The results are summarized as follows:

- Title 22 metals were not detected at total concentrations greater than respective TTLC values or 10 times their STLC values;
- No PCBs were detected in soil samples above the method reporting limit;
- The pesticides DDD, DDE, DDT, chlordane, alpha-chlordane, and gamma-chlordane were detected at low concentrations (less than 0.3 mg/kg) in the surface soil composite sample from area SF1. DDE and DDT were also detected at low concentrations in the surface soil composite samples from areas SF2 and SF3. In all areas, the detected concentrations were not greater than respective TTLCs or 10 times respective STLC values. Additionally, the detected pesticide concentrations are below Preliminary Remediation Goals (PRGs) established by USEPA.
- TPHmo and TPHd were detected in each surface soil sample analyzed. The maximum TPHmo concentration was 280 mg/kg. The maximum TPHd concentration was 100 mg/kg; and
- VOCs, SVOCs, BTEX, MTBE, and TPHg were not detected at concentrations greater than the respective method reporting limits.

5.1.3 Subgrade Soil Investigation

A total of 11 subgrade (3 feet bgs) soil samples were analyzed for the full suite of analysis. Of the 11 subgrade soil samples subjected to laboratory analyses:

- Title 22 metals were not detected at total concentrations greater than respective TTLC values or ten times their respective STLC.
- No Pesticides or PCBs were detected in soil samples above the method reporting limit;
- TPHmo and TPHd were detected in most of the subgrade soil samples analyzed. The maximum TPHmo concentration was 10 mg/kg and the maximum TPHd concentration was 6.0 mg/kg; and
- VOCs, SVOCs, BTEX, MTBE, and TPHg were not detected at concentrations greater than the respective method reporting limits.

5.2 Groundwater Samples

A summary of analytical test results for VOCs, TPHg, TPHd, pesticides, and PCBs is presented in Table 3. A summary of analytical laboratory test results for dissolved Title 22 metals is presented in Table 4. Copies of the laboratory reports are presented in Appendix A.

- TPHmo was reported in four groundwater samples, with a maximum concentration of 0.40 mg/l. TPHd was reported in one groundwater sample at 0.18 mg/l.
- TPHg, VOCs, SVOCs, and BTEX compounds were not detected in groundwater above the laboratory reporting limits.
- MTBE was detected in three of the boring locations, with a maximum detected concentration of 4.7 ug/l. The three MTBE detections are all less than the Primary Health Goal of 13 ug/l.
- Mercury was the only dissolved metal detected above its MCL, with a maximum detected concentration of 0.0081 mg/l. The MCL for mercury is 0.002 mg/l. Chromium was detected at four boring locations. The maximum detected concentration equals the MCL of 0.05 mg/l. All other dissolved metals concentrations were below respective MCLs.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The investigation was accomplished through the advancement of soil borings, the collection of soil and groundwater samples, and the performance of laboratory analyses. The investigative results will be used to evaluate health and safety issues, appropriate soil re-use/disposal measures, and appropriate groundwater disposal measures.

Creek Sediment

Sediment samples were collected at five locations (SD1 through SD5) from the existing creek channel. While TPHmo and TPHd were detected, only TPHmo was detected above 100 mg/kg in one sample. TPHg or BTEX were not detected above laboratory reporting limits in any of the sediment samples.

Pesticides, PCBs, SVOCs, VOCs and BTEX compounds were not detected above laboratory reporting limits.

Total metal concentrations were less than respective Title 22 TTLC values and less than 10 times their respective STLC.

Embankment Soil

Soil samples were collected and analyzed from 11 borings (B1 through B11) advanced along the creek banks. Three four-part composite samples (SF1 through SF3) from surface soil were also collected and analyzed.

TPHd were detected in most soil samples. With the exception of 280 mg/kg TPHmo and 100 mg/kg TPHd at SF2, the reported TPHmo and TPHd concentrations were less than 100 mg/kg.

TPHg, BTEX, MTBE, VOCs, or SVOCs were not detected above laboratory reporting limits in any of the soil samples.

The pesticides DDT, DDE, DDD, and chlordane were detected at low concentrations in the surface soil samples. The reported pesticide concentrations are much less than California and Federal hazardous waste thresholds and less than PRGs established by USEPA.

Total metal concentrations were less than respective TTLC values and less than ten times their respective STLC values.

Groundwater

Petroleum hydrocarbons and an associated analyte (MTBE) were detected in sample locations between East Capitol Expressway and South Jackson Avenue. The samples exhibited relatively low concentrations of TPHmo and TPHd. TPHmo was reported at concentrations ranging from less than 0.05 milligrams per liter (mg/l) to 0.4 mg/l. TPHd was reported at concentrations ranging from less than 0.050 mg/l to 0.18 mg/l.

TPHg was not detected in any of the grab-groundwater samples. MTBE (2.6 ug/l in B5, 2.6 ug/l in B6, and 4.7 ug/l in B8) was the only gasoline-related analytes detected in grab-groundwater samples. All MTBE concentrations were below their Primary Health Goal.

VOCs or SVOCs were not detected in groundwater.

With the exception of mercury, dissolved total metal were not detected in groundwater above their respective MCLs. Mercury was detected at 0.0081 mg/l in B4, 0.0045 mg/l in B8, and 0.0063 mg/l in B9. The MCL for mercury is 0.002 mg/l. Chromium was detected at its MCL of 0.050 mg/l in B4 and B11.

Discussion

Based on the investigation results, the concentrations detected in sediment, soil, and groundwater do not pose a human health risk but may require special handling and disposal practices during construction as discussed below.

Sediment

The low levels of TPHmo TPHd detected in sediment is likely due to storm water runoff entering the creek from nearby streets and storm drains. The detected concentrations should not restrict sediment reuse or disposal. It is anticipated that the sediment should be accepted by most landfills, as only one detected petroleum hydrocarbon concentration was greater than 100 mg/kg (in a discrete sample). It is likely that the representative disposal concentration following excavation and inherent mixing will be less than 100 mg/kg.

It is recommended that the excavation contractor obtain acceptance for sediment reuse/disposal from the receiving location(s) prior to construction.

Soil

The low levels of TPHmo and TPHd detected in embankment soil are also likely due to storm water runoff entering the creek from nearby streets and storm drains. While heavy petroleum hydrocarbons were reported in one soil sample (SF2), it is anticipated that the representative disposal concentration will be less than 100 mg/kg due to the inherent mixing that will occur during construction. This

mixing (and associated dilution) is allowable as part of typical construction activities. It is anticipated that the soil should be accepted by most landfills, as the representative petroleum hydrocarbon concentrations should be less than 100 mg/kg.

The low levels of pesticides detected in surface soils are likely due to the agricultural history of the Santa Clara Valley. The detected concentrations are less than regulatory thresholds and the soil is not considered a hazardous waste based on pesticide concentrations. The low pesticide levels may however restrict the acceptance of the soil by landfills.

It is recommended that the excavation contractor obtain acceptance for soil reuse/disposal from the receiving location(s) prior to construction.

Groundwater

At four locations, the detected TPHmo concentrations in groundwater exceed the instantaneous maximum limit of 0.05 mg/l established in *Discharges of Extracted and Treated Groundwater Resulting From the Cleanup of Groundwater Polluted by Fuel Leaks and Other Related Wastes at Service Stations and Similar Sites* (RWQCB Order No. 96-078). The concentrations of TPHmo ranged from 0.072 to 0.4 mg/l.

At two locations, chromium was detected at its MCL of 0.05 mg/l. At four locations, mercury was detected above its MCL. All other dissolved metals concentrations were below respective MCLs. The dissolved metal concentrations detected in groundwater may restrict the discharge of water encountered during construction.

Based on the investigation results, sampling and analysis may be required to monitor heavy petroleum hydrocarbon concentrations in soil and groundwater and chromium and mercury concentrations in groundwater.

Geocon recommends that engineering controls (i.e., sediment traps, settling tanks) be implemented during construction to regulate water discharge. The controls will serve to 1) allow for the retention, sampling, and potential treatment of water prior to discharge and 2) reduce the suspended sediment load and suspended sediment discharge rate.

The contractor should implement appropriate health and safety measures as required by relevant regulations for construction activities scheduled to occur within the project boundaries. The health and safety plan should include a discussion of the constituents of concern, routes of exposure, permissible exposure limits, and personal protective measures. The health and safety plan should be reviewed and signed by the on-site construction workers prior to the commencement of field activities.

Based on the findings of this investigation, sediment, soil, and groundwater at the site are not classified as "Hazardous Waste" due to contaminant concentrations. However, the low levels of petroleum hydrocarbons and pesticides detected may restrict the reuse or disposal of excess soil. Additionally, low levels of petroleum hydrocarbons and dissolved metals detected in the groundwater, may restrict the discharge of the water.

Geocon anticipates that the contractor will be required to complete a waste profile and may be required to perform additional sampling and analysis to prior to acceptance for offsite reuse or disposal. The analytical methods and sample frequency will be dependent on the volume of material to be exported and facility-specific acceptance criteria. Analytical methods may include, but are not limited to, the analytical suite used in this investigation, soluble metals, and oil and grease.

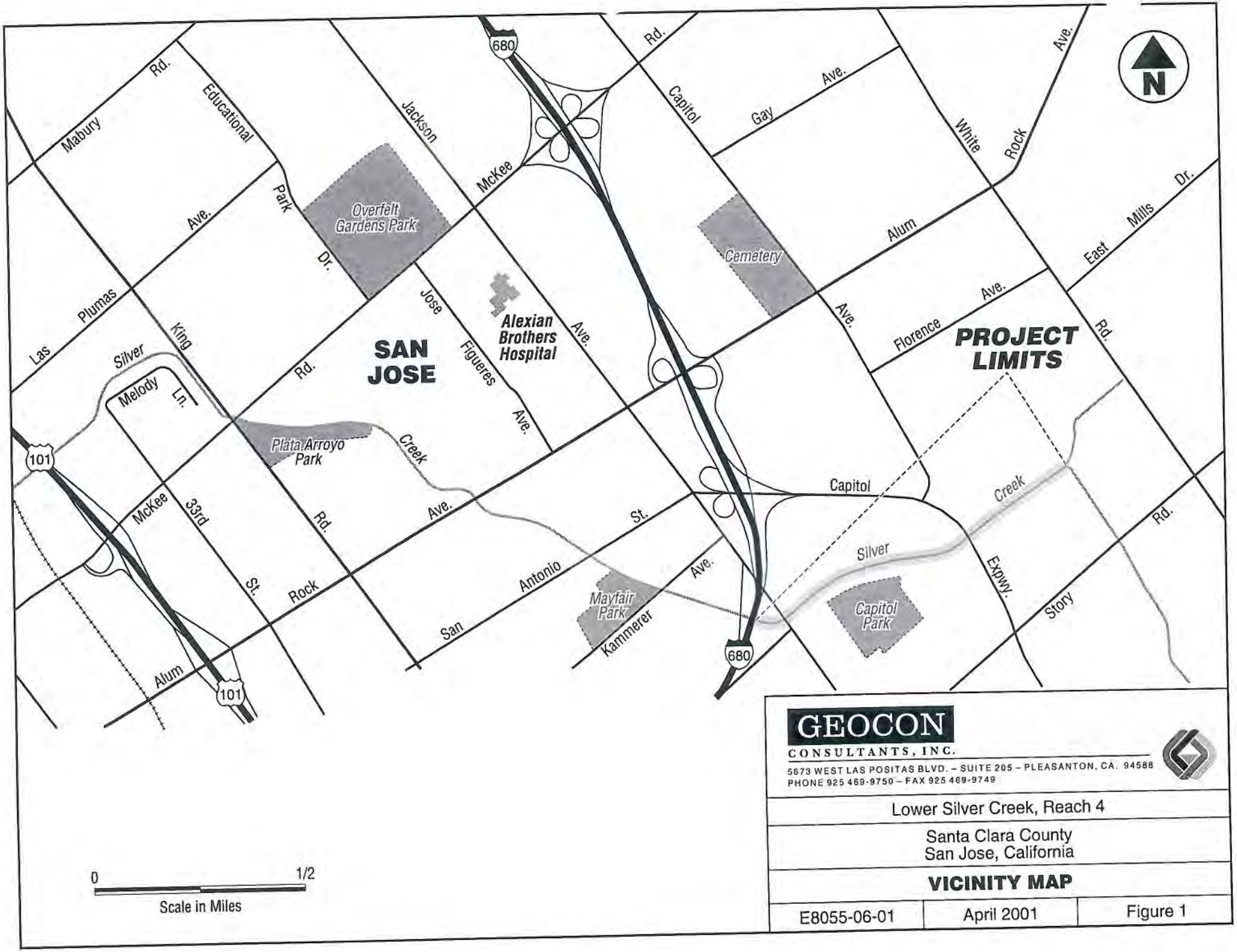
Geocon further recommends that the investigation results and recommendations be forwarded to the appropriate regulatory agencies (i.e., US Army Corps of Engineers and Regional Water Quality Control Board) for their review and concurrence during project certification.

7.0 REPORT LIMITATIONS

This report has been prepared in accordance with generally accepted practices using standards of care and diligence normally practiced by recognized consulting firms performing services of a similar nature. This report presents our professional judgment based upon data and findings identified in this report and the interpretation of such data based on our experience and background, and no warranty, either expressed or implied, is made. The conclusions presented are based on the current regulatory climate and may require revision if future regulatory changes occur.

The findings identified in this report are predicated on the results of the limited sampling and laboratory testing performed. This report does not address impacts related to sources other than those specified herein.

The contents of this report reflect the views of Geocon Consultants, Inc., who is responsible for the facts and accuracy of the data presented herein. This report does not constitute a standard, specification, or regulation.



GEOCON
CONSULTANTS, INC.
5673 WEST LAS POSITAS BLVD. – SUITE 205 – PLEASANTON, CA. 94588
PHONE 925 469-9750 – FAX 925 469-9749

Lower Silver Creek, Reach 4

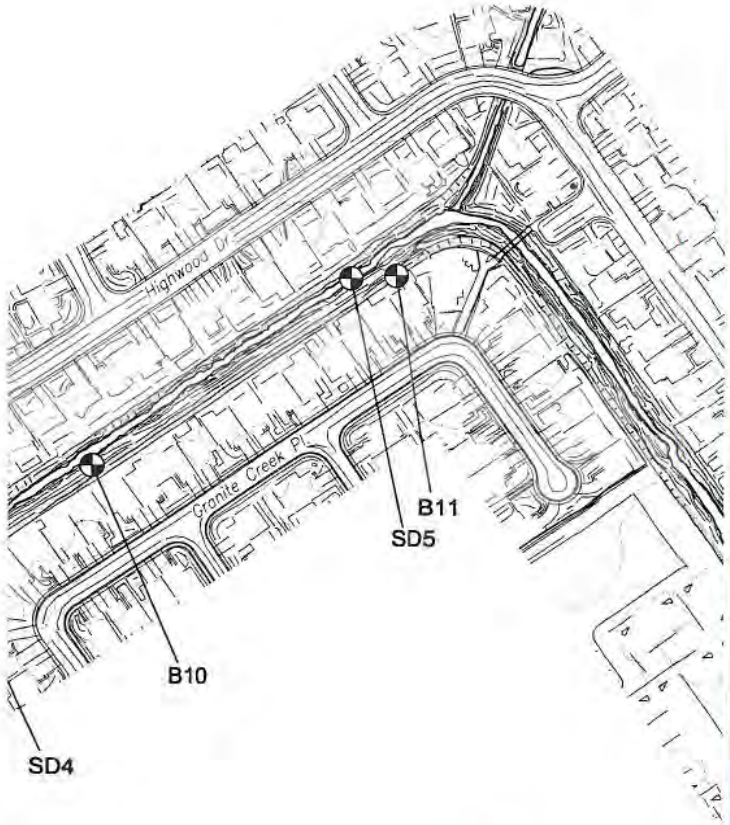
Santa Clara County
San Jose, California

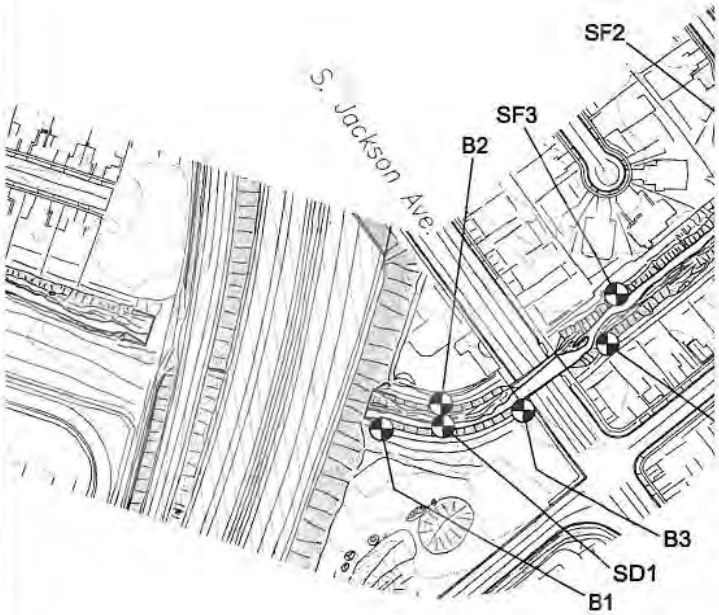
VICINITY MAP

E8055-06-01	April 2001	Figure 1

LEGEND:

⊕ Approximate Boring Location





N

0 300

SCALE: feet

1in. = 300ft

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Lower Silver Creek - Reach 4

San Jose, California	**SITE PLAN**	
GEOCON Proj. No. E8055-06-01	July 2001	Figure 2

BORINGS

TABLE 1
SOIL ANALYTICAL RESULTS - ORGANICS
LOWER SILVER CREEK REACH 4
SAN JOSE, SANTA CLARA COUNTY, CALIFORNIA

Sample I.D.	Sample Depth (ft)	TPHmo (mg/kg)	TPHd (mg/kg)	TPHg (mg/kg)	BTEX (ug/kg)	MTBE (ug/kg)	VOCs (ug/kg)	SVOCs (ug/kg)	Pesticides (ug/kg)	PCBs (ug/kg)
Sediment Samples										
SD1	NA	110	20	< 1.0	< 5.0	< 5.0	< 5.0	ND	ND	ND
SD2	NA	2.8	< 1.0	< 1.0	< 5.0	< 5.0	< 5.0	ND	ND	ND
SD3	NA	50	20	< 1.0	< 5.0	< 5.0	< 5.0	ND	ND	ND
SD4	NA	16	4.3	< 1.0	< 5.0	< 5.0	< 5.0	ND	ND	ND
SD5	NA	28	5.9	< 1.0	< 5.0	< 5.0	< 5.0	ND	ND	ND
Surface Samples										
SF1 Comp	0.5	61	24	<1.0	<5.0	<5.0	---	ND	DDD = 4.9 DDE = 76 DDT = 89 alpha-Chlordane = 30 Chlordane = 280 gamma-Chlordane = 29	Aroclor 1260 = 62
SF1-B	0.5	---	---	---	---	---	<5.0	---	---	---
SF2 Comp	0.5	280	100	<1.0	<5.0	<5.0	<5.0	ND	DDE = 8.4 DDT = 4.0	ND
SF3 Comp	0.5	31	15	<1.0	<5.0	<5.0	<5.0	ND	DDE = 6.7 DDT = 7.1	ND

TABLE 1
SOIL ANALYTICAL RESULTS - ORGANICS
LOWER SILVER CREEK REACH 4
SAN JOSE, SANTA CLARA COUNTY, CALIFORNIA

Sample I.D.	Sample Depth (ft)	TPHmo (mg/kg)	TPHd (mg/kg)	TPHg (mg/kg)	BTEX (ug/kg)	MTBE (ug/kg)	VOCs (ug/kg)	SVOCs (ug/kg)	Pesticides (ug/kg)	PCBs (ug/kg)
Soil Borings										
B1	3	6.9	2.7	<1.0	<5.0	<5.0	<5.0	ND	ND	ND
B2	3	< 1.0	<1.0	<1.0	<5.0	<5.0	<5.0	ND	ND	ND
B3	3	3.0	1.8	<1.0	<5.0	<5.0	<5.0	ND	ND	ND
B4	3	10	6.0	<1.0	<5.0	<5.0	<5.0	ND	ND	ND
B5	3	1.6	1.6	<1.0	<5.0	<5.0	<5.0	ND	ND	ND
B6	3	5.4	2.3	<1.0	<5.0	<5.0	<5.0	ND	ND	ND
B7	3		<1.0	<1.0	<5.0	<5.0	<5.0	ND	ND	ND
B8	3	10	1.9	<1.0	<5.0	<5.0	<5.0	ND	ND	ND
B9	3	2.5	<1.0	<1.0	<5.0	<5.0	<5.0	ND	ND	ND
B10	3	3.3	2.2	<1.0	<5.0	<5.0	<5.0	ND	ND	ND
B11	3	1.4	<1.0	<1.0	<5.0	<5.0	<5.0	ND	ND	ND

TPHmo = Total Petroleum Hydrocarbons as motor oil
TPHd = Total Petroleum Hydrocarbons as diesel
TPHg = Total Petroleum Hydrocarbons as gasoline
BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
MTBE = Methyl tertiary-butyl ether
PCBs = Polychlorinated Biphenyls

ND = No analytes detected above the method detection limit
< = Analyte was not detected above the stated detection limit
mg/kg = milligrams per kilogram (parts per million)
ug/kg = micrograms per kilogram (parts per billion)
VOCS = Volatile Organic Compounds
SVOCs = Semi-Volatile Organic Compounds

TABLE 2
SOIL ANALYTICAL RESULTS - METALS (mg/kg)
LOWER SILVER CREEK REACH 4
SAN JOSE, SANTA CLARA COUNTY, CALIFORNIA

Sample I.D.	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
Sediment Samples																		
SD1	NA	< 0.25	4.5	57	< 0.15	< 0.15	12	3.0	6.5	6.5	0.12	< 0.25	21	< 0.25	< 0.15	0.37	10	29
SD2	NA	0.43	10	190	< 0.15	< 0.15	36	11	29	6.0	< 0.10	< 0.25	61	< 0.25	< 0.15	0.50	26	54
SD3	NA	< 0.25	3.5	57	< 0.15	< 0.15	12	3.0	9.0	7.0	< 0.10	< 0.25	19	< 0.25	< 0.15	< 0.25	9.0	44
SD4	NA	< 0.25	2.0	28	< 0.15	< 0.15	5.5	1.0	3.0	2.5	< 0.10	< 0.25	7.0	< 0.25	< 0.15	< 0.25	4.5	18
SD5	NA	< 0.25	2.5	60	< 0.15	< 0.15	7.5	1.5	4.0	3.0	< 0.10	< 0.25	11	< 0.25	< 0.15	< 0.25	6.5	19
Surface Samples																		
SF1 Comp	0.5	0.44	9.0	140	< 0.15	< 0.15	34	8.5	29	32	< 0.10	< 0.25	54	< 0.25	< 0.15	0.41	22	92
SF2 Comp	0.5	0.38	10	150	< 0.15	< 0.15	35	9.5	26	18	< 0.10	< 0.25	58	< 0.25	< 0.15	0.50	25	110
SF3 Comp	0.5	0.43	8.0	130	< 0.15	< 0.15	30	8.0	20	42	< 0.10	< 0.25	50	< 0.25	< 0.15	0.50	20	80

TABLE 2
SOIL ANALYTICAL RESULTS - METALS (mg/kg)
LOWER SILVER CREEK REACH 4
SAN JOSE, SANTA CLARA COUNTY, CALIFORNIA

Sample I.D.	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
Boring Samples																		
B1	3	0.50	10	160	< 0.15	< 0.15	29	9.0	22	6.5	< 0.10	< 0.25	44	< 0.25	< 0.15	0.5	25	42
B2	3	0.36	9.0	120	< 0.15	< 0.15	24	8.5	16	6.0	< 0.10	0.50	42	< 0.25	< 0.15	0.50	20	36
B3	3	< 0.25	5.0	64	< 0.15	< 0.15	17	4.5	11	17	< 0.10	< 0.25	32	< 0.25	< 0.15	0.37	12	29
B4	3	0.50	10	140	< 0.15	< 0.15	42	10	24	7.5	0.12	< 0.25	76	< 0.25	< 0.15	0.50	24	53
B5	3	0.50	10	170	< 0.15	< 0.15	34	10	25	5.5	< 0.10	< 0.25	58	< 0.25	< 0.15	0.50	23	52
B6	3	0.44	6.0	86	< 0.15	< 0.15	20	6.0	12	4.5	< 0.10	< 0.25	38	< 0.25	< 0.15	0.33	11	32
B7	3	0.48	9.0	78	< 0.15	< 0.15	32	8.5	20	6.0	< 0.10	< 0.25	58	< 0.25	< 0.15	0.50	20	42
B8	3	0.50	12	120	< 0.15	< 0.15	28	8.5	18	6.0	< 0.10	< 0.25	48	< 0.25	< 0.15	0.50	22	42
B9	3	0.50	9.5	110	< 0.15	< 0.15	38	9.0	22	5.0	< 0.10	< 0.25	62	< 0.25	< 0.15	0.48	24	46
B10	3	0.50	10	79	< 0.15	< 0.15	41	9.5	24	6.5	< 0.10	0.33	71	< 0.25	< 0.15	0.50	25	48
B11	3	0.50	9	100	< 0.15	< 0.15	33	6	18.0	4.5	< 0.10	< 0.25	52	< 0.25	< 0.15	0.5	26	39

mg/kg = milligrams per kilogram
< = Analyte not detected above laboratory reporting limit

TABLE 3
GROUNDWATER ANALYTICAL RESULTS - ORGANICS
LOWER SILVER CREEK REACH 4
SAN JOSE, SANTA CLARA COUNTY, CALIFORNIA

Sample I.D.	TPHmo (mg/l)	TPHd (mg/l)	TPHg (mg/l)	BTEX (ug/l)	MTBE (ug/l)	VOCs (ug/l)	SVOCs (ug/l)
B2	---	---	---	---	---	---	ND
B3	---	---	< 0.05	< 0.50	---	< 5.0	---
B4	0.40	0.18	< 0.050	< 0.50	< 0.50	< 5.0	ND
B5	0.078	< 0.050	< 1.0	< 0.50	2.6	< 5.0	---
B6	0.072	< 0.050	< 0.050	< 0.50	2.6	< 5.0	ND
B7	---	---	---	---	---	---	ND
B8	---	---	< 0.050	< 0.50	4.7	< 5.0	---
B9	0.12	< 0.062	< 0.050	< 0.50	< 0.50	< 5.0	ND
B10	< 0.050	< 0.050	< 0.050	< 0.50	< 0.50	< 5.0	ND
B11	< 0.062	< 0.062	< 0.050	< 0.50	< 0.50	< 5.0	ND

TPHmo = Total Petroleum Hydrocarbons as motor oil
TPHd = Total Petroleum Hydrocarbons as diesel
TPHg = Total Petroleum Hydrocarbons as gasoline
BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
MTBE = Methyl tertiary-butyl ether
VOCS = Volatile Organic Compounds
SVOCs = Semi-Volatile Organic Compounds
--- = Not Analyzed
ND = No analytes detected above the method detection limit
<0.050 = Analyte was not detected above the stated detection limit
mg/l = milligrams per liter
ug/l = micrograms per liter

TABLE 4
GROUNDWATER ANALYTICAL RESULTS - METALS (mg/l)
LOWER SILVER CREEK, REACH 4
SAN JOSE, SANTA CLARA COUNTY, CALIFORNIA

Sample I.D.	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
B4	< 0.0050	0.020	0.17	< 0.0030	< 0.0030	0.050	< 0.0030	0.070	0.070	0.0081	0.20	0.080	< 0.0050	< 0.0030	< 0.0050	0.050	0.050
B5	< 0.0050	0.0059	0.090	< 0.0010	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0050	< 0.0020	0.20	< 0.0030	< 0.0050	< 0.0010	< 0.0050	< 0.0030	0.010
B6	< 0.0050	0.010	0.16	< 0.0030	< 0.0030	0.0032	< 0.0030	< 0.0030	< 0.0050	< 0.0020	0.010	0.0051	< 0.0050	< 0.0030	< 0.0050	0.0032	< 0.010
B8	< 0.0050	0.010	0.18	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0050	0.0045	0.030	0.0047	< 0.0050	< 0.0030	< 0.0050	< 0.0030	< 0.010
B9	< 0.0050	0.010	0.26	< 0.0030	< 0.0030	0.010	< 0.0030	0.0058	< 0.0050	0.0063	0.020	0.030	< 0.0050	< 0.0030	< 0.0050	0.010	< 0.010
B10	< 0.0050	0.010	0.10	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0050	< 0.0020	0.010	< 0.0030	< 0.0050	< 0.0030	< 0.0050	< 0.0030	< 0.010
B11	< 0.0050	0.03	0.36	< 0.0030	< 0.0030	0.050	0.004	0.030	< 0.0050	0.017	< 0.0050	0.090	< 0.0050	< 0.0030	< 0.0050	0.060	0.020

mg/l = milligrams per liter
< = Analyte not detected above laboratory reporting limit

APPENDIX 3A-17

LSC RS5&6 PHASE II HAZMAT INVESTIGATION REPORT

SANTA CLARA VALLEY WATER DISTRICT

LOWER SILVER CREEK REACHES 5 & 6 PROJECT

PHASE II HAZARDOUS MATERIALS INVESTIGATION REPORT

Prepared by

PARSONS

MARCH 2001

LOWER SILVER CREEK REACHES 5 & 6
PHASE II HAZARDOUS MATERIALS INVESTIGATION REPORT
SAN JOSE, CALIFORNIA

Prepared by:

Rob Schapiro
Staff Geologist

3/27/01
Date

Reviewed and approved by:

Fred Kintzer
Task Manager

3/27/2001
Date

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SECTION 2

SOIL AND GROUNDWATER INVESTIGATION

2.1 LOCATION OF INVESTIGATION POINTS

Soil and groundwater samples were collected from 13 borings drilled at intervals of approximately 300 to 900 feet along Reaches 5 & 6 of Lower Silver Creek. The locations of the borings are shown on Figure 2 through Figure 8. Borings B1, B5, B6, B8, B11, and B14 were drilled on maintenance roads near the creek bed. Borings B3, B7, B9, B10, B12, and B13 were drilled on maintenance roads on top of the creek embankment. Boring B2 was drilled from a paved road on top of the creek embankment. Boring B4 was not drilled due to access problems. The borings on top of the embankment were designed to obtain a full profile of the creek embankment soils.

Creek bed sediment samples were collected from five locations (SD1 through SD5) shown on Figures 2 through 8. Sampling locations were selected to be representative of creek conditions or to sample specific areas of potential concern. SD1 was collected at the north end of Reach 5, less than 50 feet downstream of the confluence with North Babb Creek. SD2 was collected approximately 700 feet upstream from the confluence with North Babb Creek, adjacent to a small shopping center. This location was selected to assess the potential impact of any runoff from the shopping center. SD3 was collected upstream of Story Road, approximately 1,300 feet downstream of the Murtha Drive crossing. SD4 was collected under the Murtha Drive crossing, approximately 300 feet downstream of the South Babb Creek confluence with Lower Silver Creek. Construction activities were taking place in the creek bed, approximately 200 feet upstream of this sampling location. SD5 was collected approximately 50 feet downstream of Cunningham Avenue, downstream from a location where storm outfall pipes drained to the creek.

2.2 DRILLING AND SAMPLING OF EXPLORATORY BORINGS

Drilling

The borings were drilled on October 16 through 19 and October 23 through 25, 2000 by Bay Area Exploration, a subcontractor to GTC. GTC supervised the drilling and logged the soils encountered. Soil borings were advanced using truck-mounted hollow-stem augers. The borings ranged from 20 to 40 feet deep.

Boring B1. MTBE was detected at a concentration slightly above its California Maximum Contaminant Level for drinking water (MCL) of 13 μg/L. PCE was detected at a concentration below its MCL of 5 μg/L. The concentration of PCE was estimated since it was at a level below the laboratory detection limit.

Bis (2-ethylhexyl) phthalate was detected in four of the six samples tested for SVOCs, all at concentrations above the MCL of 4 μg/L. Like many urban creeks, Silver Creek has plastic debris (plastic bags, milk jugs, garbage, etc.) floating in the creek and stuck in the sediment. The phthalate detections are likely related to this debris, as phthalates are commonly present in plastics.

Metals with established MCLs were detected in the groundwater samples at concentrations above MCLs. The elevated metals levels may have resulted from sediment in the water. The results may therefore not be representative of dissolved concentrations in the groundwater. Filtration prior to laboratory analysis would have allowed for determination of dissolved metal concentrations. However, this study was a screening to evaluate the potential risks of discharging water to Silver Creek during construction. Water generated during construction will be turbid and will likely contain sediment. Thus, to fully assess the impact of discharging investigation derived water, the samples were left unfiltered.

Sediment Results

Sediment analytical results are summarized in Table 3. The Curtis and Tompkins, Ltd laboratory analytical reports are included in Appendix B. All five sediment samples were analyzed for TPH in the gasoline, diesel, and motor oil ranges; metals, VOCs, SVOCs, pesticides, and PCBs.

No pesticides, PCBs or VOCs were detected. TPH results were similar to those of the groundwater with TPH in the diesel (53 mg/kg maximum concentration) and motor oil (210 mg/kg maximum concentration) ranges detected in all samples. As was the case for the groundwater, the detections of TPH-d were noted as non-standard by the laboratory, since they contained heavier hydrocarbons than typical diesel fuel. Butylbenzylphthalate, which was detected at a concentration of 680 mg/kg (equal to the reporting limit) in the sample from SD1, was the only SVOC detected.

Low concentrations of 14 of the 17 metals included in the analyses were detected. Antimony, molybdenum, and silver were not detected. Except for the lead and zinc in SD5, metals were detected at similar concentrations in the sediment as in the soil. The concentrations of metals were generally two orders of magnitude or more below TTLCs. The concentrations of metals in the sediment were also generally below the corresponding STLC values. The maximum ratio of concentration of metal detected to corresponding STLC value for the sediment samples was for the lead detected in SD5. The concentration of lead was approximately eight times the corresponding STLC value in the sample. None of the metals concentrations exceeded ten times the corresponding STLC value. These results indicate that the sediment should not be characterized as hazardous.

Detected concentrations of metals and the concentration of butylbenzylphthalate detected were also well below PRGs for residential soil. These results indicate that the soil should not pose an unacceptable health risk.

SECTION 4

RECOMMENDATIONS

4.1 SOIL HANDLING AND DISPOSAL

Investigation Derived Soil

Soil cuttings and excess soil derived from drilling activities between October 16th and 25th 2000 were stored in 55-gallon steel drums. These drums were temporarily located on Santa Clara Valley Water District property, inside locked gates. Disposal of these drums was the responsibility of the geotechnical subcontractor, Geotechnical Consultants, Inc., based on the Recommendations for Disposal of Investigation Derived Soil (Parsons 2000c).

Based on the analyses performed for this project, the investigation derived waste soil does not contain contaminants, should not be classified as hazardous waste, and will not require special handling. This soil can be disposed of at a Class III landfill, pending any landfill specific acceptance criteria or profiling that may be required.

Soil Generated During Flood Control Improvements

Based on the findings of this Phase II Hazardous Materials Investigation, soil generated during future construction activities along Reaches 5 and 6 of Lower Silver Creek is not expected to contain contaminants and should not be classified as hazardous waste. This soil should be suitable for reuse or, alternatively, excess soil may be disposed of at a Class III landfill, pending any landfill specific acceptance criteria or profiling that may be required.

Based on comparison to PRGs for residential soil, soil generated during construction activities should not pose an unacceptable health risk.

Sediment excavated during future construction activities may require removal of water for project reuse or in order to be acceptable for landfill disposal. In addition, the landfill may have established criteria for disposal of TPH contaminated soil. Landfill specific acceptance criteria or profiling should be assessed prior to disposal of sediment.

It is recommended that District contractors be required to submit a sedimentation control plan showing how erosion of excavated soil stockpiles will be minimized to prevent increasing sediment loading of the creek.

4.2 GROUNDWATER HANDLING AND DISPOSAL

No water or groundwater wastewater was retained at the site as a result of this investigation.

Due to the likelihood that groundwater will be generated during construction activities, plans must be made for the handling and disposal of this water. If the water is to be discharged to the creek, a discharge permit must be obtained from the San Francisco Bay Regional Water Quality Control Board (RWQCB). The RWQCB grants discharge permits on a case-by-case basis. The water samples collected during this investigation contained relatively high concentrations of metals; however they were grab samples that contained a considerable amount of sediment, and are therefore not representative of actual groundwater concentrations. Groundwater that is clarified by filtration or settling out of suspended fines would likely have lower concentrations of metals. Construction contractors should be required to submit plans describing their proposed measures for controlling water discharges and minimizing suspended sediment in discharged water.

4.3 CONSTRUCTION MONITORING

The extent of soil and sediment sampling was limited in this investigation; therefore, material excavated during construction should be assessed for visual field indications of potential contamination (e.g. visible staining, odor, and real-time screening with handheld field instruments) and evaluated accordingly. These observations should be made by environmental professionals experienced in hazardous materials assessments. Additionally it is recommended that soil and sediment samples be analyzed during the construction activities. This will aid in determination of proper disposal of the soil and sediment. The frequency of observation should be based on rates of excavation. We recommend an inspection for each 100 cubic yards of soil removed, with samples collected for laboratory analysis from a variety of depths and locations.

SECTION 5

QUALITY ASSURANCE / QUALITY CONTROL

5.1 FIELD QA/QC PROCEDURES

Field activities were documented in a bound field logbook, including meter readings and calibration data. Those data were subsequently transferred to appropriate field forms. Copies of this sampling plan, the Health and Safety Plan (HASP), and any permits were available on site during all field activities.

Instruments requiring field calibration were calibrated daily, prior to the start of work. All calibration data were entered into the field logbook.

Strict chain-of-custody and sample preservation procedures as required by the specific analytical methods were adhered to by field personnel. Care was taken to ensure that air bubbles were not present in volatile organic analysis (VOA) vials, and that the samples were kept cool at 4 degrees Celsius. Appendix A of the Hazardous Materials Sampling and Analysis Plan (Parsons 2000b) shows the required sample volumes, preservation methods, and holding times for the analytical methods.

Field activities were conducted in accordance with the requirements specified in the sampling plan, under the supervision of a California Registered Geologist (R.G.) and a Certified Engineering Geologist (C.E.G.).

5.2 LABORATORY QUALITY CONTROL CHECKS

Quality control checks within the laboratory included several specific items in addition to those relating to calibration. These include method blanks for assessing contamination and spikes and duplicates for assessing precision and accuracy. The laboratory ran method blanks throughout the course of their analyses. No analytes were detected in the method blanks. All of the laboratory quality control / quality assurance data is on file and can be accessed upon request.

5.3 LABORATORY ANALYTICAL PROCEDURES

Laboratory analytical procedures are listed in Appendix A of the Hazardous Materials Sampling and Analysis Plan (Parsons 2000b).

SECTION 6

REFERENCES

D&M Consulting Engineers, Inc., Environmental Site Assessment Report, Lower Silver Creek Confluence to Aborn Road, San Jose, CA, Project 1445, September 2000.

Parsons, Health and Safety Plan, Lower Silver Creek Reaches 5 & 6, Phase II Hazardous Materials Investigation, October 2000a.

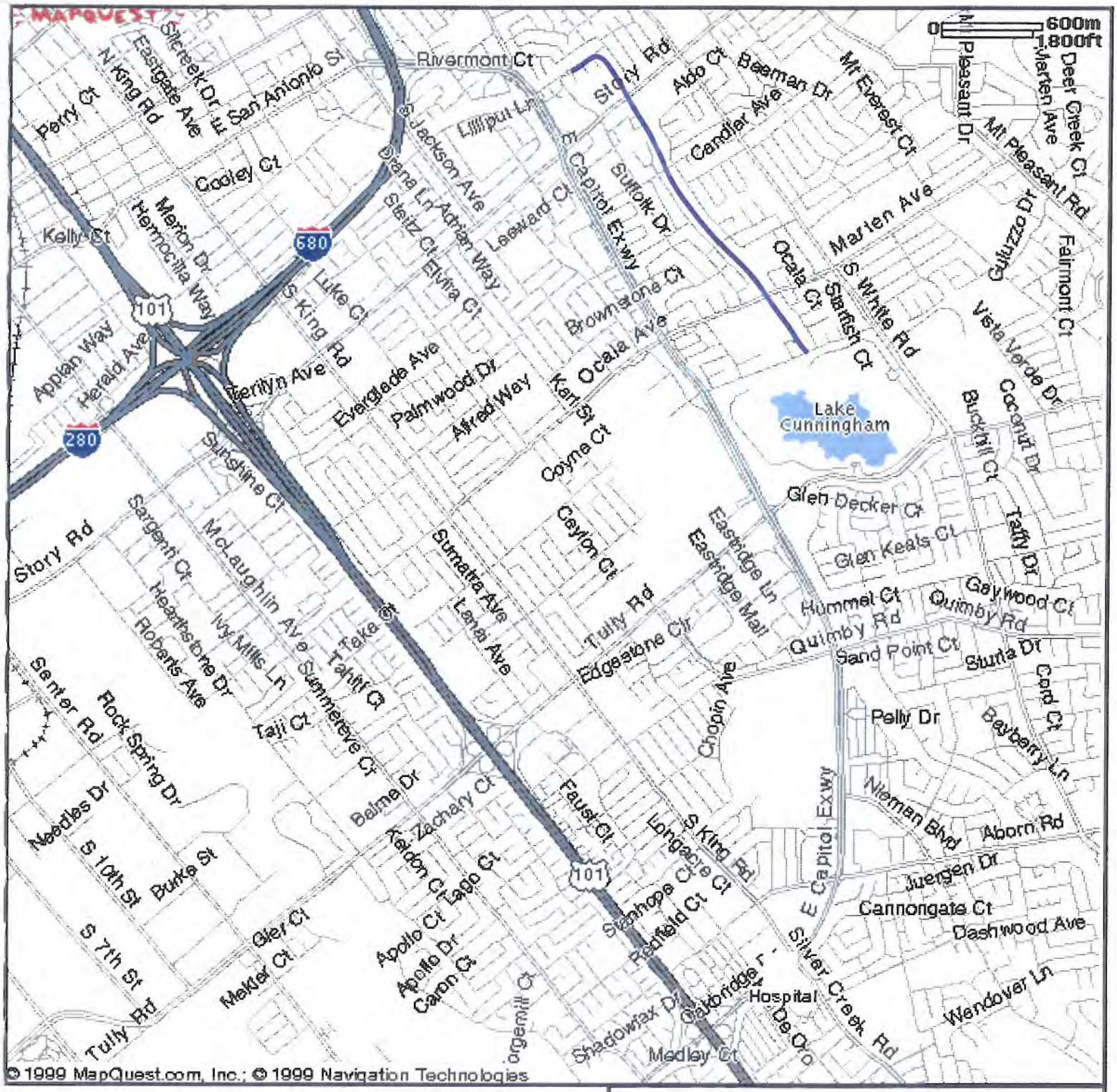
Parsons, Hazardous Materials Sampling and Analysis Plan, Lower Silver Creek Reaches 5 & 6, Phase II Hazardous Materials Investigation, October 2000b.

Parsons, Recommendations for Disposal of Investigation Derived Soil, Lower Silver Creek Reaches 5 & 6, Phase II Hazardous Materials Investigation, December 2000c.

Scott, C.M., Background Metals Concentrations in Soils in Northern Santa Clara County, California, M.S. Thesis at the University of San Francisco Environmental Management Program, December 1991.

FIGURES

FIGURE 1



N

600 m

1800 ft

Lower Silver Creek Reaches 5 & 6

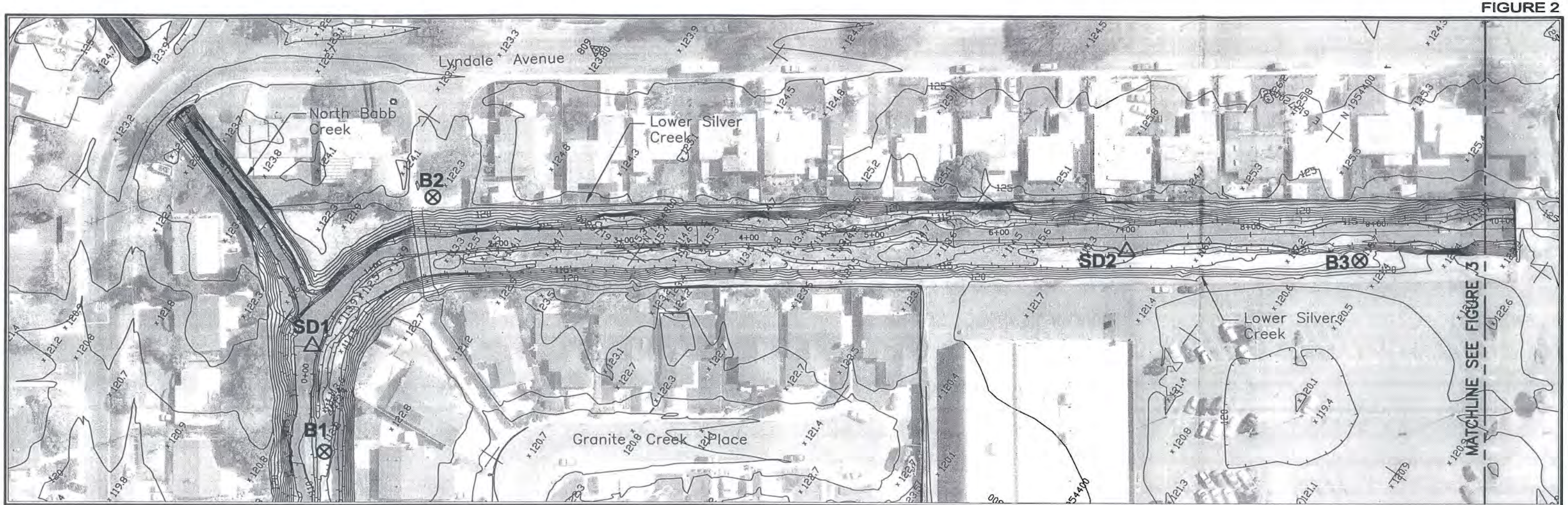
SITE LOCATION MAP

Lower Silver Creek Reaches 5 & 6
San Jose, CA

Lower Silver Creek Reaches 5 & 6
Phase II Hazardous Materials Investigation

PARSONS

FIGURE 2



LEGEND

⊗ HOLLOW STEM AUGER BORING LOCATION

△ CREEK SEDIMENT SAMPLING LOCATION

0 40' 80'

SCALE: 1"=80'

VERIFY SCALES

0 1"

BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SITE MAP WITH SAMPLING LOCATIONS
OCTOBER 2000

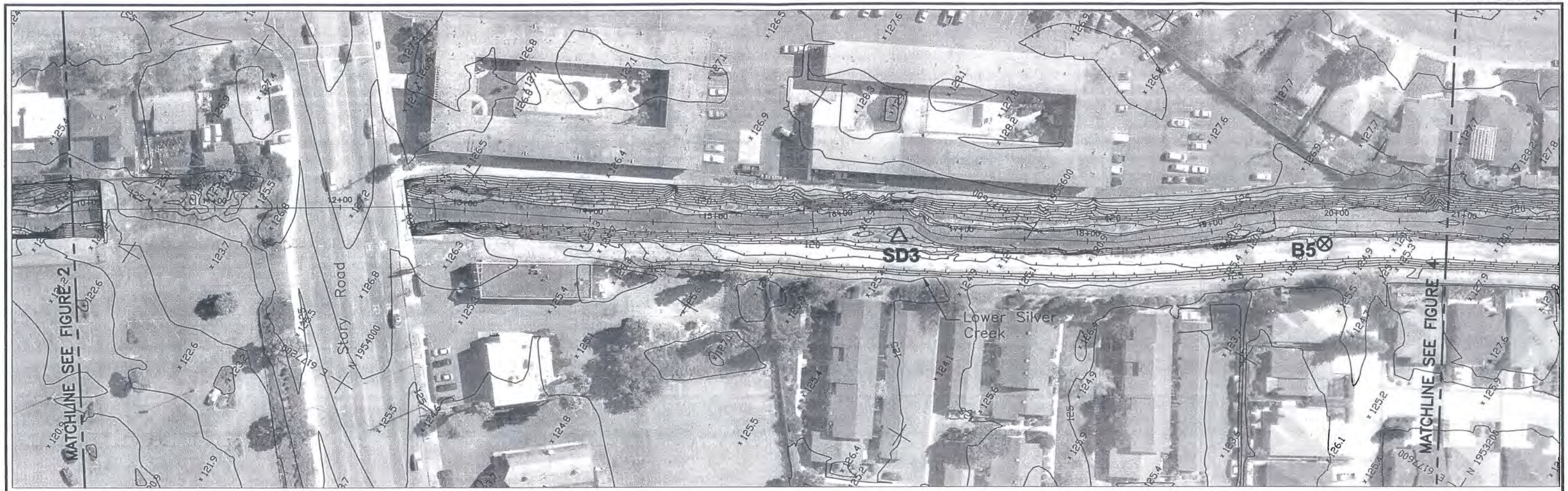
LOWER SILVER CREEK
REACHES 5 & 6
PHASE II ENVIRONMENTAL SITE ASSESSMENT

Santa Clara Valley Water District

PARSONS

DEC 7, 2000 - 10:21am Wanshare\ESOL\738703 Scvwd\figures\Scv001.dwg

FIGURE 3



LEGEND

⊗ HOLLOW STEM AUGER BORING LOCATION

△ CREEK SEDIMENT SAMPLING LOCATION

0 40' 80'

SCALE: 1"=80'

VERIFY SCALES

0 1"

BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SITE MAP WITH SAMPLING LOCATIONS
OCTOBER 2000

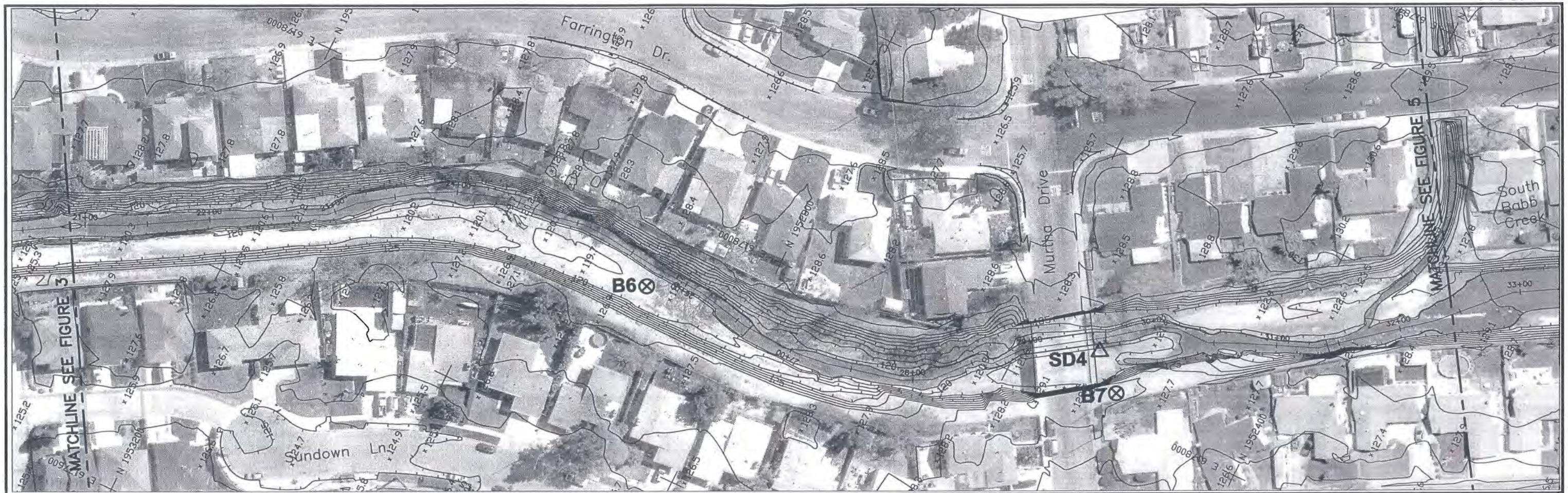
LOWER SILVER CREEK
REACHES 5 & 6
PHASE II ENVIRONMENTAL SITE ASSESSMENT

Santa Clara Valley Water District

PARSONS

DEC 7, 2000 – 9:58am Wanshare\ESOL\738703 Scvwd\figures\Scv002.dwg

FIGURE 4



LEGEND

⊗ HOLLOW STEM AUGER BORING LOCATION

△ CREEK SEDIMENT SAMPLING LOCATION

0 40' 80'

SCALE: 1"=80'

VERIFY SCALES

0 1"

BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SITE MAP WITH SAMPLING LOCATIONS
OCTOBER 2000

LOWER SILVER CREEK
REACHES 5 & 6
PHASE II ENVIRONMENTAL SITE ASSESSMENT

Santa Clara Valley Water District

PARSONS

JAN 3, 2001 - 7:45am Wanshare\ESOL\738703 Scvwd\figures\Scv003.dwg

FIGURE 5

LEGEND

⊗ HOLLOW STEM AUGER BORING LOCATION

△ CREEK SEDIMENT SAMPLING LOCATION

0 40' 80'

SCALE: 1"=80'

VERIFY SCALES

0 1"

BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SITE MAP WITH SAMPLING LOCATIONS
OCTOBER 2000

LOWER SILVER CREEK
REACHES 5 & 6
PHASE II ENVIRONMENTAL SITE ASSESSMENT

Santa Clara Valley Water District

PARSONS

DEC 7, 2000 – 8:42am Wanshare\ESOL\738703 Scvwd\figures\Scv004.dwg

FIGURE 6

LEGEND

⊗ HOLLOW STEM AUGER BORING LOCATION

△ CREEK SEDIMENT SAMPLING LOCATION

0 40' 80'

SCALE: 1"=80'

VERIFY SCALES

0 1"

BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SITE MAP WITH SAMPLING LOCATIONS
OCTOBER 2000

LOWER SILVER CREEK
REACHES 5 & 6
PHASE II ENVIRONMENTAL SITE ASSESSMENT

Santa Clara Valley Water District

PARSONS

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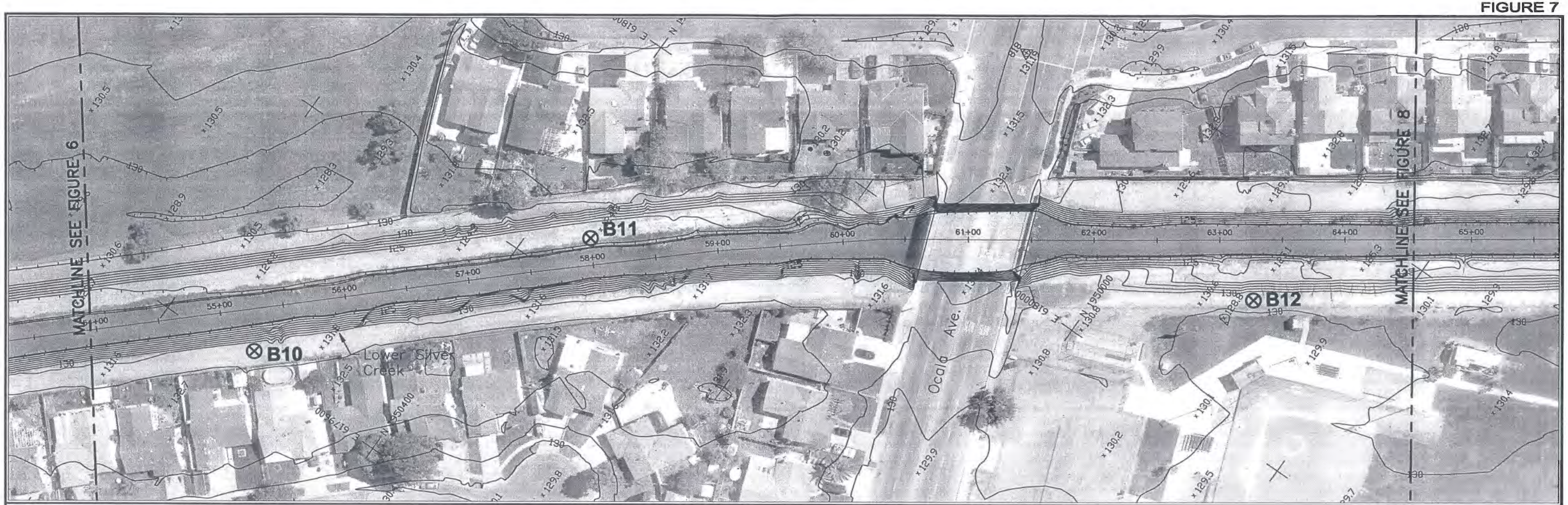
FIGURE 7



LEGEND

⊗ HOLLOW STEM AUGER BORING LOCATION

△ CREEK SEDIMENT SAMPLING LOCATION

0 40' 80'

SCALE: 1"=80'

VERIFY SCALES

0 1"

BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SITE MAP WITH SAMPLING LOCATIONS
OCTOBER 2000

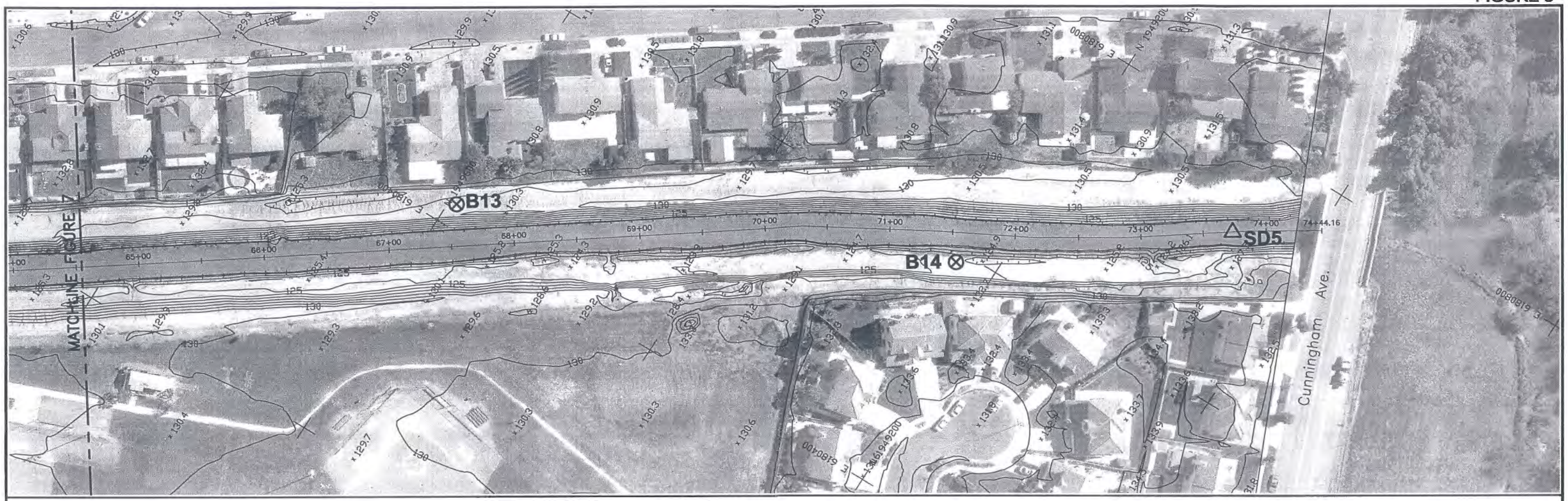
LOWER SILVER CREEK
REACHES 5 & 6
PHASE II ENVIRONMENTAL SITE ASSESSMENT

Santa Clara Valley Water District

PARSONS

DEC 7, 2000 – 9:18am Wanshare\ESOL\738703 Scvwd\figures\Scv006.dwg

FIGURE 8



LEGEND

⊗ HOLLOW STEM AUGER BORING LOCATION

△ CREEK SEDIMENT SAMPLING LOCATION

0 40' 80'

SCALE: 1"=80'

VERIFY SCALES

0 1"

BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SITE MAP WITH SAMPLING LOCATIONS
OCTOBER 2000

LOWER SILVER CREEK
REACHES 5 & 6
PHASE II ENVIRONMENTAL SITE ASSESSMENT

Santa Clara Valley Water District

PARSONS

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TABLES

Boring	B1	B2	I
Depth (ft bgs)	5.0	10.25	1
Analytes (EPA methods)			
TPH (SW8015m)			
TPH-gasoline	< 50		<
TPH-diesel		< 50	
Motor oil		< 300	
Metals (SW6010/7400)			
Arsenic	**370**	**360**	4
Barium	**19,000**	**7,300**	1,
Beryllium	**100**	**33**	4
Cadmium	**300**	**120**	1
Chromium	**3,200**	**2,300**	2
Cobalt	**1,800**	**520**	7
Copper	**2,300**	**880**	1
Lead	**1,200**	**280**	4
Mercury	**12**	**4.1**	0.
Molybdenum	< 200	< 100	<
Nickel	**11,000**	**3,200**	4
Selenium	**140**	< 25	1
Thallium	**310**	**76**	7
Vanadium	**3,000**	**2,300**	2
Zinc	**8,600**	**3,000**	4
BTEX & MTBE (SW8260)			
MTBE	< 5.0		<
VOCs (SW8260)			
tetrachloroethene	**3.3** J		<
SVOCs (SW8270)			
bis (2-Ethylhexyl) phthalate		< 9.8	
Pesticides (SW8081a)	ND	ND	N
PCBs (SW8082)	ND	ND	N

Abbreviations:

bgs = below ground surface

TPH = total petroleum hydrocarbons

BTEX = benzene, toluene, ethylbenzene, xylenes, and c

VOCs = volatile organic compounds

SVOCs = semi-volatile organic compounds

PCBs = polychlorinated biphenyls

TABLE 2

Groundwater Concentrations
Lower Silver Creek Reaches 5 and 6
San Jose , California

Table 3
Creek Sediment Concentrations
Lower Silver Creek Reaches 5 & 6
San Jose, California

Sample	SD1	SD2	SD3	SD4	SD5	[A] PRG (mg/kg)	[B] TTLC (mg/kg)	[C] STLC (mg/L)
Analytes (EPA methods)	all concentrations in mg/kg							
TPH (SW8015m)								
TPH-gasoline	< 0.94	< 0.95	< 0.94	< 0.92	< 0.91	----	----	----
TPH-diesel	**8.6** [D]	**52** [D]	**53** [D]	**24** [D]	**52** [D]	----	----	----
Motor oil	**44**	**210**	**170**	**82**	**200**	----	----	----
Metals (SW6010/7400)								
Arsenic	**2.1**	**2.7**	**2.4**	**2.1**	**2.7**	22	500	5
Barium	**49**	**120**	**89**	**76**	**69**	5,400	10,000	100
Beryllium	**0.16**	**0.27**	**0.20**	**0.19**	**0.21**	150	75	0.75
Cadmium	**0.59**	**0.87**	**0.66**	**0.63**	**0.97**	37	100	1
Chromium	**13**	**24**	**15**	**19**	**34**	210	2,500	560
Cobalt	**3.3**	**5.7**	**3.8**	**3.7**	**6.5**	4,700	8,000	80
Copper	**4.4**	**12**	**8.4**	**7.1**	**16**	2,900	2,500	25
Lead	**5.1**	**7.8**	**5.0**	**4.8**	**38**	400	1,000	5
Mercury	**0.10**	**0.04**	**0.04**	**0.04**	**0.09**	23	20	0.2
Molybdenum	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	390	3,500	350
Nickel	**18**	**39**	**22**	**22**	**56**	150	2,000	20
Selenium	**0.5**	**0.66**	**0.43**	**0.55**	**0.89**	390	100	1
Thallium	**1.1**	**0.85**	**0.75**	**0.55**	**0.52**	5.2	700	7
Vanadium	**11**	**18**	**13**	**12**	**18**	550	2,400	24
Zinc	**19**	**35**	**30**	**25**	**66**	23,000	5,000	250
BTEX & MTBE (SW8260)	ND	ND	ND	ND	ND	----	----	----
VOCs (SW8260)	ND	ND	ND	ND	ND	----	----	----
SVOCs (SW8270)								
Butylbenzylphthalate	**680** [J]	< 1,700	< 570	< 660	< 3,300	12,000	----	----
Pesticides (SW8080)	ND	ND	ND	ND	ND	----	----	----
PCBs (SW8080)	ND	ND	ND	ND	ND	----	----	----

Notes:

< 1.0	Not detected above the listed detection limit
ND	Not detected (none of the analytes detected)
----	Not applicable
5	Detections are shown in boldface

Analytes not shown on this table were not detected.

[A] US EPA Region IX Preliminary Remediation Goals for Residential Soil
[B] Total threshold limit concentration from Title 22 of the California Code of Regulations
[C] Soluble threshold limit concentration from Title 22 of the California Code of Regulations
[D] Sample exhibits fuel pattern which does not resemble standard
[J] Estimated value, equal to the reporting limit

Abbreviations:

bgs = below ground surface

TPH = total petroleum hydrocarbons

BTEX = benzene, toluene, ethylbenzene, xylenes, and other related compounds

MTBE = methyl tertiary-butyl ether

VOCs = volatile organic compounds

SVOCs = semi-volatile organic compounds

PCBs = polychlorinated biphenyls

Table 4
Sampling Schedule
Lower Silver Creek Reaches 5 6
San Jose, California

		TPHg SW8015m	TPHd SW8015m	Pesticides & PCBs SW8081a SW8082	VOCs, BTEX, and MTBE SW8260	SVOCs SW8270	Metals SW6010 SW7400	Container
Soil Samples								
Boring	Depth (ft)							Tubes
B1	6.0	■	■	■				1
	15.0			■				1
B2	5.5			■				1
	15.5			■	■	■	■	1
B3	11.0			■				1
	16.0	■	■	■				1
B5	6.0			■				1
	10.0	■	■	■				1
B6	11.0			■				1
	15.0			■	■	■	■	1
B7	6.0	■	■	■				1
	16.0			■				1
B8	11.0			■				1
	13.5			■	■	■	■	1
B9	2.5			■				1
	5.5	■	■	■				1
B10	2.5			■	■	■	■	1
	5.5			■				1
B11	5.5			■				1
	10.5	■	■	■				1
B12	2.5			■				1
	10.5			■	■	■	■	1
B13	5.5	■	■	■				1
	10.5			■				1
B14	2.5	■	■	■				1
	10.5			■	■	■	■	1
	15.5			■				1
Groundwater Samples								
Boring	Depth (ft)							Bottles
B1	5.0	■		■	■		■	6xA,1xB,1xC
B2	10.3		■	■		■	■	4xB,1xC
B3	11.0	■		■	■		■	6xA,1xB,1xC
B5	5.3	■		■	■		■	6xA,1xB,1xC
B6	3.5		■	■		■	■	4xB,1xC
B7	20.0	■		■	■		■	6xA,1xB,1xC
B8	5.0		■	■		■	■	4xB,1xC
B9	13.3	■		■	■		■	6xA,1xB,1xC
B10	13.0		■	■		■	■	4xB,1xC
B11	2.3	■		■	■		■	6xA,1xB,1xC
B12	11.8		■	■		■	■	4xB,1xC
B13	12.0			■			■	1xB,1xC
B14	7.8		■	■		■	■	4xB,1xC
Sediment Samples								
Sample	Depth							Tubes
SD1	NA	■	■	■	■	■	■	1
SD2	NA	■	■	■	■	■	■	1
SD3	NA	■	■	■	■	■	■	1
SD4	NA	■	■	■	■	■	■	1
SD5	NA	■	■	■	■	■	■	1
Soil Total		8	8	27	6	6	6	27 tubes
Groundwater Total		6	6	13	6	6	13	36xA,38xB,13xC
Sediment Total		5	5	5	5	5	5	5 tubes

Abbreviations:

bgs = below ground surface

TPH = total petroleum hydrocarbons

PCBs = polychlorinated biphenyls

MTBE = methyl tertiary-butyl ether

VOCs = volatile organic compounds

SVOCs = semi-volatile organic compounds

BTEX = benzene, toluene, ethylbenzene, xylenes, and other related compounds

Sampling containers:

A = 40 mL VOAs

B = 1 L glass

C = 250 mL plastic

Notes:

■ Sample analyzed

NA Not applicable

Table 5
Background Concentrations of Metals
Lower Silver Creek Reaches 5 & 6
San Jose, California

Metals	[A] Highest Detection in Soil (mg/kg)	[B] Backround Levels (mg/kg)	[C] PRG (mg/kg)	[D] TTLC (mg/kg)	[E] STLC (mg/L)
Arsenic	5.4	0.2 to 5.5	22	500	5
Beryllium	0.52	0.3 to 1.4	150	75	0.75
Chromium	34	30.5 to 72	210	2,500	560
Copper	20	23.8 to 47.5	2,900	2,500	25
Lead	5.7	6.8 to 16.1	400	1,000	5
Nickel	64	46.4 to 101	150	2,000	20
Zinc	43	47.7 to 82.2	23,000	5,000	250

[A] Highest concentration in soil borings 1-14 from the Phase II Hazardous Materials Investigation

[B] Based on Scott 1991.

[C] US EPA Region IX Preliminary Remediation Goals for Residential Soil

[D] Total threshold limit concentration from Title 22 of the California Code of Regulations

[E] Soluble threshold limit concentration from Title 22 of the California Code of Regulations

APPENDIX 3A-18

GEOTECH R4

GEOTECHNICAL INVESTIGATION REPORT

LOWER SILVER CREEK, REACH 4
SANTA CLARA VALLEY WATER DISTRICT
SANTA CLARA COUNTY, CALIFORNIA

For

Ruggeri-Jensen-Azar & Associates
8055 Camino Arroyo
Gilroy, CA 95020

PARIKH CONSULTANTS, INC.
356 South Milpitas Blvd., Milpitas, CA 95035
(408) 945 - 1011

August, 2003

Job No. 200116.10

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Typical Section with Helical Anchor ..... Plates C-1

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APPENDIX D

Relevant Extract From Previous Reports

Lower Silver Creek, Reach 4
Santa Clara Valley Water District
Santa Clara County, California

Executive Summary of Geotechnical Investigation

The Lower Silver Creek Watershed Project is proposed to reduce floodwater and related damages and the potential loss of life to the residents of San Jose along Lower Silver Creek. Damages to buildings, vehicles and the need for emergency services would be reduced by modifying approximately 5 miles of channel to convey the 1 in 100-years storm event. Reach 4 is from approximately Highway 680 to North Babb Creek for a distance of approximately 4,000 feet.

Flood protection improvements within these reaches generally include U-channel wall, upgraded box culvert, vegetated block wall with helical anchor, retaining wall, floodwall and low-flow channel.

Parikh Consultants Inc. is retained as geotechnical consultant to perform geotechnical investigation for this project. Site reconnaissance and desk study of the available information was carried out during the initial phase of the project. Seventeen borings were drilled for the subsurface investigation and to obtain samples for the laboratory testing. The subsurface profile of the project site consists of mainly stiff lean clay and fat clay with isolated pockets/lenses of silty sand and clayey sand. Thin layers of medium dense to dense clayey sand with gravel were noted in the borings at depth, upstream of Capitol Expressway.

Geotechnical parameters for the design of the planned elements are recommended based upon subsurface geological information obtained, interpretation of the laboratory test results, reference to geotechnical data from projects in the vicinity and engineering judgment. Slope stability analysis was carried out to obtain the factor of safety of the modified slope with gabion using the computer program UTEXAS3. The factor of safety required for various design conditions is based on the US Army Corps of Engineer's Manual. The factors of safety of the proposed 4(V): 1(H) slope using vegetated block wall and helical anchors were found to be above the required standard.

A previous report was submitted at 35% design stage. Subsequently, the slope protection

option was modified to a vegetated block wall with helical anchors. This revised report reflects these changes.

GEOTECHNICAL INVESTIGATION REPORT

LOWER SILVER CREEK, REACH 4
SANTA CLARA VALLEY WATER DISTRICT
SANTA CLARA COUNTY, CALIFORNIA

1. INTRODUCTION

Lower Silver Creek drains a watershed in the southeastern portion of the City of San Jose. It is approximately five miles long, and empties into the Coyote Creek, which then drains into the San Francisco Bay. Flood protection improvements are planned for all segments of Lower Silver Creek from Coyote Creek confluence to Lake Cunningham. Reach 4 (includes 4a, 4b and 4c) is from approximately Highway 680 to North Babb Creek for a distance of approximately 4,000 feet.

This report presents the results of our Geotechnical Engineering Investigation performed for the proposed flood protection impoundment along Lower Silver Creek Reach 4 in the City of San Jose, California. The attached Plate 1, Vicinity Map and Plate 2, Project Location Map, shows the location of the site.

This report presents our understanding of the project, purpose and scope of investigation, existing site conditions followed by general geology at the site, description of field exploration, seismicity, our interpretation of the subsurface and groundwater conditions, and our findings and discussions. The work presented in this report was performed in general accordance with our agreement with Ruggeri-Jensen-Azar & Associates.

2. PURPOSE AND SCOPE

The proposed flood protection is to be provided by increasing the flow capacity of the channel. This will be accomplished by slope trimming with gravity wall and anchor, U-framed structure, floodwall, and replacement of existing box culvert under Jackson Avenue. The replacement of existing reinforced box culvert under Capitol Expressway is to be designed by other consultants. The purpose of this investigation was to evaluate the general soil conditions at the site, to evaluate their engineering properties, to present recommendations for the above various elements of the creek improvement.

The scope of work for this investigation included review of readily available soils and geologic

literature pertaining to the site; obtaining representative samples and logging soil materials encountered in seventeen exploratory borings; laboratory testing of collected samples, engineering analysis of the field and laboratory data; and preparation of this report. A detailed scope of work is presented in our proposal to Ruggeri-Jensen-Azar & Associates, which was reviewed by the Santa Clara Valley Water District's staff. Subsequently the scope has been modified to consider alternate wall systems.

3. SITE CONDITIONS

The description of existing conditions at the project site presented in this section of the report is based on our field observations and topographic information provided to us by Ruggeri-Jensen-Azar & Associates. The project site includes the segment along Lower Silver Creek from Interstate 680 (Sta. 127+93.63) at one end to North Babb Creek (Approximate Sta. 170+07.79) at the other end (see attached Site Plan, Plate 3). Except for the existing reinforced concrete box culvert under the Jackson Avenue and Capitol Expressway, the creek banks are earth slopes. The project is divided into 3 sub-reaches. Reach 4a is from I-680 to Jackson Avenue. Reach 4b is from the box culvert underneath Jackson Avenue to Capitol Expressway. Reach 4c is from the box culvert underneath the Capitol Expressway to North Babb Creek.

The elevation of the top of the bank is generally higher on the left bank than the right bank. The approximate existing grade at the right-of-way of the right bank generally increases from the beginning of the project limit (Approximate Elev. 106) to the end of the project (Approximate Elev. 119). The approximate existing grade at the right-of-way of the left bank generally increases from slightly upstream of Jackson Avenue (Approximate Elev. 107) to the end of the project (Approximate Elev. 122).

The existing slope is generally steep on both sides of the creek within Reach 4a, with gradient between 1(V): 1(H) and 1(V):0.8(H). The existing slope is relatively gentle within Reach 4b,

with gradient between 1(V): 1.2(H) and 1(V): 2.75(H). The slope on the northern side is generally steeper than the slope on the southern side. However, the slope on the southern side in the vicinity of Station 140+00 and Station 141+00 is steep with slope gradient of approximately 1(V): 0.25(H). The slope on the northern side of the creek gets steeper within Reach 4c, with the average slope gradient of approximately 1(V): 1(H). The average height of the existing slope is approximately 10 feet. The existing banks of the creek appear to be in a fair condition. No apparent sign of sloughing or slippage was observed during the site reconnaissance. A longitudinal crack of limited extent was observed at the crest of the slope on the south bank within Reach 4b near Jackson Avenue.

4. GEOLOGY

The project site is in the southeastern portion of the San Francisco Bay area in the Coast Range geomorphic province of California. The Coast Range forms a nearly continuous topographic barrier between the California coastline and the San Joaquin Valley. In general, the Coast Range in this region is a double chain of mountain running north-northwest. Three prominent geologic blocks dominate the San Francisco Bay Area: the Santa Cruz Mountains (western block), the San Francisco Bay (central block), and the East Bay Hills/Diablo range (eastern block).

The general geology in the site vicinity was mainly studied from geologic maps compiled by E.J. Helley and E.E. Brabb (1971), (see attached Plate 4, Geologic Map). The surficial geologic units in the site vicinity were deposited during Late Cenozoic Periods. The older units generally occupy higher elevations. The oldest unit mapped by them is Santa Clara Formation (QTs), which is composed of poorly consolidated conglomerate, sandstone, siltstone, and claystone of Pliocene and Pleistocene age, with minor lignite deposits. Relatively younger units i.e. Interfluvial Basin Deposits (Qb), Fluvial Deposits at the outer edge of young alluvial fans (Qyfo), Young Alluvial Fan Deposits (Qyf), and Older Alluvial Fan Deposits (Qof) which mainly consist of alluvial and fluvial deposits are mapped within

the project vicinity.

The site is generally underlain by alluvial (and fluvial) deposits consisting of mainly lean and fat clays with pockets or lenses of silty sand/clayey sand with gravel.

5. FIELD EXPLORATION AND LABORATORY TESTING

Based on the plans provided, discussions with client, and readily available geologic and existing boring information, seventeen borings were drilled from a depth of 24.5 feet to 31.5 feet below the top of the bank. These borings were generally spaced evenly on both left and right bank within the project limits except within the left bank of Reach 4c (approximately from Station 157+00 to Station 170+00). No boring was drilled at this location because inaccessibility of the drill rig to the site. The attached Plate 3, Site Plan (3A to 3G), shows the approximate locations of these borings and previous borings drilled by others.

Majority of the test borings were advanced with a mobile rig using 4-inch solid stem auger. Boring B3, B9, B12 and B14 were advanced with truck-mounted drill rig using 8-inch diameter hollow stem auger. Selected drive samples were obtained from the borings at various depths using a 2.5 inches I.D. Modified California Sampler or a 1.375 inches I.D. Standard Penetration Sampler. The sampler was driven into the subsurface soils under the impact of a 140 lbs hammer having a free fall of 30 inches. The blow counts required to drive the sampler for the last 12 inches are presented on the Boring Logs, Appendix A. (When correlating standard penetration data, the blow counts for the Modified California Sampler can be taken as roughly twice that for the Standard Penetration Test in similar soils). Pocket penetration tests were also performed on clay samples during field investigation to evaluate their consistency. The soil samples obtained during drilling were visually classified in the field and then transported to our laboratory for further evaluation and testing. All the boreholes were grouted as per Santa Clara Valley Water District (SCVWD) guidelines.

Laboratory tests including moisture content, dry density, Atterberg Limits, sieve analysis, corrosion analysis and unconfined compression were performed on soil samples collected during field exploration to determine the physical and engineering properties of the subsurface soils. Test methods and test results are presented on plates attached in Appendix B. Laboratory test results for moisture content, dry density, sieve analysis, Atterberg Limits and unconfined compression tests are presented on the attached boring logs, Appendix A.

The description of the soils encountered and relevant boring information is presented on the boring logs, attached in Appendix A. The boring logs presented in Appendix A were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs. The abrupt stratum changes shown on these logs may be gradual and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations.

The generalized soil profile developed from the boring logs is shown on Plate A-19 and A-20 in Appendix A.

To supplement our study, we also made reference to geotechnical investigation report prepared by Soil Conservation Service dated October 1980. The relevant boring logs from this report are contained in Appendix D.

6. SOIL CONDITIONS

Based on the available geotechnical information; and, data obtained from our exploratory borings and laboratory tests the site is generally underlain by alluvial (and fluvial) deposits. These consist of mainly lean and fat clays of moderate to high plasticity with inclusions of sandy clay/clay, with sand and occasional pockets or lenses of silty sand/clayey sand with gravel.

The site is located at the southern end of San Francisco Bay in the wide alluvial Santa Clara Valley. The Valley is underlain by a great thickness of unconsolidated sediment, which is mostly alluvial in origin. The logs of the seventeen borings drilled for this investigation are generally similar. The site is underlain by lean/sandy clay near the surface and fat clay near the bottom of the borings. Lenses of mainly clayey sand and sandy silt were encountered at various locations within the project limits. A relatively thick layer (minimum of approximately 4.5 feet in Boring B16 to maximum of approximately 12 feet in Boring B17) of clayey sand with gravel was encountered from the borings upstream of Capitol Expressway.

The Plasticity Indices (PI) and Liquid Limits (LL) of the lean clay usually vary between 9 to 22 percent and 29 to 47 percent, respectively. Discontinuous, fat clay (CH) layers were generally encountered below or inter-bedded with the lean clay layers. Based on the Atterberg Limits test data, this fat clay is characterized as having medium to high potential for expansion. The Plasticity Indices (PI) and Liquid Limits (LL) for the fat clay vary between 25 to 41 percent and 51 to 61 percent, respectively.

The lean clay is stiff to very stiff (average SPT blow count of 12 and average unconfined compressive strength of 1.8 tsf) with average natural moisture content and dry unit weight of 22 percent and 104 pcf respectively. The fat clay is stiff to very stiff (average SPT blow count of 18 and average unconfined compressive strength of 1.6 tsf) with average natural moisture content and dry unit weight of 25 percent and 103 pcf respectively.

Clayey sand, poorly graded and well-graded sand were encountered in our borings in the form of isolated pockets or lenses near the top of the bank. They are generally described as loose to medium dense (with average SPT blow count of 10) and wet. The thickness of these sand pockets or lenses was in the range of approximately a foot to 5 feet. Approximately 3 to 8 feet thick layer of stiff to very stiff sandy silt was logged in Boring B14 and B17. Clayey sand with gravel was consistently encountered at depth in Borings B14, B16 and B17, which is described as medium dense to dense (with average SPT blow count of 25). The average natural moisture content is 13 percent. The D_{10} of this clayey sand with gravel is likely to be less than 0.05 mm

and the coefficient of permeability is considered as smaller than 50 x 10^{-6} m/sec (or 5.17 x 10^{2} feet/year) according to Figure 3-5 of Army Corp of Engineer's Manual EM1110-2-1913 "Design and Construction of Levees".

Groundwater was encountered in the borings at depths ranging from 6 feet to 23 feet during drilling. Monitoring wells were installed at Boring B3, B9 and B14 after the completion of drilling. Groundwater levels were measured from these monitoring wells in March and May of 2001 with the groundwater level in the range of approximately 9.5 feet to 13.5 feet below ground. We expect the groundwater at the site to be at or near the creek water level. It should be noted that the groundwater level at the site may change with passage of time due to groundwater fluctuations in the creek from season to season, weather conditions, and other factors which may not have been present at the time of the investigation.

Detailed descriptions of the materials encountered in the exploratory borings are presented on boring logs attached in Appendix A. The descriptions and related information presented on these logs of test borings depict subsurface conditions only at the locations indicated on the plan and on the particular date noted on the logs. Subsurface conditions at other locations may differ from conditions occurring at the locations explored. Also, the passage of time may result in a change in the soil conditions at these locations due to environmental changes.

7. SEISMIC CONSIDERATIONS

The project site is located in a seismically active part of northern California. Many faults exist in the San Francisco Bay area, which are capable of producing earthquakes, may cause strong ground shaking at the site. Attached Fault Map, Plate 5, presents the locations of the fault systems relative to the project site.

Maximum credible earthquake magnitudes for some of the major faults in the area determined by Mualchin (California Seismic Hazard Map 1996) are summarized in Table 1 below. These

maximum credible earthquake magnitudes represent the largest earthquakes that could occur on the given fault based on the current understanding of the regional tectonic structure.

TABLE 1

Fault	Estimated Distance from Project Site (km)	Maximum Credible Earthquake Magnitude
Hayward (strike-slip)	4	7.5
Monte Vista/East (unknown/not published)	13	6.5
Calaveras-Pacines-San Benito (strike-slip)	8	7.5
San Andreas/North (strike-slip)	25	8.0

Based on the seismic hazard map prepared by Mualchin (1996) the controlling fault is the Hayward Fault (Mw = 7.5). According to the Attenuation Relationship by Sadigh et Al. (1997), the Peak Bedrock Acceleration (PBA) at the site should be in the order of 0.6 g.

The summary of the seismic considerations based on the readily available data is as follows:

1. Governing Fault = Hayward Fault (strike-slip; Mw=7.5)
2. Distance to Fault = 4 km (2.5 miles)
3. Soil Type = D
4. Peak Bedrock Acceleration = 0.6 g

Using the above information and Caltrans Seismic Design Criteria (July 1999, Version 1.1), Peak Ground Acceleration at the project location is on the order of 0.6 g.

Potential seismic hazards at a site may arise from three sources: surface fault rupture, strong ground shaking and liquefaction. Since no known active or potential active faults cross the project site, therefore, in our opinion, the potential for ground surface fault rupture due to faulting at the site is considered relatively low. Based on available geological and seismic data, the possibility of the site to experience strong ground shaking may be considered

moderate to high.

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged cohesionless sands and silts of low relative density are the type of soils, which usually are susceptible to liquefaction. Clays are generally not susceptible to liquefaction. Based on the available data, the majority of the subsoils are cohesive. Cohesionless strata appears to be generally medium dense to dense. The liquefaction potential at the site is low.

8. FINDINGS AND RECOMMENDATIONS

8.1 General

Based on the findings of our investigation, it is our opinion that the flood protection within the Lower Silver Creek Reach 4 is feasible provided the recommendations presented in this report are incorporated into the final design and construction.

This report was prepared specifically for the proposed improvement shown on Site Plan, Plate 3. Normal construction procedures were assumed throughout our analysis and represent one of the bases of recommendations presented herein. Our design criteria have been based upon the materials encountered in the investigation. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations.

8.2 Earthwork and Grading

The proposed project includes mainly cutting back of the existing channel slopes. No major embankment fill is proposed. However, minor earthwork and grading work is

anticipated for the maintenance roads, ingress and egress ramps to the creek.

The grading within the creek should be performed in accordance with Santa Clara Valley Water District's specifications for levee reconstruction. Based on the SCVWD specifications, the fill to be placed on top of the bank should contain at least 40 percent of clay (by weight) passing US Standard Sieve No. 200 and should have Plasticity Index (PI) in the range of 10 to 20. The Liquid Limit of the fill material should also not exceed 40. Based on the results from the Atterberg Limit tests, the fat clay may not be appropriate for the levee fill according to the SCVWD requirement.

In addition to the above requirements, the fill should not contain rocks or lumps over 3 inches in greatest dimension and should not contain more than 10 percent greater than 1 ½ inch. The fill material should be placed and mechanically compacted in horizontal layers to a relative compaction not less than 95 percent in accordance with ASTM 1557. The loose thickness of each layer of fill before compaction shall not exceed 8 inches. The compaction moisture content of the fill should be within a range of -2 percent to +3 percent of optimum moisture content.

At the time of our investigation, the crests and side slopes of the existing creek were covered with light to moderate growth of vegetation. Prior to the commencement of grading operations, the existing creek and the adjacent natural ground on which fill is to be placed should be stripped to a minimum depth of 6 inches, or to a greater depth as determined necessary by the regulatory agency or Geotechnical Engineer at the time of construction. Fills to be placed on slopes of existing creek should be keyed and benched into the creek bank. The height of the key should not be less than 3 feet or more than 5 feet. The frequency and location of the benches may be adjusted and modified in the field as necessary. We also recommend that the fill to be placed on the slopes should be over-built and cut back to the proposed grade. Grading within the creek should be performed under the observation of the regulatory agency or Geotechnical Engineer in accordance with the project

specifications.

8.3 Evaluation of Creek with Modified Geometry and Creek with Floodwall

It is our understanding that a vegetated block wall with helical anchors will be used in this flood protection project. The analyses were carried out as per guidelines outlined in US Army Corps of Engineer's Levee Design and Construction Manual EM 1110-2-1913. Both the trimmed slope without and with the helical anchors were evaluated for slope stability. A near-horizontal force is applied to the slope for the anchored slope condition. Case No. I was not analyzed since it is believed to be not critical to the slope stability. Case IV was found to be not relevant to this project since there is no placement of fill above the existing bank and no landside creek. The results of these analyses are included in Appendix C of the report and discussed in the following subsections.

Since there is no formation of an embankment, seepage from the creekside of channel is not an issue and therefore no seepage analysis has been performed. Settlement of the bank has also not been considered because no significant additional surcharge is anticipated in considering the configuration of the proposed floodwall. The loading from the floodwall will be acting as a point load and its settlement impact is minimal.

8.3.1 Slope Stability Analysis

Slope stability analyses were performed on the proposed trimmed slope [1(H): 4(V)] sections with anchor using Spencer's method of the UTEXAS3 program developed at the University of Texas at Austin. Critical sections used for the slope stability analyses were developed based on the proposed slope geometries, geology, boring logs and laboratory test results.

Stability analyses were carried out based on the typical section prepared by

Ruggeri-Jensen-Azar & Associates. One to two rows of helical anchors were proposed within the slope based on the recommendations by the Structural Engineer.

It is indicated on the 65% Submittal Plan developed by Ruggeri-Jensen-Azar & Assocaites (RJA) that the channel bed will be protected by a concrete mattress. On the northern side, the concrete mattress will be placed on the surface of the maintenance road. On the southern side, the concrete mattress will be constructed underneath the 5-foot berm (Shaded Riparian Area - SRA) between the grade beam of the vegetated block wall and the cut-off wall. The SRA will be vegetated according to RJA. However, the soil above the concrete mattress is ignored in the slope stability analyses.

Critical sections were analyzed for Cases II, III and V on the creekside slope outlined in the US Army Corps of Engineer's Manual EM 1110-2-1913. These critical conditions and the corresponding minimum strength and factors of safety requirements are presented on Table 2.

TABLE 2

CASE NO.	DESIGN CONDITION	SLOPE ANALYZED	SHEAR STRENGTH*	MINIMUM FACTOR OF SAFETY
II	Sudden Drawdown	Creekside	S where < R R where < S	1.0
III	Intermediate River Stage	Creekside	S where < R (R+S)/2 where R < S	1.4
V	Earthquake: Case I, or III with seismic loading	Creekside	Seismic Coefficient 0.2g	1.0

* Q Strength: Unconsolidated Undrained Strength
R Strength: Consolidated Undrained Strength
S Strength : Consolidated Drained Strength

Majority of the new slopes will be constructed by trimming of the existing slope. For the anchored slope, both the local slope stability (with the potential slip surface through the anchor) and the global slope stability (with the potential slip surface behind the anchor) were checked. Helical anchor, as a form of soil reinforcement, is the only external force assumed in the slope stability analyses. The vegetated block wall in front of the trimmed slope has not been considered. The stability of the vegetated block wall in front of the slope will be separately evaluated by the Structural Engineer.

The effective and total strength parameters were estimated from field Standard Penetration Test results, unconfined compression test results, reference to the test results from the other reaches of Lower Silver Creek, empirical correlation, and engineering judgment. For the effective strength parameters of cohesive soil, apparent cohesion c' is usually between 100 psf and 500 psf according to Lamb and Whitman. ø' was estimated by correlation with the plasticity index. $ø_T$ is usually less than ø', and often it is about one-half of ø'.

The borings indicate that the existing creek material is variable and ranges from lean clay/sandy lean clay to fat clay with thin layer of clayey sand with gravel. Based on the field investigation and laboratory data, we have modeled the creek bank as lean clay within Reach 4b (Station 131+25.35 to Station 154+71, between Jackson Avenue and Capitol Expressway), lean clay with the presence of clayey sand with gravel layer within Reach 4c (Station 156+71 to Station 170+07.79, between Capitol Expressway and Reach 5). No slope stability analysis was performed within Reach 4a (between Interstate 680 and Jackson

Avenue) since U-channel wall and box culvert are proposed within this reach of the project. No fat clay has been assumed in the critical sections because their depths and thickness varies within the project limits and they are stiffer than the lean clay. The density of the clayey sand with gravel is described as medium dense to dense in the boring logs. The percentage of fine content from the gradation analysis was found to be in the range of approximately 20 to 40 percent. The adopted strength parameters for the soil materials in the slope stability analyses are shown on Plates C-2A to C-2V in Appendix C.

The potential for developing tension cracks within the bank of the creek was evaluated using the method suggested by Chirapuntu and Duncan (1975). Based on our evaluation, in our opinion, tension cracks are unlikely to be formed within the bank of the creek. Therefore, tension cracks were not considered in the slope stability analysis. The maintenance road on top of the bank is presently being used. The load due to the maintenance traffic on the top of the bank was modeled as a uniform surcharge of 250 psf.

Earthquake loading conditions were modeled by using a seismic loading coefficient of 0.2g for pseudo-static analysis. The minimum water level was assumed to be at the bottom of the channel and the maximum water level was assumed to be at the top of the creek bank for the "sudden draw-down" case. For the Intermediate River Stage case (Case III), the minimum factor of safety was obtained by assuming minimum channel water level and anticipated maximum groundwater level from the bank. The average groundwater level was measured at approximately 10 feet below ground in the monitoring well. An additional two feet was allowed for the rise of groundwater table during the rainy season.

The shear strengths, unit weights, geometry, phreatic surfaces used in the analyses, the factors of safety and possible critical sliding surfaces obtained from slope stability analyses are presented on Plates C-2A to C-2V.

The factors of safety obtained from the analyses are summarized on Table 3 and 4. The minimum factors of safety were found to be the same for both assumed soil profiles in Reach 4b and 4c. Based on these results, it is concluded that factors of safety for the unsupported slopes were below the factors of safety required by the SCVWD (especially under the sudden-drawdown condition) and the trimmed slope of the creek bank stabilized with the helical anchors proposed for the project have adequate stability under static and seismic (pseudo-static) loading conditions.

The stability analysis evaluates the overall global slope stability of the creek bank. After bank excavation, strength softening is expected for the bare (before the application of surface protection) surficial cohesive soil materials submerged under water. Stiff clays tend to be fissured to some degree. The unconfined clays at the face of the cut may be cyclically dried and wetted and the fissures will tend to open. The fissures will be filled with water as the water level rises and local sloughing and cracking etc. may occur after the water recedes. Exposed pockets of cohesionless sand or silt on the face of the excavated bank slope could also experience minor slough during construction. Therefore, the construction for the slope trimming should be planned in the dry season with the minimum water level in the channel. Adequate surface protection should be provided to the slope surface after its exposure during construction. Regular routine maintenance should be carried out in the future to ensure proper surface protection to the slope.

TABLE 3

Location (Creek-side) Reach 4b and 4c (left and right bank)	Minimum Factor of Safety of Proposed Trimmed [1(H): 4(V)] Slope Sections		
	Case No. II (Sudden Drawdown)	Case No. III (Intermediate River Stage)	Case No. V (Seismic or pseudo-static)
	1.0*	1.4*	1.0*
Slope height = 9.5 feet	1.0	1.4	1.2
Slope height = 10.5 feet	0.8	1.3	1.1
Slope height = 11.5 feet	0.7	1.2	1.0
Slope height = 13 feet	0.7	1.1	0.9

TABLE 4

Location (Creek-side)	Minimum Factor of Safety of Proposed Trimmed [1(H): 4(V)] Slope Sections with Helical Anchor(1)		
	Case No. II (Sudden Drawdown)	Case No. III (Intermediate River Stage)	Case No. V (Seismic or pseudo-static)
	1.0*	1.4*	1.0*
Slope height = 9.5 feet	1.5	2.0	1.6
Slope height = 10.5 feet	1.2	1.9	1.5
Slope height = 11.5 feet	1.3	2.0	1.6
Slope height = 13 feet	1.1	1.6	1.3

* Required minimum factor of safety

(1) The details of the proposed anchor, such as the length and force per each helical anchor, were provided by the Structural Engineer. A copy of this detail is included in Appendix C.

Based on the above results, it is concluded that the modified geometry of the bank of the creek with the proposed vegetated block wall and helical anchors has the adequate global stability under static and seismic (pseudo-static) loading conditions.

Temporary Slopes

The stability of the temporary trimmed slope was evaluated using the undrained shear strength of the cohesive soil. Only Case III (Intermediate River Stage) was checked in considering the short duration of its occurrence. The required minimum factor of safety is 1.25 as discussed with SCVWD in the meeting at the Coyote Watershed Program Office on December 12, 2001. The factors of safety for various heights of temporary slope are summarized in Table 5 below:

TABLE 5
Factor of Safety for the Temporary Slope

Slope Height of Temporary Slope (ft)	Calculated Factor of Safety
9.5	1.8
10.5	1.7
11.5	1.6
13	1.4

Based on the factors of safety shown in the table above, the temporary slopes have adequate factor of safety. However, the contractor should coordinate the construction work so that the installation of the vegetated block wall with helical anchors can be completed as soon as possible after the excavation to maintain the integrity of the temporary slope.

Clayey sand, poorly graded and well-graded sand are likely to be in the form of isolated pockets or lenses near the top of the bank. Since these pockets or lenses are generally above or slightly below the assumed groundwater level, the possibility of piping within these pockets or lenses of cohessionless soil materials is likely to be small. For the clayey sand with gravel layer near Reach 4c, the possibility of piping is also likely to be small because of their high density. These conditions should be verified during construction.

8.4 Lateral Design

For the lateral design of the retaining wall, floodwall, vegetated block wall, box culvert and U-channel wall, the following lateral earth pressures (Equivalent Fluid Pressures) and design parameters should be used:

(a) 40 pcf EFP for the active lateral earth pressures above water;

(b) 26.5 pcf EFP for the active lateral earth pressures below water. Water pressure of 62.4 pcf EFP should be added for "below water level" case.

(c) The recommended passive resistance is 350 pcf EFP (above water and Rankine condition). For elements below groundwater, the passive resistance should be reduced to 190 pcf EFP.

(d) An at-rest earth pressure of 63 pcf equivalent fluid pressure (EFP) may be used for granular structural backfill material (3 feet minimum) behind the retaining structure above design water elevation and 36 pcf equivalent fluid pressure below design water elevation. Water pressure of 62.4 pcf EFP should be added for "below water level" case. The minimum required rotation for flexible wall assumption is 0.005 radian.

(e) A coefficient of friction of 0.3 may be used to estimate the frictional resistance along the bottom of the footing.

(f) In the event earth pressure and friction are combined for lateral resistance, the passive component should be reduced by one-third.

(g) Add 0.2 g of the mass for the pseudo-static analysis.

(h) The additional horizontal forces recommended to simulate earthquake loads are dependent upon the magnitude of ground surface accelerations and height of the wall, together with the weight and type of material retained by the wall. The magnitude of the dynamic lateral force in pounds per lineal foot of wall, developed during seismic loading may be estimated as $7.5H^2$; where H is the height of wall in feet. It is recommended that the dynamic lateral force be considered to act at the mid height of the wall and represent the resultant of a rectangular distribution of pressure. The dynamic lateral force will act in addition to the static earth pressures recommended above.

8.5 Floodwall

Floodwall has been proposed generally from approximately Station 128 to Station 140 and from approximately Station 166 to Station 170. The proposed floodwall is planned to be on top of the existing bank. According to the Structural Engineer, the floodwall will be a masonry wall on concrete pile cap and supported on CIDH (Cast-In Drilled Hole) pile (The I-type floodwall). The maximum height of the floodwall is approximately five feet.

8.5.1 Foundation Design of Floodwall

An I-type floodwall is considered stable if sufficient passive earth resistance

can be developed for a given penetration of the wall into the creek bank to yield an adequate factor of safety against overturning. Based on the discussion with the designer, it is anticipated that the depth of embedment to resist lateral load will be determined by formula under "Nonconstrained" condition (Section 1806.8.2.1) of the 1997 Uniform Building Code.

For lateral design, refers to Section 8.4 "Lateral Design" for recommended design parameters for lateral design of floodwall. For the lateral bearing capacity of the pile foundation of the floodwall, 300 psf/ft is recommended for the design.

Since the lateral support for a cantilever wall comes from passive pressure exerted on the embedded portion, penetration depths can be quite high (approximately 16 feet according to the Structural Engineer), resulting in excessive stresses and severe yield. Therefore the CIDH pile should be checked to provide adequate structural strength against such lateral stresses.

8.5.2 Seepage Control of Floodwall

The depth of penetration of the floodwall should be such that adequate seepage control is provided. Normally the penetration depth of the floodwall required for stability is sufficient to satisfy the seepage requirements.

8.6 Vegetated Block Wall with Helical Anchor

Vegetated block wall with helical anchors are proposed within Reach 4b and 4c. The following parameters should be used in the design of the helical anchors and vegetated block wall:

(a) The assumed moist unit weight is 120 pcf and saturated unit weight is 130 pcf for the soil behind the vegetated block wall.

(b) The active pressure coefficient is assumed to be 0.25. The active pressure distribution is assumed to be triangular.

(c) Recommended surcharge is 250 psf.

(d) For lateral design, refer to lateral earth equivalent fluid pressures recommended in Section 8.4 above.

(e) The frictional resistance of the native soil is assumed to be 400 psf.

(f) Wall footings founded as recommended may be designed for a maximum toe pressure of 3000 psf (above water) and 2000 psf (below water) with respect to dead plus live loads. This allowable bearing pressure may be increased by one-third for total loads including transient loads such as seismic load and under sudden drawdown conditions.

(g) The maximum groundwater table for the sudden drawdown case in the slope stability analysis was assumed to be the maximum water surface elevation of the creek, which is at the top of the bank.

Self-compacting and free draining material is recommended behind the vegetated block wall. The granular backfill should be wrapped inside the filter fabric to prevent the migration of the fines from the native soil behind the wall.

The foundation of the vegetated block wall should be protected against scour. Groundwater and flows for the creek should be anticipated during the wall construction. It is assumed that the foundation will be supported on firm competent soil conditions. Where soft or loose soils are encountered at the bottom of the foundation excavations, they should be excavated to a maximum depth of 3 feet or to firm native soils,

whichever is smaller, and replaced with compacted engineered fill.

8.7 Box Culvert

A new box culvert is proposed to replace the existing box culvert underneath Jackson Avenue from Station 130+34.77 to Station 131+25.35.

The box culvert may be designed in accordance with Caltrans Bridge Design Specifications 6.2.1. The proposed box culvert should be supported on a pad constructed as follows:

(a) Excavate approximately 1 foot of existing soil below the bottom of the box culvert. The excavation should extend 2 feet beyond the culvert foot print.

(b) Place a layer of subgrade enhancement engineering fabric on the subgrade. The engineering fabric may be either woven or non-woven type fabric and should conform to Caltrans Standard Specification (Section 88-1.04, Type B).

(c) Place Permeable Material Class I, Type B on the filter fabric. The permeable material should be compacted to 95% relative compaction per ASTM 1557-91.

(d) Another layer of subgrade enhancement engineering fabric should be placed on top of the Permeable Material Class I, Type B for a minimum of two feet from the edge.

The Permeable Material Class I, Type B can serve as a "local distribution bridge" for reducing load imposed on the underlying materials and provides a working platform.

The total settlements for the box culvert structure supported as describe above are anticipated to be relatively insignificant, corresponding to an allowable bearing capacity

of 2000 psf for dead load and live loads.

8.7.1 Wingwalls

Based on the discussions with the designer, the wingwalls may be designed as part of the box culvert and structurally connected to the box. In which case, the wingwalls do not require specific footing design. Alternatively, the wingwalls may be designed as conventional retaining walls supported on spread footings.

Wingwalls should be designed to resist the applied lateral earth pressures as discussed in Section 8.4.

Cantilever walls, which are free to rotate at least 0.005 radian may be assumed flexible and designed for the active condition. Walls that are not capable of this movement should be assumed rigid and designed for the at-rest condition. The effect of any surcharge (dead or live load) should be added to the preceding lateral earth pressure. A coefficient of 0.3 may be used to determine the additional earth pressure resulting from the surcharge.

The above values assume no hydrostatic pore pressure buildup behind the wall and are based on well-drained backfill behind the walls. To minimize hydrostatic pressure buildup behind the walls, a drainage system incorporating weep holes and pervious backfill such as Bridge Detail 3-1 of Caltrans standard plans (B0-3) can be used. If hydrostatic pressures are allowed to build up behind the walls, additional lateral loads due to this should be considered in the design.

The lateral forces acting on the wing walls may also be resisted by friction acting on the base of the foundation and by passive earth resistance. A coefficient of friction of 0.3 may be used for dead loads only.

Sacked concrete or rock slope protection (RSP) is recommended at the inlet and outlet of the box culvert near the wingwalls.

If spread footing foundations are used for support of wingwalls, it is recommended that the footing be embedded a minimum of 2 feet below the finish grade. The footing subgrade should be over-excavated a minimum of 2 feet and replaced with engineered fill compacted to a minimum 95% relative compaction per ASTM D1557-91. The over-excavation and recompaction under the footing should extend at least B/2 (where B is the footing width) beyond the edges of the footing. The engineered fill should be relatively non-expansive material having a plasticity index in the range of 10 to 20.

An allowable bearing capacity of 2000 psf for dead load and live load may be used for design of the footing supported in accordance with the above recommendations. This allowable bearing capacity may be increased by one-third for transient and seismic loadings.

8.8 U-Channel Wall

U-Channel Wall structure is proposed from approximately Station 128+00 near Highway 680 to approximately Station 130+00 near Jackson Avenue, and from Station 131+25 to Station 131+50 within Reach 4a.

The design parameters for the lateral pressure, pseudo-static loading and allowable bearing capacity should be referred to Section 8.4 and 8.7 above. An at-rest earth pressure of 63 pcf equivalent fluid pressure (EFP) may be used for granular structural backfill above design water elevation and 36 pcf equivalent fluid pressure below design water elevation. The minimum required rotation for flexible wall assumption is 0.005 radian.

The modulus of subgrade reaction K_s of the cohesive soil is recommended to be 75 Kip/ft^3.

The U-channel wall should be supported on a pad similar to that for the box culvert as described in Section 8.7 above. However, the thickness of the Permeable Material Class I, Type B should be 2 feet instead of 1 foot for the box culvert.

Since the U-channel wall is not designed as watertight structure and weep holes are proposed in the design, buoyancy consideration is not required for the design of the structure. To minimize hydrostatic pressure buildup behind the walls and the drop in the hydraulic head from the bank to the base of the U-channel wall, a drainage system incorporating weep holes and pervious backfill such as Bridge Detail 3-1 of Caltrans standard plans (B0-3) is recommended.

8.9 Retaining Wall

Retaining Wall is proposed from approximately Station 131+50 to approximately Station 132+75 to support the ramp near Jackson Avenue within Reach 4a. Another retaining wall is proposed to support the existing PG&E Tower from Station 142+35 to Station 142+85 within Reach 4b.

The design parameters for the lateral pressure, pseudo-static loading and allowable bearing capacity should be referred to Section 8.4 and 8.7 above. An at-rest earth pressure of 63 pcf equivalent fluid pressure (EFP) may be used for granular structural backfill above design water elevation and 36 pcf equivalent fluid pressure below design water elevation. The minimum required rotation for flexible wall assumption is 0.005 radian.

Based on the discussion with the Structural Engineer, the bearing pressure due to the footing of the existing PG&E Tower is assumed to be 3,000 psf (which is the

allowable bearing capacity of the native soil under dry condition). The maximum vertical pressure acting on the heel of the retaining wall footing due to the surcharge from the PG&E Tower footing is estimated to be 600 psf.

8.10 Maintenance Ramp and Roadway

Fifteen feet wide concrete ramps and twenty feet wide maintenance road are proposed on the south side of the creek within the project limits. Due to the soft and wet soil conditions anticipated at the creek level, constructability of the roadway section may become difficult. The maintenance road is to be covered by 6 inches of Class 2 Aggregate Baserock over the native soil to provide uniform support. Drain rock is also recommended to be provided underneath the concrete ramp.

8.11 Corrosion

Chemical tests were performed on composite soil samples from Boring B1 and B2 to evaluate the corrosion potential of the subsoil. A summary of the corrosion test results is presented in Table 6 below:

TABLE 6

Sample Location	Resistivity (ohm-cm)	pH	Sulphate (ppm)	Chloride (ppm)
B1 (#2-#5) 4' to 19'	670	9.1	83.5	13.5
B2 (#2-#6) 4' to 24'	870	9.1	46.1	3.6

Based on the test data, the on-site soil is corrosive, and the structural elements should be designed to mitigate these conditions. Type II modified cement with a mix design containing 8 sacks of cement per cubic yard is recommended for this condition. Corrosion test results are summarized in Appendix B.

9. CONSTRUCTION CONSIDERATIONS

The following sections of the report include comments related to excavation, dewatering, temporary excavation and shoring, foundation construction, earthwork and other geotechnical aspects of the proposed construction. The sections are written primarily for the engineer responsible for the preparation of plans and specifications. Since these sections discuss potential construction issues related to the project, it may also be of use to the District's representatives involved in monitoring of construction activity. The field investigation performed by us primarily address design issues and was not intended to identify construction-related issues.

Prospective contractors for the project must evaluate construction-related issues on the basis of their own knowledge and experience in the local area, on the basis of similar projects in other localities, or on the basis of field investigation on the site performed by them, taking into account their own proposed construction methods and procedures. In addition, construction activities related to excavation and lateral earth support must conform to safety requirements of OSHA and other applicable municipal and State regulatory agencies.

9.1 Temporary Excavations & Shoring

In our opinion, conventional equipment could be used to excavate on-site soil materials. The materials to be excavated will mostly be stiff clays and medium dense sands. It is possible that unknown old buried utilities or abandoned structures, concrete rubble etc. are located along the alignment. It might require special equipment and additional efforts to remove these buried objects.

Groundwater should be expected during excavation. Excavations should not be expected to stand vertically without any support. According to OSHA Safety Standards, temporary excavations with personnel working within the excavations should be sloped or shored if the excavations are deeper than 5 feet. It should be noted that the slope

ratios recommended by OSHA are for temporary, un-surcharged slopes. Traffic and surcharge loads should be kept back at least 15 feet from the top of the excavations unless they are accounted for in the design of the support system. In addition, it should also be noted that the recommended slopes are for adequately dewatered excavations. The groundwater should be maintained at least 3 feet below the bottom of the excavation at all times.

During our investigation, several sand and non-plastic silt lenses and layers were encountered at various locations along the creek at various depths. Surficial drying of these granular soils exposed along the excavation slopes may result in sloughing and caving. To minimize sloughing and caving of these soils, they should be kept moist (but not saturated) by occasional light spraying of water during construction.

If an open cut with sloping sides extend beyond the right-of-way, undercut any existing buried utilities, foundations of adjacent structures and trees, shoring may be necessary for the excavations. The type of shoring system, design of the selected system, and the performance of the system should be the responsibility of the Contractor. The Contractor should have the shoring system designed by a Registered Engineer.

Shoring system is anticipated for the construction of the box culvert, U-channel wall and the retaining wall adjacent to the existing PG&E Tower. The shoring system should be designed to be relatively rigid and with as many supports or struts as necessary to prevent excessive straining and deformation of the supported soils. This is also important with regards to existing asphaltic concrete pavements where tension cracking may develop, even under minor strains. It is also very important with regards to protection and movement of the existing utilities. Trench shield (boxes) or similar passive shoring systems are not recommended as exclusive methods of support unless it can be demonstrated through field monitoring (inclinometer) that lateral soil creep will not affect existing facilities and utilities.

All excavations should be closely monitored during construction to detect any evidence of instability, soil creep, settlements, etc. Appropriate mitigation measures should be implemented to correct such situations that may cause or lead to future damage to facilities, utilities and other improvements.

9.2 Excavation Bottom Stability

Excavation bottom instability may occur as a result of bottom heave, piping, or blow-out. Bottom heave is typical for excavations in clays. In granular soils, bottom heave is usually not a problem. However, piping may be of concern if the force of the upward flow of water exceeds the buoyant weight of the soil at the excavation bottom. Blow-out is another mode of failure where a pervious sand layer is located below a clay layer at excavation bottom. Blow-out occurs when hydrostatic pressures at the base of the clay layer exceed the shear strength and weight of the clay plug.

Excavation bottom stability is a concern during the channel and/or low flow channel excavation. If excavation bottom failure due to bottom heave, piping or blow-out occurs at these locations, the Contractor should implement adequate measures such as dewatering, installing deep sheeting, etc. to mitigate these conditions.

9.3 Working Platform

Groundwater should be expected during excavation. The clays and saturated sands with high fine contents anticipated at the planned depths of excavations are sensitive to disturbance. If these deposits are sufficiently disturbed due to construction activities at the bottom of the excavations, they could become soft. Also, soft and loose, saturated native soil deposits may be encountered at the excavation bottom. In such cases working conditions at the bottom of the excavation may become difficult, equipment used at the bottom of the excavation may loose mobility, etc. The Contractor should take adequate measures to minimize the disturbance of the sensitive deposits at the

excavation subgrade. The Contractor may minimize the disturbance of sensitive deposits or mitigate existing soft ground conditions by constructing a working platform at the bottom of the excavation. The working platform may be installed by (1) Overexcavating 18 inches below the planned subgrade; (2) Placing a stabilizing geotextile filter fabric at the bottom of the resulting excavation; (3) Backfilling with crushed rock or Class II AB or Class I bedding material or other such approved bridging material; and, (4) Overlapping the ends of the geotextile filter fabric on top of the bridging material for a minimum distance of 2 feet. The imported and on-site bridging materials and sources should be approved by the Geotechnical Engineer prior to importing and placing the materials on the project site. The top of the bridging layer should be densified by vibratory compaction equipment. The Contractor's method of compacting the bridging layer should be reviewed by the Geotechnical Engineer.

The Contractor may use other methods of subgrade stabilization. The Contractor's proposed method should be reviewed by the Geotechnical Engineer.

Occasionally clayey sands, poorly graded sands, well graded sands will be exposed within the cut slopes. These types of soil have relatively high erosion potential. Therefore, protective measures should be adopted to mitigate erosion potential of these soils if found necessary.

9.4 Dewatering

As described in the section entitled "Subsurface Conditions", groundwater at the site was encountered at depths ranging from 6 feet to 23 feet below the existing ground surface at the time of drilling. Groundwater should therefore be anticipated during excavations. Groundwater may cause instability of excavation walls (piping, erosion, etc.), instability of the excavation bottom (blow-outs, piping, etc.) and may also result in difficult working conditions at the excavation bottom. Unstable excavation walls and bottom may cause slope failures, damage the shoring system, etc., causing excessive

settlements of surrounding ground, damage to adjacent underground and above ground utilities and structures and excessive long-term differential settlements in the pipelines. Excessive water in the excavations may also result in difficult working conditions at the bottom of the excavations causing subsequent delays in work and/or additional efforts during construction. Therefore, the Contractor should implement a dewatering system to mitigate these conditions.

All dewatering schemes proposed by the Contractor should be submitted to the Owner prior to implementation. However, developing and implementing an effective dewatering program should be the Contractor's responsibility. The Contractor should install a dewatering system that will lower the groundwater level at least 3 feet below the bottom of the excavation. In some areas that have conditions, which are difficult to effectively dry the bottom of the excavation, it may be necessary to maintain the groundwater at a deeper depth. All dewatering systems should be properly designed to prevent pumping soil fines with the discharge water. The Contractor should sample and test the groundwater for soil fines content from the wells, as needed. If soil fines are being pumped, the Contractor should revise his dewatering operations; otherwise, it may result in failure of shoring, partial instability of excavation bottom resulting in intolerable settlement of foundations of existing structures and utilities and unsafe working conditions. The Contractor should provide discharge sampling locations for each pump. Prior to excavation, the Contractor should install observation wells at frequent locations along the alignment, to verify and demonstrate to the District that the required drawdown has been attained. Contractor is encouraged to perform their own investigation, test program, etc. prior to construction in order to satisfy their design requirements for an effective dewatering program. During construction, the three existing wells should be abandoned by the Contractor as per Santa Clara Valley Water District's guidelines.

10. INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our field exploration and the assumption that the soil conditions do not deviate from observed conditions. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the Lower Silver Creek, Reach 4 Flood Protection project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes are reviewed and the recommendations modified or approved in writing.

The findings in this report are valid as of the present date. This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field. However, changes in the soil conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Very truly yours,
PARIKH CONSULTANTS, INC.

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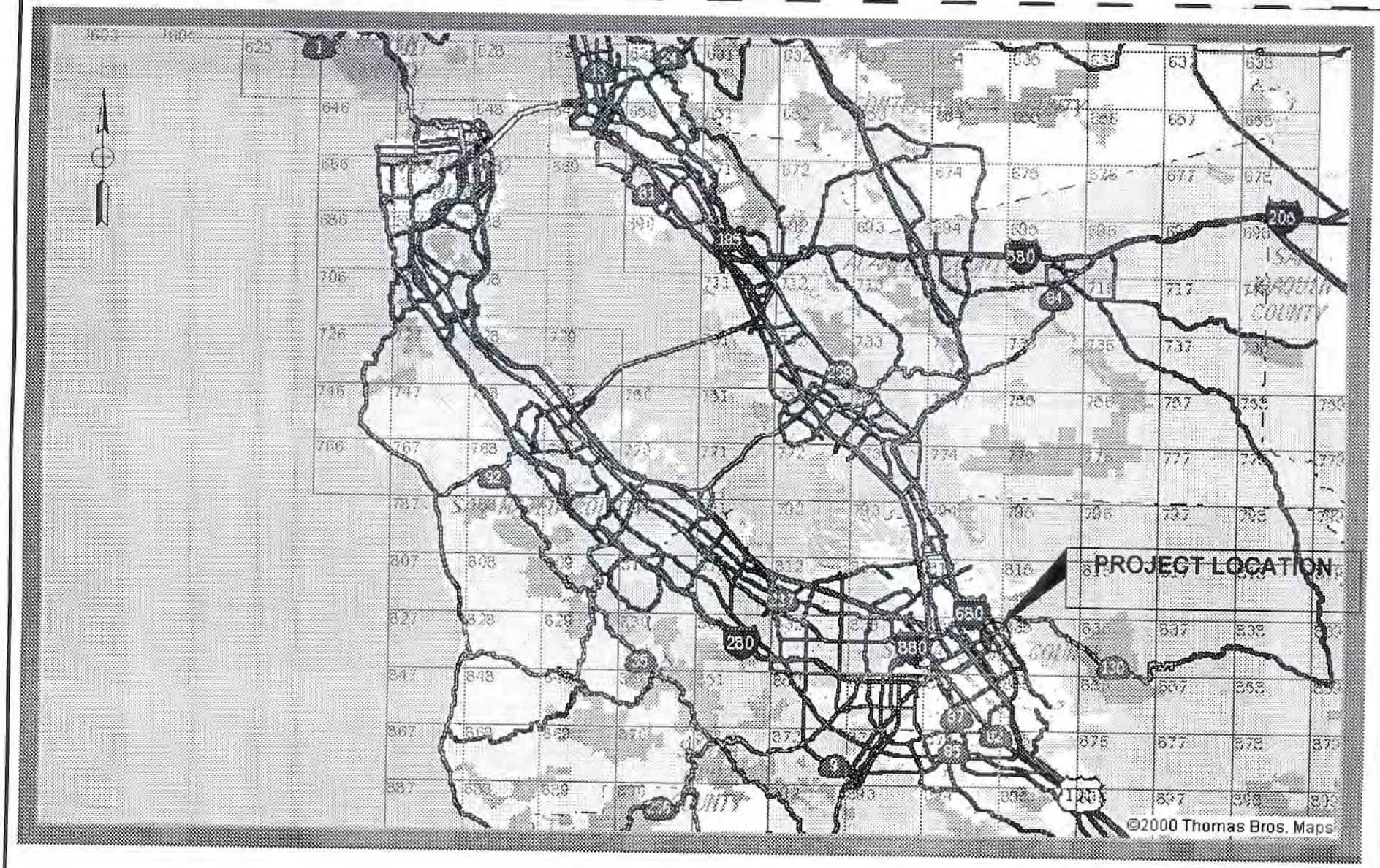
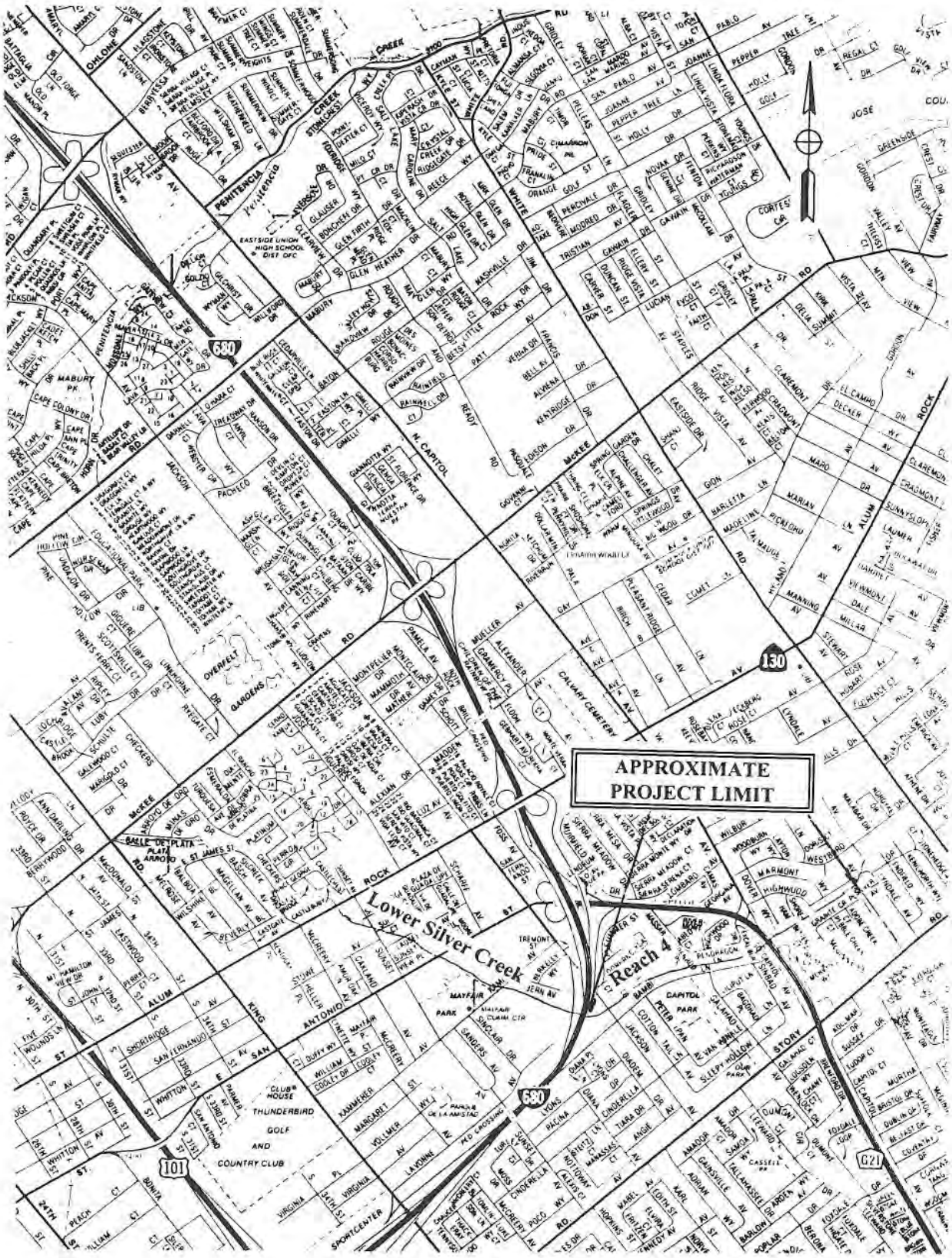


	PARIKH CONSULTANTS, INC. GEOTECHNICAL ENGINEERING MATERIALS TESTING	LOWER SILVER CREEK REACH 4 SANTA CLARA COUNTY, CALIFORNIA	VICINITY MAP
		JOB NO.: 200116.10 / PLATE NO.: 1	



PROJECT LOCATION MAP

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS TESTING	**LOWER SILVER CREEK, REACH 4** **SANTA CLARA COUNTY, CALIFORNIA**
	JOB NO.: 200116.10 — PLATE NO.: 2

APPENDIX 3A-19

THOMPSON CREEK HMP

Hydromodification Management Plan

Working Draft Report

Lower Silver - Thompson Creek Subwatershed

March 1, 2003

by

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Credits

This document is a joint effort of the Project Team that consists of the following firms:

- GeoSyntec Consultants,
- Balance Hydrologics, Inc. (BH),
- Philip Williams & Associates, Ltd. (PWA), and
- Raines, Melton, and Carella, Inc. (RMC).

Most of the chapters of the report involved input by various Team members, and in this sense it is a Team report. However, each firm took the lead on various aspects of the work as described below.

The introductory Chapters 1 and 2 were a Team effort, although Chapter 2 adapted information prepared by Balance Hydrologics for the Santa Clara Basin Watershed Management Initiative Basin Watershed Characteristics Report. Balance Hydrologics took the lead in conducting the geomorphic field work with assistance provided by PWA. Balance also was responsible for drafting Chapter 3. GeoSyntec, PWA and RMC are currently completing work on Chapters 4, 5, and 6. As part of separate contract with the Santa Clara Valley Water District, William Lettis & Associates (WLA) and David Mattern & Associates prepared GIS drainage area and percent impervious maps which were used as input for the hydrologic modeling. WLA also prepared a description of the geomorphology of the historical Lower Silver - Thompson Creek subwatershed that is summarized in Chapter 2.

Alison Tucker, Communication and Environmental Planning Services, served as the technical editor for the report.

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1 Introduction

1.1 About this Document

This document provides a geomorphic assessment of one subwatershed in the Santa Clara Basin and outlines an approach to assessing other watersheds or subwatersheds in the Basin in order to evaluate whether, and how, increased stormwater discharge rates and/or durations from certain new and redevelopment projects will result in increased potential for erosion or other adverse impact to beneficial uses in Basin watersheds. This document was prepared in response to the regulatory requirements described in section 1.2.

1.2 Regulatory Framework

The San Francisco Bay California Regional Water Quality Control Board (SFRWQCB) is the regulatory agency that issues National Pollutant Discharge Elimination System (NPDES) permits to municipal agencies for stormwater discharges to San Francisco Bay. Beginning in 2000, in response to direction from the State Water Resources Control Board and changes to NPDES permits in Southern California, the SFRWQCB began to reissue or amend existing permits to include stricter requirements for control of stormwater from new development and redevelopment. The first Bay Area permit to include the new requirements was that of the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), which is comprised of the thirteen cities of Santa Clara County, Santa Clara County, and the Santa Clara Valley Water District (SCVWD), all of which are Co-permittees, also referred to as Dischargers. (The SFRWQCB's Order 01-119 [October 2001] amended Provision C.3. of SCVURPPP's reissued NPDES permit [Order 01-024, February 2001] to incorporate the requirements.)

Under Provision C.3.f., of the NPDES permit, *Limitation on Increase of Peak Stormwater Runoff Discharge Rates*, the Dischargers must manage increases in peak runoff flow and increased runoff volume from certain new development and redevelopment projects so that post-project runoff does not exceed pre-project rates and durations where the increased runoff from the project will result in increased potential for erosion or other adverse impacts to beneficial uses, attributable to changes in the amount and timing of runoff. That provision requires the Dischargers to develop a Hydromodification Management Plan (HMP) to govern where and how runoff controls[1] should be implemented.

When required, runoff controls must be designed so that "post-project runoff shall not exceed estimated pre-project rates and/or durations" (from Provision C.3.f.i.). On-site runoff controls

[1] This document focuses on the requirements related to controlling the volume, rate, and duration of runoff. It uses the term runoff controls to refer to Best Management Practices (BMPs) that reduce impacts to runoff volume, rate, and duration. Many runoff controls also remove pollutants from stormwater, but this document focuses on their effect on runoff volume and flow rate.

are not required for projects that discharge stormwater runoff where the potential for erosion, or other impacts to beneficial uses, is minimal. Such situations may include discharges into creeks that are concrete-lined or significantly hardened (e.g., with rip-rap, sackrete, etc.) downstream to their outfall in San Francisco Bay, underground storm drains discharging to the Bay, and construction of infill projects in highly developed watersheds, where the potential for single-project and/or *cumulative* impacts is minimal (from Provision C.3.f.ii).

Provision C.3.f.vii.of the permit allows peak flow impacts to be addressed through the development of a protocol for using strategies other than on-site runoff controls. The protocol may allow increases in peak flow and/or durations, subject to the implementation of specified BMPs and land use planning practices that would accommodate expected stream changes without harming beneficial uses (e.g. increases in the cross-sectional area of a stream channel.).

The final HMP will include the following elements required under the permit:

1. A review of pertinent literature;

2. A protocol to evaluate potential hydrograph change impacts to downstream watercourses from proposed projects;

3. An identification of the rainfall event or range of events below which peak flow management standards will apply;

4. A description of how the Dischargers will incorporate these requirements into their local approval process or the equivalent; and

5. Guidance on management practices and measures to address identified impacts.

Provision C.3.f.vi. of the permit indicates that the HMP's evaluation protocols, management measures, and other information may include:

1. Evaluation of the cumulative impacts of urbanization of a watershed on stormwater discharge and stream morphology in the watershed

2. Evaluation of stream form and condition, including slope, discharge, vegetation, underlying geology, and other information as appropriate

3. Implementation of measures to minimize impervious surfaces and directly connected impervious area in new development and redevelopment projects

4. Implementation of measures including stormwater detention, retention, and infiltration

5. Implementation of land use planning measures to allow expected changes in stream channel cross sections, stream vegetation, and discharge rates, velocities, and/or duration without adverse impacts to stream beneficial uses

6. A mechanism for pre- vs. post-project assessment to determine the effectiveness of the HMP and to allow amendment of the HMP, as appropriate

7. Other measures, as appropriate.

1.3 Overall Approach

The HMP uses a watershed-based approach to address the impacts of urban development on streams. Developing the HMP includes the following tasks:

1. Develop a problem statement and goals.

2. Review literature and data availability.

3. Characterize stream conditions and future development patterns.

4. Develop a conceptual model of the hydrologic and geomorphic processes relevant to hydromodification.

5. Develop a method and model for computing stream stability.

6. Compile available data and apply the model to determine stream impacts.

7. Evaluate and recommend cost effective solutions to address the impact on streams.

8. Develop guidance for hydromodification control measures.

9. Develop an implementation strategy and process for continuous improvement.

10. Convene an expert panel.

11. Involve the public.

The problem statement and goals, conceptual model (Figure 1-1), and literature review were completed with input from an outside expert panel and then submitted to the RWQCB in September 2002. The expert panel has assisted the project team throughout the study and will continue to be involved in the preparation of the final HMP Report.

The goals and objectives and conceptual model guided the development of an overall framework for conducting the assessment (Appendix A). Based on this framework, a more detailed assessment method was developed as described in Chapters 3 through 5.

The Lower Silver - Thompson Creek subwatershed was selected to develop, test, and verify the assessment method. It was chosen for the following reasons:

- The subwatershed is of a size appropriate for the testing methodology (approximately 40 square miles) and has a stream gage where data is currently being collected that can be used to help calibrate the hydrologic model.
- The stream is non-hardened.
- The subwatershed has undergone significant development in the past 20 years, with additional growth planned for the future.
- The subwatershed has three distinct areas and associated stream reaches: a steep headwaters area which will not be developed; a mid-section with moderate slope that is undergoing substantial development and where stream erosion is beginning to increase with development; and a flatter downstream area draining directly to Lower Silver where the stream shows extensive deposition as a result of erosion from upstream areas.

However, the Lower Silver - Thompson Creek subwatershed is not representative of all the Basin watersheds for many reasons:

- It is located in the Coyote Creek Watershed, which, unlike some other Basin watersheds, does not have channels that are continuously hardened all the way downstream to the tidal zone.
- Most of the urbanization has occurred recently (since 1970) and is still ongoing.
- The subwatershed has a variety of soil layers, including some loose and erodible soils that make the stream channels particularly susceptible to impacts from increased flows.
- The subwatershed has already been heavily impacted as a result of development in the mid-slope area.

Therefore, some aspects and complexity of the Lower Silver - Thompson Creek subwatershed are unique and those assessments results may not be applicable to other Basin watersheds.

The final HMP will document assessment of potential hydrograph change to downstream watercourses from proposed new and redevelopment projects in two additional Santa Clara Watersheds; and will address how potential hydrograph change impacts to downstream watercourses will be assessed and managed from proposed projects that are located in watersheds that have not been assessed under the HMP.

1.4 Organization of the Report

The Draft HMP Report is organized into the following six chapters:

- Chapter 1 Introduction
- Chapter 2 Characterization of the Lower Silver - Thompson Creek Subwatershed
- Chapter 3 Geomorphic Assessment of the Lower Silver – Thompson Creek Subwatershed
- Chapter 4 Hydrologic and Hydraulic Modeling of the Lower Silver – Thompson Creek Subwatershed
- Chapter 5 Stability Assessment of the Lower Silver – Thompson Creek Subwatershed
- Chapter 6 Hydromodification Management Alternatives for the Lower Silver – Thompson Creek Subwatershed

1.5 Watershed Terminology

A *watershed* is the land area that drains to a given water body or watercourse. Any given watershed is typically part of a larger watershed (associated with a larger water body or watercourse) and, in turn, is typically comprised of smaller ones (associated with smaller, tributary watercourses). This document uses the following terminology to distinguish watershed levels:

- The Santa Clara Basin (or the Basin) refers to the 840 square miles that drain into San Francisco Bay south of the Dumbarton Bridge.
- The major streams within the Santa Clara Basin—such as Coyote Creek—define watersheds, which are named for the associated watercourse (for example, the Coyote Creek Watershed).
- The term “subwatershed” refers to the land that drains to a tributary of one of the major streams (for example, the Lower Silver - Thompson Creek subwatershed within the Coyote Creek Watershed).
- The term “catchment” refers to an area that drains to a single storm drain outfall.
- The term “drainage area” is used for areas smaller than a subwatershed but larger than a catchment. For example, the land draining to Yerba Buena Creek, which flows into Thompson Creek, is referred to as the Yerba Buena Creek drainage area. Drainage areas used in the modeling are described in Chapter 4.

2 Characterization of the Santa Clara Basin and the Lower Silver - Thompson Creek Subwatershed

The following basin descriptions are adapted from the Santa Clara Basin Watershed Characteristics Report (Santa Clara Basin Watershed Management Initiative, 2000) and the Coyote Watershed Stream Stewardship Plan (Santa Clara Valley Water District, 2002). The information on geology and the historical Lower Silver – Thompson Creek system is primarily derived from the draft *Geomorphology of the Historical Silver Creek Watershed* (Sowers and Pearce, 2003).

2.1 Description of the Santa Clara Basin

The Santa Clara Basin – San Francisco Bay south of the Dumbarton Bridge and the 840 square miles that drain to it – is bounded by the crest of the Diablo Mountains on the east and the crest of the Santa Cruz Mountains to the west and south. About 1.9 million people live in the Basin, nearly half of them in the city of San Jose. The Basin includes about half of Santa Clara County plus small parts of San Mateo and Alameda counties. All or part of 20 cities lie within the Basin (Figure 2-1).

2.2 Description of the Lower Silver – Thompson Creek Subwatershed

The Lower Silver – Thompson Creek subwatershed (approximately 42 square miles) is located within the Coyote Creek watershed, the largest watershed in the Santa Clara Basin (Figure 2-2). The Coyote Creek watershed covers approximately 320 square miles and drains most of the west-facing slope of the Diablo Range. The creek originates in the mountains of the Diablo Range northeast of Morgan Hill and flows northwest approximately 42 miles before entering South San Francisco Bay (the South Bay).

Lower Silver Creek and Thompson Creek are located in the eastern portion of the Santa Clara Valley, partially in the City of San Jose and partially in unincorporated Santa Clara County.

Thompson Creek originates in the Diablo Range foothills at an elevation of about 2,300 feet and flows northerly to its confluence with Lower Silver Creek near the Eastridge Shopping Center at an elevation of approximately 125 feet. Its tributary streams include, from north to south: Quimby Creek, Fowler Creek, Evergreen Creek, Yerba Buena Creek, and Cribari Creek. Thompson Creek discharges to Lower Silver Creek. The Thompson Creek Watershed encompasses about 17.5 square miles.

Lower Silver Creek originates near Silver Creek Road at an elevation of about 180 feet and flows northerly past Thompson Creek to the Lake Cunningham area. From the Lake Cunningham area, Lower Silver Creek flows in the northwesterly direction to its confluence with Coyote Creek. This confluence, at an elevation of about 64 feet, is near the US-101 freeway near McKee Road.

The Lower Silver Creek watershed includes the watersheds of many tributary creeks, one of which is Thompson Creek. Other tributaries to Lower Silver Creek are, from north to south: Miguelita Creek, North Babb Creek, South Babb Creek, Flint Creek, Ruby Creek, and Norwood Creek. Historically, with its gentle slopes and poorly drained soils, Lower Silver Creek flowed in an ill-defined channel; most of the flatter areas were often swampy and prone to ponding and frequent floods. In the early 1950s, prior to urbanization, Lower Silver Creek was placed in a defined man-made channel and diverted to its present alignment between Lake Cunningham and what is now North Babb Creek.

2.3 Historic Land Uses and Development Patterns

2.3.1 Historic Land Uses

When the Spanish arrived in the Bay region in the latter 18th century, the Santa Clara Basin was inhabited by Native Americans of the Puichon, Tamien, and Alson Ohlone tribelets. The Spanish colonized the valley, building the first mission and pueblo near the Guadalupe River. Agriculture and ranching spread across the valley in the 1800s and early 1900s. By the first decades of the 1900s the Santa Clara Basin was a major agricultural area, but in succeeding decades the landscape was increasingly dominated by residential, commercial, and industrial growth.

The lower part of the Lower Silver - Thompson Creek subwatershed has experienced rapid development from 1970 to the present day, as farmland has been converted to residential communities.

2.3.2 Existing Land Uses

The Santa Clara Basin has a distinct transition in land use at 600 to 800 feet above sea level. Areas above this threshold (upper zone) have steeper slopes and are largely forest and rangeland; below this threshold (lower zone) an urbanized landscape dominates.

In the upper zone, forest predominates on steeper slopes and rangeland on moderate slopes. In the western Basin hills, forest occupies 2 to 10 times as much area as rangeland. In the eastern hills, rangeland commonly occupies 10 to 40 times as much area as forest; at high elevations, however, somewhat more forest than rangeland occurs.

In the lower zone, high-density residential communities occupy most of the Basin floor. A relatively small amount of moderate-density housing is in the northwestern corner of the Basin and an even smaller amount is in the southwestern portion. Commercial land uses are found throughout the Basin floor, concentrated along federal, state, and county highways. Public and quasi-public land uses are more evenly dispersed than commercial land uses. Industrial areas are clustered near the Bay and along major transportation corridors. Agricultural uses occur either near the Baylands or on the urban fringe, mainly on the east side.

Existing land uses in the Lower Silver - Thompson Creek subwatershed are typical of the eastern portion of the Santa Clara Basin. The lowland areas are predominantly urban. The upland areas are devoted to uses ranging from rangelands to wildlife habitat, and are largely located outside of the City of San Jose's Urban Service Area boundary and in unincorporated areas of Santa Clara County.

2.3.3 Future Land Use

The Greenline/Urban Growth Boundary has been established by the City of San Jose to define the ultimate perimeter of urbanization in San Jose (San Jose General Plan 2020). Lands outside of the Greenline/Urban Growth Boundary are intended to remain permanently rural in character. Allowable development, as defined by the Non-Urban Hillside land use designation and the Hillside Slope Density Formula, promotes low-intensity (approximately twelve percent total impervious area), non-urban uses. Historic development patterns have allowed some urban development on hillsides. These developed areas are designated Urban Hillside.

The Lower Silver - Thompson Creek subwatershed is substantially developed within the Urban Growth Boundary as illustrated in Figure 2-3. There are some areas still to be developed along the Urban Growth Boundary, but most additional growth will be accommodated through urban infill activities.

2.4 Climate and Precipitation

The Santa Clara Basin has a Mediterranean climate, characterized by extended periods of precipitation during the winter, and virtually none from spring through autumn. The wet season generally extends from about November through April, whereas rainfall during May through October tends to be minimal. Annual average rainfall amounts vary significantly due to topography. Portions of the basin in the Santa Cruz Mountains receive 40 to 60 inches per year, while the central Santa Clara Valley near downtown San Jose receives on average 13 to 14 inches.

Average figures can be somewhat misleading, however, because droughts in California are not uncommon (and some years are unusually wet). For example, although the average annual rainfall for San Jose is approximately 13 inches, annual rainfall has ranged from six to over 30 inches over the last 100 years or so. (Santa Clara County General Plan, 1994.)

2.5 Geology and the Historic Lower Silver - Thompson Creek System

2.5.1 Geology

Geology is one of the primary factors that influence how channels evolve, both prior to urbanization and in response to hydromodification. Thompson Creek flows through a valley

between the Edenvale Hills and the Diablo Range. The geologic deposits there fall into three general bands, described below.

- The "eastern band" along the eastern mountain front is comprised of alluvial fans formed by the deposition of bedrock materials that were eroded from the foothills and mountain ridges. The alluvial deposits are generally quite permeable.

- The "central band," along the axis of the Thompson Creek valley floor, contains alluvial deposits of different types and ages. Some of the deposits appear to have originated as stream sediments and others as mudflow deposits. Individual beds or sedimentation units are often two to eight feet thick, and, where exposed along the creek bank, can usually be traced for up to two miles. In many places, the creek channel has cut to a resistant gravely, silty clay alluvium. In all cases, the deposits are cohesive, with substantial silt and clay content, leaving a valley floor incised by sinuous, meandering channels.

- The "western band" has two main divisions. Downstream of what is now Yerba Buena Blvd., the western band is comprised of floodplain deposits of Coyote Creek, which have accumulated as natural levees. Upstream of Yerba Buena Blvd., the western band contains tectonically uplifted older alluvial materials and bedrock.

All three bands converge at the southern end of present-day Lake Cunningham, shown as a natural depression and marsh in older maps and aerial photographs. The depression is mapped as having old soils characteristic of seasonal lakebeds and pond floors, and is shown to be separated from Coyote Creek by a low but well-developed natural levee that is of natural origin and likely at least several thousand years in age.

2.5.2 Lower Silver - Thompson Creeks: Historically Versus Today

Historically, the Lower Silver - Thompson Creek system was much less interconnected than it is today and represented a complex system of surface water and groundwater.

As shown on a 1939 aerial photograph, most of the streams draining the eastern hills never reached Thompson Creek (originally called Dry Creek); instead they ended in the alluvial fans (the "eastern band" described above), where the channel flows spread out on the fans, the water soaked into the ground, and the sediment load was deposited. Today, those streams are connected to Thompson Creek via storm drains or engineered channels.

Similarly, Thompson Creek historically did not reach Lower Silver Creek, but instead terminated on the alluvial plain before reaching the Silver Creek marsh in the vicinity of what is now Lake Cunningham. Silver Creek itself did not continuously extend to the marsh in a natural channel (only the lower section reached the marsh). (In a 1899 topographic map, Silver Creek is continuously connected to the marsh but includes a section of what is likely a man-made channel, because it was straight and followed a road; the 1939 aerial photo doesn't show that

channel.) Today, Thompson Creek connects to Lower Silver Creek, but Upper Silver has been diverted to connect directly to Coyote Creek rather than to Lower Silver Creek.

Historically, it does not appear that there was a natural channel draining the marsh by what is now Lake Cunningham; instead, groundwater drainage was likely the primary water pathway. By the time of the 1939 aerial photo, the Silver Creek canal (the engineered portion of Lower Silver Creek) had been constructed.

In pre-urban times, the natural levees formed by Coyote Creek floodplain deposits deflected Silver and Thompson Creeks into parallel channels that were not connected to Coyote Creek, but continued downstream until they joined Penitencia Creek, ultimately discharging to the Bay. Today, Lower Silver Creek and Thompson Creek discharge into Coyote Creek due to the Silver Creek canal cut through the levee.

Where Thompson Creek meanders through the central band of the valley floor, the individual meanders found today are also identifiable in the 1899 topographic map. Although currently the meanders are incising and perhaps widening in response to hydromodification, they are intrinsic features of the streams.

A review of the historical record also suggests the role of climate in influencing stream channels. Topographic maps from 1989 and 1953, and a 1939 aerial photograph, show all channels but Yerba Buena Creek as dissipating on the alluvial fan rather than connecting to Thompson Creek; however, a 1942 topographic map shows them all as being connected. The late 1930s and early 1940s were one of the very wettest periods in Santa Clara Valley's recent history and included a number of significant storms. Although the 1942 maps may have been hastily compiled (due to the war) and incorrect, it is possible that this atypically wet period led to partial integration of the valley's hydrography, which subsequently (after the record drought of 1945-1950) resumed the disconnected drainage shown in the 1953 topographic map.

2.5.3 Implications

The geology of the Lower Silver - Thompson Creek subwatershed and the differences between the historical and current stream system have bearing on the hydromodification analysis. Key points are summarized below.

- The channel meanders are intrinsic to the inherent properties of the natural bank material, so must be recognized when planning to restore a stable Lower Silver - Thompson Creek system.

- The diversion of Upper Silver Creek directly to Coyote Creek reduced flows and sediment loads to Lower Silver Creek and increased them in Coyote Creek. That means the effects of hydromodification in Lower Silver - Thompson Creeks are less (now and in the future) than they would be without the diversion.

- The connection of streams—that once terminated in the alluvial fan—to Thompson Creek has increased flows and sediment loads in Thompson Creek. Increased coarse-sediment loads typically increase channel width, resulting in both additional bank retreat and meander migration, likely compounding channel instability (which further increases coarse-sediment yields). The historical role of the alluvial fan in attenuating flow and trapping sediment will be largely completely eliminated with build-out of the valley floor.

- Findings from the Thompson Creek subwatershed may have bearing on other Santa Clara Basin subwatersheds with urbanizing alluvial fans However, the hydromodification impacts in Lower Silver - Thompson Creek subwatershed may be larger and broader than in other developing subwatersheds in the Santa Clara Basin, because of the subwatershed's rare combination of poorly connected historical drainage and a broad alluvial fan.

- The possible increase in stream connectedness during the wet period of the late 1930s and early 1940s underscores the role of weather in stream flows and associated channel characteristics. The fact that the Santa Clara Basin recently experienced a particularly rainy period (1993 to 2000) may have aggravated the hydromodification effects observed in the Lower Silver - Thompson Creek subwatershed.

Additional channel history analysis may provide further insight into how best to mitigate hydromodification impacts and create stable channels. Individual streams could be further evaluated through sequential aerial photographs and other archival materials to identify recent changes, infer their causes, identify reaches that are especially vulnerable or resistant, and quantify where vegetation or drainages may have been added or removed, or instream structures constructed.

2.6 Existing Flood Control Facilities

Two drop structures are present upstream and downstream of Quimby Road along Thompson Creek. Further upstream, the channel features levees, rock slope protection, box culverts, and outfalls.

Sediment control basins were built on Norwood Creek and Quimby Creek. Similar structures were planned for most of the other tributaries of Lower Silver and Thompson Creeks, but have not been constructed.

3 Field Geomorphic Assessment

3.1 Overview

A field geomorphic assessment was completed for the Thompson Creek subwatershed as part of this draft Hydromodification Management Plan (HMP). Conducting a geomorphic assessment is a critical step toward understanding the hydrologic and geomorphic processes controlling channel stability within an urbanizing watershed. The historic assessment and geomorphic field work conducted for this study provide the foundation for evaluating how past hydrology has changed, and how modified flow pathways have affected channel form and stability. Future work on this HMP will evaluate whether and where increases in peak runoff flow and volume from new and redevelopment projects in the subwatershed that are subject to HMP requirements will result in the potential for increased erosion or other adverse impacts to beneficial uses..

The geomorphic assessment complements and supplements information addressed by hydrologic and stability assessment models, and it helps in the interpretation of what the models mean in different stream systems.

This chapter covers:

- Previous work that guided the creation of a geomorphic assessment program for this subwatershed
- The scales at which the geomorphic assessment was conducted (the identification of geomorphic reaches and hydrographic segments)
- Methods used to conduct the geomorphic assessment
- Results of the field survey
- Discussion
- Summary and conclusions

3.2 Previous Work

Several studies and reference items guided the geomorphic assessment and provided a strong framework for setting up and interpreting the results of the field survey:

- *Geomorphology of the Historical Silver Creek Watershed* (William Lettis & Associates, Inc., January 2003)
- Santa Clara Valley Water District Yellow Book

- Information from the SCVWD maintenance crew on stream conditions

3.3 Divisions used in the Assessment

3.3.1 Geomorphic Reaches

Thompson Creek and its tributaries vary longitudinally—that is, from upstream to downstream both with respect to channel bed and bank properties and with respect to the flows which act upon them. Both the intrinsic properties of bed and banks plus the flows acting upon them need to be considered when developing a method for predicting how future flows will affect the creek.

The project team distinguished ten *geomorphic reaches* based on the longitudinal variation of bed and bank conditions. The reaches are shown on Figure 3-1 and include seven along the main stem of Thompson Creek and three that describe the major tributaries of Thompson Creek. Within a given reach, broadly-similar influences (whether vegetation, geology, topography, level of upstream development, etc. or some combination therein) affect channel form and processes.

The primary geomorphic features of the seven reaches along the main stem of Thompson Creek are as follows:

- Geomorphic Reach A: Exposed clay hardpan with localized zones of deposition
- Geomorphic Reach B: Incised with severe bank erosion
- Geomorphic Reach C: Incised with bank erosion at bends and a sinuous planform
- Geomorphic Reach D: Channel form controlled by dense vine vegetation
- Geomorphic Reach E: Actively incising with bank erosion
- Geomorphic Reach F: Upper end of development, less disturbed with minimal bank erosion
- Geomorphic Reach G: Canyon-like channel with landslides

The three reaches along the tributaries of Thompson Creek are distinguished as follows:

- Geomorphic Reach H: Actively incising with bank erosion and large knickpoints
- Geomorphic Reach I: Stable rock- or clay-cut tributary channels
- Geomorphic Reach J: Engineered channels or storm drains

Table 3-1 summarizes the geomorphic reaches along Thompson Creek, the key characteristics defining each, and how the reaches overlap with the hydrographic segments discussed below.

Table 3-1. Observed Geomorphic Reaches in the Thompson Creek Subwatershed

Code	Geomorphic Reach	Hydrographic Segment	Affected Cross-Sections[1]	Bed	Banks[2]	Remarks
A	Exposed Clay Hardpan w/ Localized Zones of Deposition	Lower Segment TC1	TC1-1 to TC1-5	Historically Incised	Localized Active Erosion	Several in-stream structures control the pattern of erosion and deposition in the reach. Incision has occurred down to the clay hardpan and has been effectively halted.
B	Historically Incised w/ Severe Bank Erosion	Upper Segment TC1 - Lower Segment TC2	TC1-6 to TC2-3	Historically Incised	Actively Eroding	Steep, vertical banks greater than 10 feet high characterize this reach that has experienced significant incision, bank erosion is severe.
C	Historically Incised w/ Bank Erosion at Bends, Sinuous Planform	Upper Segment TC2 - Lower Segment TC4	TC2-5 to TC3-7	Historically Incised	Actively Eroding	Similar to Geomorphic Reach B, but slightly more stable due to increased density of bank vegetation. Also, increased sinuosity of channel planform with excessive erosion focused at bends.
D	Channel Form Controlled by Dense Vine Vegetation	Upper Segment TC4 - Lower Segment TC5	None	Not Currently Incising	No Excessive Erosion	Extremely dense vine (blackberry) and shrub vegetation controls the stability of the reach where high flows are routed and dispersed over the dense vegetation rather than through the channel, limiting bank erosion.
E	Actively Incising w/ Bank Erosion	Mid Segment TC5	TC5-1 to TC5-5	Actively Incising	Actively Eroding	Located just downstream from some the most recent development, the channel bed in this reach is showing signs of past and present incision (exposed root mats, small knickpoints), which decreases in the upstream direction.
F	Upper End of Development, Meta-Stable, Less Disturbed	Upper Segment TC5	TC5-6 to TC5-7	Not Currently Incising	No Excessive Erosion	Located upstream from most development, this reach has relatively stable channel bed and banks, but could be impacted by a) future development and/or b) downstream incision.
G	The Gorge Reach:Canyon-like Channel w/ Landslides	Up to the headwaters "bowl"	None	Not Currently Incising	No Excessive Erosion	Periodic natural landslides probably recur, likely causing pulses of sedimentation downstream.
	Tributaries					
H	Actively Incising w/ Bank Erosion and Large Knickpoints	Segment YB1, Yerba Buena Creek	YB1-1 to YB1-7	Actively Incising	Actively Eroding	At least three large (> 5 feet) knickpoints are present along the length of Yerba Buena Creek, with some sections exhibiting very steep, canyon-like channels. Yerba Buena Creek above Villa Vista is currently stable (not incised).
I	Stable Rock- or Clay-cut Tributary Channels	Upper Evergreen Creek, Upper Yerba Buena	None	Not Currently Incising	No Excessive Erosion	Small channels cut into bedrock or hard clay with thin, immature floodplains characterize the upper sections of these tributaries, which have the potential to be impacted by downstream incision or nearby development.
J	Engineered Channels or Storm Drains	Norwood, Quimby, Fowler Creeks	None	Not Currently Incising	No Excessive Erosion	Man-made channels or pipes that convey flows to Thompson Creek that are presently stable but could be affected by incision on the main stem.

Notes:

[1] Cross-sections represent one site within a geomorphic reach and may not exhibit all characteristics that are described for the reach.

[2] Some amount of bank erosion is expected in un-disturbed stream systems, therefore, it is noted in reaches that are not experiencing severe erosion that "no excessive erosion" is occurring to distinguish natural erosion processes from accelerated erosion due to disturbance.

3.3.2 Hydrographic Segments

The project team identified six hydrographic segments based on significant flow increases in the downstream direction due to confluences with major tributaries (Figure 3-2). Each hydrographic segment has similar stream discharges. The segmentation reflects important differences in channel-forming flows.

The six hydrographic segments are as follows (listed from downstream to upstream):

- Segment TC1: Thompson Creek between Norwood Creek and Quimby Creek
- Segment TC2: Thompson Creek between Quimby Creek and Fowler Creek
- Segment TC3: Thompson Creek between Fowler Creek and Evergreen Creek
- Segment TC4: Thompson Creek between Evergreen Creek and the confluence of Yerba Buena Creek
- Segment TC5: Thompson Creek upstream of Yerba Buena Creek
- Segment YB1: Yerba Buena Creek

The results of the geomorphic fieldwork are presented by segment. As previously noted, Table 3-1 shows how the geomorphic reaches overlap with the hydrographic segments.

3.4 Work Conducted

The geomorphic field work consisted of taking a set of qualitative and quantitative measurements at thirty-seven cross-sections along Thompson Creek and Yerba Buena Creek. Cross-sections were selected to represent typical problem sites found within the subwatershed. It was also a goal to locate cross-sections at non-problem sites that did not experience incision or excessive erosion for use in the stability assessment model. SCVWD maintenance staff identified thirty problem sites in the Thompson Creek subwatershed that were used to guide the selection of cross-sections. The location of the problem sites and cross-sections are shown on Figure 3-2.

Most of the problem sites identified by SCVWD are located along the main stem of Thompson Creek downstream of Yerba Buena Creek, but a few sites are found on upper Thompson above Yerba Buena Creek and on Yerba Buena Creek itself. The problems reflect both site-specific existing conditions as well as larger-scale watershed factors. The field program is providing the data to characterize both small- and larger-scale hydrologic and geomorphic factors causing creek problems.

3.4.1 Field reconnaissance

The project team conducted field reconnaissance along Thompson Creek and Yerba Buena Creek during November 2002. The site visits consisted of walking most of the length of Thompson Creek and Yerba Buena Creek and noting problem areas, zones of deposition, sediment transportation and erosion, in-stream and bankside structures, and other qualitative observations on the geomorphic characteristics of the streams. Also as part of the field reconnaissance, the project team measured depth from "hanging" structures (such as pipes and outfalls) to the existing channel bed to obtain a rough estimate of how much incision has occurred at a specific site. The hanging structures were dated where possible to give a time period for incision.

3.4.2 Channel geometry

Channel geometry is used in the stability assessment model to calculate water depths and velocities and other hydraulic parameters. The project team measured channel geometry at each problem or non-problem site by establishing a cross-section that best represents the site. Each cross-section was monumented using a piece of rebar to allow future re-surveying and comparison.

The project team then measured the following:

- Cross-section stations across the channel (using a tape)
- Relative elevations of points along the cross-sections (measured using a standard level and stadia rod) —see Figure 3-4
- All major breaks in slope, with particular focus on top of bank, toe of slope, edge of channel and in-channel bars
- Where visible, a set of high water mark elevations from mid-December 2002 storms (the high water mark elevations may be used later to help calibrate the model and adjust roughness values)

3.4.3 Channel slope

Channel slope for each cross-section was measured using a standard level, stadia rod, and tape. The field crews measured an elevation upstream and downstream from the cross-section over a distance that varied depending on the homogeneity of the site, steepness of the slope, and visibility with the level. Field measured channel slopes were then compared to existing topographic maps and longitudinal profile as a way to check the filed results. The slopes for four of thirty-six cross sections were adjusted.

3.4.4 Bank Characterization

The stability of channel banks (i.e. the ability of channel banks to resist erosion) depends on several factors, including bank material composition and stratigraphy, bank angle, bank vegetation, and subsurface conditions. These parameters were either directly or indirectly (through survey work) described at each cross-section.

At each cross-section, the project team characterized the banks by describing bank material; sketching bank stratigraphy; noting the type and density of bank vegetation (including root structure); and describing the types, frequency, and possible causation of bank failures observed at or near the surveyed cross-section.

3.4.5 Bed Characterization

Bed material was characterized primarily to help evaluate channel bed and bank response during different flow events. In addition, bed descriptions provide data that will be needed for SCVWD's envisioned sediment-transport modeling effort and allow comparisons of the particle-size distributions of bed material with material transported as bedload sediment.

For this study, the field crew walked the creek near the targeted cross-section and collected samples at a point that best represented the bed in that particular cross-section, avoiding lateral bars and material deposited on the lee side of obstructions. Next, the field crew evaluated whether the bed material was consolidated (such as bedrock), cohesive (such as clay), or composed of granular bed material (such as sand, gravel, or cobbles). The team assumed that at creek flows sufficient for sediment transport, the channel would likely scour to the cohesive bed layer if there was an overlying sediment layer less than one foot deep. The depth of the granular layer was measured by pounding rebar into the bed.

The project team collected samples at 14 sites on January 28, 2003, following a two-week period of winter baseflows. Sample locations are shown on Figure 3-3. Samples were collected by driving a six-inch thin-walled sampler (in this case, a three-pound coffee can) into sand and gravel beds. The team decided in the field whether to include individual gravels or cobbles partially within the sampler, choosing to sample those in which more than 50 percent of volume fell within the ring. Even though no armor or imbrication (shingling) was noted, a thin layer of bed material was scraped away to obtain a more representative sample of the bed material.

Samples were transported to Cooper Testing Labs, where they were dried and sieved. Two bedload samples collected during the December 2002 storms, one from Lower Thompson (TCQR) and one from Yerba Buena (YBSF) were also submitted for analysis. Three cohesive bed material samples were also submitted to the laboratory, where they were sieved and analyzed for silt and clay content using the hydrometer method.

3.4.6 Photographic record

A set of photographs was taken at each cross-section from at least three different vantage points; across the cross-section, upstream from the cross-section, and downstream from the cross-section. Additional photographs recorded features of interest, such as unique bank stratigraphy, failing grade control structures, and areas where depth of incision from bridge abutments or pipes were measured. This photographic record illustrates problems sites and will also serve as a frame of reference for evaluating Thompson and Yerba Buena Creeks in the future.

3.5 Results

This section describes key results of the geomorphic field work along Thompson and Yerba Buena Creeks. Table 3.2 summarizes the results by individual stream cross-sections. Note that the cross-section numbers increase along Thompson Creek from downstream to upstream, whereas the opposite convention is used along Yerba Buena Creek (so the cross-section numbers there increase in the downstream direction). Table 3-3 shows the results of the particle size analysis of the stream bed and bedload material. Table 3-4 shows the depth from hanging structures to the existing bed.

3.5.1 Field Reconnaissance

The following observations are among those made during the reconnaissance visits:

- Upper Thompson Creek near the headwaters has very erodible bank soils, a canyon-like form, and is prone to landslides. The banks there are composed primarily of shaly material.

- During the November 20th site visit, most of Thompson Creek was dry. However, portions of the creek were wet due to urban runoff, particularly near subdivisions upstream from the Yerba Buena confluence. The entire creek showed signs of having water flow during the November 8th storm, even though most of it was dry on November 20; this illustrates the intermittent nature of the stream.

- Dense blackberry vines cover the banks and overhang into the channel of Thompson Creek near the Yerba Buena confluence. This appears to have a significant effect on channel stability.

- Several old grade control structures, outfall structures, and bank protection projects were observed along the length of Thompson Creek. Many of these structures have failed, and “hanging” structures were deemed a useful tool to measure approximate depths of incision.

Table 3-2. Hydraulic and Geomorphic Characteristics of Reaches in the Thompson Creek Subatershed

Cross-section	Top of Bank Width	Average Depth from TOB[1]	W/D Ratio [2]	Channel Slope	D^{50} [3]	Exposed Clay Hardpan on Bed?	Depth of Mobile Material	Weakest Bank Material (left bank)[4]	Weakest Bank Material (right bank)[4]	Erosion Ranking (H,M,L)[5]
	(feet)	*(feet)*	*(unitless)*	*(feet/feet)*	*(mm)*	*(Y/N)*	*(in)*			
Segment TC1										
TC1-1	16.8	4.3	3.9	0.0016	5.8	N	24	sandy gravel	silty loam and gravel	L
TC1-2	20.3	4.7	4.3	0.0040	-	Y	3-4	silt loam	sand and small gravel	L
TC1-3	23.5	10.9	2.2	0.0064	0.0082	Y	0	pebbly clay	pebbly clay	M
TC1-4	22.8	6.1	3.7	0.0170	-	Y	6	pebbly clay	pebbly clay	M
TC1-5	25.8	9.5	2.7	0.0170	-	Y	0-24	sandy clay	silty layer	H
TC1-6	52.0	11.5	4.5	0.0102	4.5	N	12-24	sandy loam with gravel	gravelly sand	L
TC1-7	11.1	3.4	3.2	0.0091	-	N	12	silt loam with gravel/sand	silty loam with gravel/sand	M
Segment TC2										
TC2-1	46.2	13.5	3.4	0.0078	-	N	18	loamy clay	loamy clay	M-H
TC2-2	36.8	12.5	3.0	0.0160	-	N	10	clayey sand-gravel	clayey sand-gravel	L-M
TC2-3	45.4	13.2	3.5	0.0109	-	N	12	clayey sand-gravel	clayey sand-gravel	H
TC2-5	15.2	3.9	3.9	0.0117	4.0	N	> 24	silt, sand and some clay	sandy silt	L
TC2-6	30.0	7.4	4.0	0.0150	-	N	10	well sorted med sand	clayey sand and gravel	M
TC2-8	34.8	10.0	3.5	0.0013	-	N	6	sand and gravel	fine sand	H
TC2-9	15.8	4.4	3.6	-	-	N	7	colluvium	fine sand w/ some clay	L
TC2-10	59.4	13.2	4.5	0.0064	3.2	N	-	sand-gravel-silt w/ clay	sand-gravel w/ some clay	M
Segment TC3										
TC3-1	17.5	4.1	4.3	0.0032	-	N	24	sand	silty loam	M
TC3-2	23.7	4.2	5.6	0.0031	-	N	24	silty-sandy loam	silty loam w/ pebbles	L
TC3-3	22.9	6.3	3.7	0.0045	5.0	N	24	silty loam w/ gravel	silty fine gravelly loam	M
TC3-4	18.7	7.0	2.7	0.0084	-	N	24	clayey pebbly with silt loam	sandy gravelly loam	M
TC3-5	22.4	4.2	5.3	0.0099	-	N	-	silty sandy loam	gravelly silty loam	H
TC3-6	10.3	3.2	3.3	0.0086	0.0065	Y	24	sandy gravelly loam	gravelly loam	H
TC3-7	13.6	3.6	3.8	0.0094	6.9	N	18	silty loam with some gravels	silty loam with some gravels	L
Segment TC5										
TC5-1	46.1	11.9	3.9	0.0250	-	N	9.6	sand and gravel with silt	silty sand w/ some gravel	H
TC5-2	13.8	5.2	2.7	0.0058	9.0	N	>24	silty sand and gravel	silty sand and gravel	M
TC5-3	11.0	7.3	1.5	0.0047	-	N	12	silts and sands	fine sand and silt	H
TC5-4	13.9	4.4	3.2	0.0166	-	N	>24	clayey sand and gravel	sandy silt	H
TC5-5	11.7	2.3	5.2	0.0102	3.7	N	>>24	pebbly sand and silt	sand, pebbly sand	M-H
TC5-6	19.0	3.6	5.2	0.0086	8.0	N	12	well sorted sand	sand and gravel	S
TC5-7	14.0	1.8	7.8	0.0129	3.5	N	>24	clayey sand and gravel	clayey sand and gravel	S
Segment YB1										
YB1-0	4.4	0.9	4.7	0.0222	-	N	24	pebbly silty loam	pebbly silty loam	S
YB1-1	4.9	2.2	2.3	0.0179	10.2	N	12	silty pebbly loam w/ gravels	silty pebbly loam w/ gravels	M
YB1-2	7.9	2.2	3.5	0.0282	-	N	12	silty pebbly loam	silty pebbly loam	M
YB1-3	8.9	2.9	3.1	0.0221	-	N	24	silty pebbly loam w gravels	silty pebbly loam	M
YB1-4	8.2	1.6	5.1	0.0111	-	N	24	silty loam -- gravelly cobbly sand	gravelly cobbly loam	L
YB1-5		unsurveyed		-	-	Y	12	cobbly, silty, pebbly loam	cobbly, silty, pebbly loam	L
YB1-6	10.8	9.4	1.2	0.0139	0.028	Y	12	clay-silty gravelly-cobbly loam	clayey-gravelly loam, cobbly silty loam	H
YB1-7	27.7	2.5	11.0	0.0149	4.8	N	24	silty gravelly loam	silty gravelly loam	M

Notes:

[1] TOB = Top of Bank
[2] W/D ratio for full channel dimensions to TOB, not bankfull
[3] D^{50} = the median diameter of bed material determined from a samples collected from the bed surface.
[4] left/right bank = described from the observer facing downstream
[5] Erosion Ranking: S=stable, L = low, M = medium, H = high; based on bank, cross-section, and reach-wide observations/measurements

3.5.2 Channel geometry and channel slope

Channel geometry and slope measurements are summarized in Table 3-2 and described here by segment and cross-section in the upgradient direction. The Yerba Buena Creek tributary is described last. The channel geometry of TC1 is generally variable due to continued changes induced by the historical and current channel modifications (described in 3.6.1). Moving upgradient from TC1-1 to TC1-5, channel width increases from 16.8 ft to 25.8 ft and depth increases from 4.3 ft to 9.5 ft. Cross-section TC1-6 widens to 52.0 ft with a depth of 11.5 ft and drastically narrows to 11.1 ft and only 3.4 ft deep at TC1-7. Channel slopes range an order of magnitude (0.002 to 0.017 ft/ft) varying with cross-section throughout the reach.

Segment TC2 through TC3 is extremely variable in width and depth. The channel attains its greatest width and depth of 59.4 ft and 13.2 ft, respectively, at TC2-10. In contrast, at TC3-7, the width and depth are 13.6 ft and 3.6 ft, respectively. Channel slope is generally steep, averaging 0.010 ft/ft through Segment TC2, decreasing to an average slope of 0.007 ft/ft through Segment TC3.

Segment TC5 shows a rapid transition in channel geometry, because the upgradient extent of incision and bed degradation is located within this segment. TC5-1 is characterized with a channel width of 46.1 ft and a depth of 11.9 ft. Further upgradient the channel width decreases to less than 20 ft, whereas the channel depth ranges between 1.8 and 7.3 ft. TC5 is located in the upper most reach of the Thompson Creek watershed and averages a slope of 0.012 ft/ft.

The Yerba Buena Creek tributary increases in width from 4.4 ft, at the upper most cross-section, YB1-0, to 27.2 ft at its confluence with Thompson Creek. Channel depth varies along this reach, but ranges from 0.9 ft to 9.4 ft. Channel slope in the Yerba Buena tributary is generally steep, averaging 0.019 ft/ft.

3.5.3 Bank material

Channel banks along Thompson and Yerba Buena Creeks are not homogenous; instead they consist of multiple layers with different sedimentological characteristics that vary longitudinally through the subwatershed. These layers represent possible source differences and/or similar material deposited during different events.

In general, the project team identified four distinct types of bank material in the Thompson Creek subwatershed:

- Well-consolidated (or cohesive) stiff clay/silty clay
- Silty/sandy loam material

- Colluvium (loam with silt, not compact)
- Alluvial deposits (sands, gravels, some silt and clay)

The stiff clay or silty clay layer was generally found in the lower portion of the bank, extending upward from one to six feet. This bank layer is the same material found exposed on the channel bed in Segments TC1 and TC3. This material varies in color from dark brown to brownish-orange (near TC5-2) and reflects that there are at least two units with similar sedimentological composition and erosive resistance, likely deposited at different times historically. The cohesive silty clay / stiff clay layer is very resistant to erosion.

The silty/sandy loam material was found in many cross-sections of the Thompson Creek subwatershed, and varied both in compactness and dominance of silt versus sand. In some cross-sections of Segment TC1 the material observed as silty/sandy loam might be artificial fill. Throughout the subwatershed, this layer was usually observed in the upper portions of the banks, and it often holds vertical or near vertical angles.

Colluvial deposits, composed of non-compacted loam, were generally very erodible. This unit is the least continuous of the identified units, as it is found only locally where the creek has cut into slope wash deposited at the base of the stream banks.

Alluvium, former channel bed and bar material, was often observed in the channel banks. These layers, composed of moderately to well-sorted sands and gravels with some silt and clay, often represented the weakest portion of the bank. Widespread undercutting often occurred at the contact between these weaker alluvial deposits and a more resistant silty clay or compacted sandy loam layer.

3.5.4 Bed material

Table 3-3 summarizes the results of the Thompson Creek bed characterization study. D-50, the sediment size that 50% of a sample is finer than, ranged from 3.2 to 10.2 millimeters, with the smallest value from the upper portion of Segment TC2 and the largest value from upper Yerba Buena Creek..

D-50 values are quite varied in the upper portion of Segment TC5 (samples from cross-sections TC5-5 through TC5-7), reflecting the diverse characteristics of this section of TC5. The low D-50 value at cross-section TC5-7 is possibly influenced by debris flow material from the upper subwatershed.

Going downstream from cross-section TC5-2 to TC2-10 there is a consistent drop in D-50 value. This may indicate a higher influx of finer sediment deposited as bed material.

Table 3-3. Grain Size Data for Stream Bed and Bedload Material, Thompson Creek Subwatershed

Sample Location[1, 2]	Cross-sections with similar bed material [3]	D-Size[4]				Percent Gravel	Percent Sand	Percent Fines	
		D-10	*D-30*	*D-50*	*D-60*				
Unconsolidated Bed Material									
TC1-1	TC1-1	0.616	1.98	5.8	8.26	53.9	44.7	1.4	
TC1-6	TC1-5 to TC2-3	0.704	1.82	4.5	6.96	48.7	50.4	0.9	
200' u/s TC2-5	TC2-5 to TC2-8	0.581	1.56	4.0	6.62	46.5	53.2	0.3	
50' d/s TC2-10	TC2-9 to TC2-10	0.541	1.33	3.2	5.37	42.8	56.9	0.3	
TC3-3	TC3-1 to TC3-3	0.677	2.38	5.0	6.63	51.7	46.7	1.6	
TC3-7	TC3-4 to TC3-7	1.09	3.31	6.9	8.91	60.4	38.9	0.7	
TC5-2	TC5-1 to TC5-3	1.18	3.82	9.0	13	65.4	34.2	0.4	
TC5-5	TC5-4 to TC5-5	0.858	1.93	3.7	5.56	43.8	55.8	0.4	
TC5-6	TC5-6	1.17	3.98	8.0	10.8	65.6	34	0.4	
50' u/s TC5-7	TC5-7	0.236	1.12	3.5	5.8	44.2	51.6	4.2	
YB1-7	YB1-1 to YB1-2	0.443	1.67	4.8	7	49.8	49.2	1.0	
YB1-1	YB1-3, 1-4, 1-7, and 1-0	0.724	4.92	10.2	15.1	70.6	28.1	1.3	
Cohesive Bed Material								*% Silt*	*%Clay*
TC1-3	TC1-2 to TC1-3	--	0.0016	0.0082	0.021	2.7	23.6	41.1	32.6
TC3-6	Small exposure at base of bank	--	0.0015	0.0065	0.011	2.3	19	45.9	32.8
YB1-6	YB1-5 and YB1-6	--	0.0048	0.028	0.0448	0.1	29.7	46.4	23.8
Bedload[5]								Percent Fines	
TCQR	--	0.373	1.02	1.9	2.55	22	76.7	1.3	
YBSF	--	0.364	2.91	8.0	10.1	63.6	34.6	1.8	

[1] Samples were sieved at Cooper Testing Lab. Hydrometer analysis was performed on the cohesive bed material.
[2] Locations are listed from downstream to upstream within each category (unconsolidated, etc.). Segment YB1 enters Thompson Creek between segments TC4 and TC5.
[3] This column lists cross-section that have similar bed characteristics to the listed sample. These designations will be used to generalize bed conditions in the stability model.
[4] Size, in millimeters, for which 10, 30, 50, and 60 percent of the sample is finer.
[5] Bedload samples were collected at high flows during the storm on December 17, 2002. TCQR is 200 feet u/s of TC1-2; YBSF is near YB1-7.
These samples were sieved at the lab and included to compare bedload (transport) to bed material (storage).

The D-50 value at cross-section YB1-7 is finer than that at YB1-1. However, the bedload sample collected near YB1-7 during the December 14, 2002 storm (YBSF)[2] is more similar to the bed material at YB1-1. This may be due to recent deposition of sand at the lower cross-section since the December 2002 storms, or an historic shift in the material being deposited at the cross-section.

The small (micrometer) D-50 numbers in Table 3-3 reflect the high clay and silt content of the cohesive bed material that was sampled at select cross-sections in Segment TC1, TC3, and Yerba Buena. At these cross-sections, the clay hardpan was exposed and a grab sample was collected for hydrometer analysis. Our intention was to evaluate whether the cohesive bed material exposed in Segment TC1 was similar to TC3, and how both of these compared to the cohesive bed material found along Yerba Buena Creek. Results indicate that the cohesive bed material collected at TC1-3 and TC3-6 are very similar in clay, silt, and sand content, both being primarily composed of silt (approximately 45 percent) with a significant clay component (greater than 30 percent). The Yerba Buena sample (taken at YB1-6) contains more sand and less clay than the samples from Segments TC1 and TC3, resulting in a slightly higher D-50.

3.5.5 Vegetation

The vegetation within the Thompson Creek subwatershed consists mainly of grasses, trees (bays, oaks, and some eucalyptus and maples), blackberries, and poison oak. Some sections of the creek also have a thin layer of moss that is partially stabilizing bank slopes.

Trees and blackberries probably play the most important role in slope stabilization. In Segment TC4 and the lowest portion of Segment TC5 the blackberry vines are so thick that the plants—not the actual banks—define the channel dimensions. In the upper portion of Segment TC1 and throughout Segment TC2, severe bank erosion often stops where there are large trees with a deep root structure that stabilizes the banks. In general, vegetation density below the top of the banks decreases downstream. The lower portion of Segment TC5 and the upper portion of Segment TC4 have the densest vegetation, with some portions having in-channel vegetation. The lower portion of Segment TC1 has very little vegetation, with only grasses and small trees on the top of the banks.

Riparian corridor width also decreases downstream. This affects stream bank stability, because one row of trees provides less stability than a grove or a more developed riparian corridor. Riparian corridor width is lowest in Segment TC2, where roads, fences, and parking lots are present at the top of the stream banks.

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[2] See methods section for discussion of bedload sampling.

3.5.6 Erosion rankings

Erosion rankings of high, medium, or low were assigned to each of the cross-sections along Thompson Creek. A rank of "stable" was assigned to two upper sections on Thompson Creek and one on Yerba Buena Creek. These rankings were qualitative in nature, which means that no numerical standard was applied. Instead, all factors affecting channel bank and bed stability (channel slope, undercut banks, bank slope, type and density of bank vegetation, in-channel obstructions, etc.) were combined with the observed extent, age, and magnitude of existing erosion to designate an appropriate erosion ranking.

Cross-sections that received an erosion ranking of "high"' were typically severely incised or actively incising with actively eroding banks, either through processes of undercutting, shearing and/or slumping. Channel banks were generally vertical and bare, with vegetation stabilizing only the very tops of the banks. A few cross-sections designated as "high" did not display tall, vertical banks (such as TC5-5) and with brief visual inspection appear in relatively good condition; however, recently exposed roots on the channel bed and banks indicate that incision is just starting to occur in these cross-sections on a reach wide scale. Without change in existing flow magnitudes, it is likely that these creek sections will experience further incision and bank erosion comparable to cross-sections located in older incised portions of the creek that also received "high" designations.

In total, nine of the thirty-seven cross-sections were assigned a "high" erosion ranking, with two additional cross-sections bordering between "medium" and "high." Cross-sections with "high" erosion rankings are located throughout the Thompson Creek subwatershed, but particularly concentrated in the lower portion of Segment TC5, just downstream from some of the most recent development.

Cross-sections were the erosion ranking was designated "low" typically had banks that were either not eroded or eroded but now in a stable configuration. Also, 'low' cross-sections generally had gentler slopes and denser vegetation, and sometimes were located behind grade control structures where the bed had aggraded. Cross-sections ranked as "medium" had characteristics in between those described for "high" and '"low." Thirteen out of thirty-seven cross-sections were designated as "medium" and thirteen designated as either "low" or "low" to "medium."

The two upper most cross sections on Thompson Creek (TC5-6 and TC5-7) were assigned a "stable" condition as well as YB-0 on Yerba Buena Creek. Stable conditions are defined in Chapter 5.

3.5.7 Segment characteristics

Segment TC1 - Thompson Creek between Norwood Creek and Quimby Creek

Segment TC1 of Thompson Creek (between Quimby and Norwood Creeks) represents the most downstream segment of Thompson Creek included in the field survey. This segment has artificial flood control levees on both sides of the channel and significant bank and in-stream structures. Based on aerial photographs, it appears that the lower portion of Segment TC1, below cross-section S1-6, was straightened sometime prior to 1968. The channel bed in Segment TC1 has incised in the past, leaving raw, vertical banks in many places. The amount of incision in this segment is *at least* three feet, based on measurements of a former underground pipe that is now exposed in the bank; it is unknown when major incision began. The incision has been effectively halted by a clay hardpan layer that now forms the channel bed in many portions of the segment. The clay layer resists erosion; it degrades slowly by the process of shear and abrasion rather than by knickpoint propagation, as is seen in Yerba Buena Creek and the upper reaches of Thompson Creek.

Currently, grade control structures are modifying the pattern of bed erosion and deposition in Segment TCI, as follows:

- A weir installed at the Quimby Road crossing has caused localized aggradation that extends about 150 feet upstream behind the weir.

- Upstream from the Quimby Road weir, a large sackrete grade control structure has been installed in the channel (see Figure 3-5).

- A series of four boulder cross-vane grade control structures were recently installed in the middle of Segment TC1 as part of a channel stabilization/restoration project. Sediment has already started to accumulate behind these structures.

- In the mid to upper portion of the segment, an old partially destroyed weir is still acting as a small grade control structure and creating a zone of localized aggradation.

Although Segment TC1 has localized zones of aggradation, much of the segment is still experiencing erosion. Most of the active erosion is targeted at the banks, with undercut and slumped banks common features throughout the reach.

Gravel or clay hardpan make up the bed material throughout Segment TC1. The gravel often appears as a thin veneer in the lower to mid portions of the segment, where the clay hardpan is either directly exposed or is covered with only three to four inches of gravel. The depth of mobile material in this segment rarely exceeds 12 inches, and when it does it is usually behind grade control structures such as the Quimby Road weir. Most of the gravel is fairly transient,

moving downstream with each significant flow event. Little to no pool-riffle morphology is found, although the bed is slightly more complex at the upper end of the segment.

The banks are composed primarily of hard clay near the channel bed and a thick silty loam layer (possibly artificial fill) extending to the top of bank. At some sites, sand and silty gravel deposits are interspersed between the hard clay and fill material. The weakest layers are these alluvial deposits composed of sand and gravel. Undercutting occurs at the interfaces between the weak sandy gravel and the more resistant clay and fill layers (see Figure 3-6).

Grasses and small woody vegetation make up most of the bank vegetation along the lower portion of Segment TC1 near Quimby Road. Larger trees become more common near the confluence with Quimby Creek. The deep roots of these larger trees aid in stabilizing some of the eroded banks in the upstream portions of Segment TC1.

Segment TC2 - Thompson Creek between Quimby Creek and Fowler Creek

Segment TC2 (just upstream of segment TC1, between Quimby and Fowler Creeks) can be divided into two sub-segments based on geomorphic characteristics, with the break at the Aborn Road crossing. The lower portion of TC2 is very similar to the upper portion of TC1 (above TC1-5), with steep banks about ten feet high and many areas with vertical, actively eroding faces. Undercutting and slumping of banks is common in this sub-segment; large trees are growing below the top of the banks, partially stabilizing the banks in some areas.

The portion of Segment TC2 above Aborn Road has a slightly higher sinuosity than that downstream. In general, vegetation is denser than in the lower portion of Segment TC2 and, partially because of that, the channel banks are more stable (see Figure 3-7). Several areas with severely eroding banks are present within this section of Segment TC2, mostly at outside bends in the creek, though they are not as extensive or as common as those downstream. Development (roads, parking lots, fences) in this area is often very close to the top of the stream bank, which makes bank stability of particular concern.

Throughout Segment TC2 the lower portion of the channel banks are typically composed of clayey sand and gravel to moderately well-sorted sand and gravel. Above this is a layer of compact, poorly sorted material about five feet thick, probably fill material underlying the surrounding developed areas. Because the fill has been compacted, it is slightly more resistant to erosion than the lower layers; as a result, there is undercutting (up to a foot) below the fill layer.

The channel bed in the upper portion of Segment TC2 is more complex than segment TC1 and has distinct pools (deeper areas) and bar forms, likely due to its meandering planform. Depth of mobile sediment is generally greater than one foot, but is highly variable because of the more complex bed morphology.

A grade control structure is present at the downstream end of the Aborn Road crossing; the structure arrested any downcutting that may have been occurring and probably caused local aggradation upstream from the structure. There is also a concrete slab (probably an old bridge crossing) upstream from cross-section TC2-6 that provides a grade control for the upper portion of this segment.

Segment TC3 - Thompson Creek between Fowler Creek and Evergreen Creek

Segment TC3 is very similar geomorphically to the upper portion of Segment TC2 and as a segment is fairly homogenous in terms of bed and bank characteristics, as well as channel geometry. Like the upper portion of Segment TC2, the channel planform is quite sinuous, exhibiting in places very tight meander bends (see Figure 3-8). Severe erosion is occurring at the outside of meander bends where the creek is close to the road, including in some sections where the creek is constrained by a retaining wall.

The channel bed consists of a mixture of sand, gravel, and some cobbles. The median grain size is mostly fine gravel. The bank material throughout the segment consists of a silty pebbly loam or silty clay loam with some gravels.

Segment TC3 is characterized by very dense vegetation, with more shrubs and vines than trees. There is a significant amount of debris in the channel, resulting in shifts in flow path direction, scour holes, and bank erosion. The types of debris found in the channel include telephone poles, rip-rap, old bridge structures, remnants of previous retaining walls, and trees.

Segment TC4 - Thompson Creek between Evergreen Creek and Yerba Buena Creek

Segment TC4 was not included in the field survey because no problem sites identified by SCVWD were located there and dense vegetation made access to the segment very difficult. However, based on the project team's familiarity with the upstream and downstream segments, and some observations during early reconnaissance walks, it appears that Segment TC4 shares similar qualities with Segment TC3, at least in the lower portion. Near the Yerba Buena confluence, the channel is covered with blackberry vines and is comparable to the downstream-most sections of Segment TC5.

Segment TC5 - Thompson Creek upstream of Yerba Buena Creek

Segment TC5 (located upstream of the Yerba Buena Creek confluence) includes the headwaters of Thompson Creek, however the most upstream cross-section surveyed was located at Early Morning Drive (TC5-7), a little over two miles upstream of the confluence with Yerba Buena Creek. Upstream from this cross-section the watershed remains relatively undeveloped, with only scattered homes and roads.

From cross-section TC5-7 to at least cross-section TC5-6 the creek has been relatively unaffected by development except where it is crossed by roads. The banks are well vegetated (mainly with grasses and trees), there has been little or no incision, and the banks are stable throughout most of the section. Some slumping of the banks has occurred, primarily where the creek is confined against the valley wall by San Felipe Road.

The portion of Segment TC5 just upstream of the bridge crossing near The Villages Parkway subdivision, at cross-section TC5-5, is characterized by thick vegetation, and a straight channel with a relatively steep local slope. Bed degradation is beginning at this cross-section, as there are many exposed roots and root mats at the base of the channel banks and on the stream bed (see Figure 3-9).

Downstream of cross-section TC5-5 the stream generally shows an increase in incision and bank degradation. Between cross-sections TC5-2 and 5-3 is an old bridge crossing dated 1947. The creek has down-cut about 3.2 feet below what looks to be the original base of the abutment (see Table 3-4).

Several portions of lower Segment TC5 are now underlain by a tan, compact clayey silt, similar to that seen in Segments TC1 and TC2. This has certainly slowed incision, and provides some stability for the lower portions of the banks (see Figure 3-10).

The section of creek just above Yerba Buena is characterized by dense vegetation, mostly blackberries, poison oak, and shrubby trees. In one section, the blackberries were so dense that they seemed to be the primary feature channeling high flows, rather than the banks. Because of this dense vegetation, no cross-sections were surveyed in this portion of the segment.

Segment YB1 - Yerba Buena Creek

Segment YB1 is Yerba Buena Creek, a tributary to Thompson Creek. The confluence of Yerba Buena Creek and Thompson Creek occurs at the upper end of Segment TC4. Yerba Buena Creek is actively incising throughout most of its length, except for the uppermost sections of the creek, above the golf course and the upstream-most urban-area outfalls, and possibly near the confluence with Thompson Creek where it is aggrading.

Segment YB1 is one of the most complex and diverse segments in the Thompson Creek subwatershed. This segment has several large knickpoints that divide it into several sub-segments with different geomorphic characteristics, especially with respect to channel geometry. The characteristics of this segment are described from upstream to downstream.

Table 3-4. Measurements of Depth to Existing Channel Bed and Banks from Dated Structures at Thompson Creek

Hydrographic Segment	Geomorphic Reach	Location	Type of structure	Date of structure	Depth from base of structure to current channel bed[1] *(feet)*	Distance from structure to current bank[2] *(feet)*
TC1	A	Upstream from the Quimby Road weir	Pipe		~2.0	-
TC2	B	Quimby Creek confluence; between cross-sections TC1-7 and TC2-1	Sackrete grade control structure		2.6 - 3.0	-
TC2	C	Between cross-sections TC2-6 and TC2-8	Old weir		2.3	-
TC2	C	Between cross-sections TC2-9 and TC2-10	Pipe		1.6	-
TC5	E	Downstream from The Villages subdivision; between cross-sections TC5-2 and TC5-3	Bridge	1943	3.2	-
TC5	E	San Filipe Road crossing near The Villages subdivision; between cross-sections TC5-4 and TC5-5	Outfall structure		3.1	4.1

Notes:

[1] To gain some understanding of the amount of incision in a particular portion of Thompson Creek, depths from old structures (believed to be at grade in the past) to the current channel bed were measured. These measurements do not indicate an absolute amount of incision and should be taken as estimates of the range of incision over a length of stream. It is important to note that channel bed incision and bank erosion are usually most severe around in-channel obstructions, such as bridge abutments, outfall structures and grade control structures.

[2] Where possible, the distance from an old structure that was once level with the channel bank to the current bank was measured to estimate bank retreat. Only one of these measurements was taken for the Thompson Creek subwatershed and such measurements must be used carefully because localized bank erosion generally occurs at the contact between natural bank material and hardened bank protection.

The portion of Yerba Buena Creek upstream of Villa Vista Road is in a fairly stable configuration, with only minor bank erosion evident at localized sites. This section of Yerba Buena Creek is comparable to the upper portions of Thompson Creek, described for Segment TC5. The bed consists of coarse material (mainly coarse gravel with some cobbles), and these materials seem to be in transport. The upper portion of Yerba Buena Creek does not meander as much as the downstream section. Most of the banks are composed of the pebbly silty loam complex, with exception of one location where fine-grained sedimentary rock is exposed. The bed slope is gentle and the banks appear stable, although the bed is incising progressively downstream from the first outfall.

The first large knickpoint (with an approximate drop of seven feet) in a series of knickpoints along Yerba Buena Creek occurs just downstream from this upper section, approximately 50 feet downstream from the new SCVWD sediment sampling and gage site near the upstream end of Villa Vista Road (YBVV). This knickpoint has temporarily stopped migrating upstream due to a sackrete sill built across the channel at the location of an outfall structure. The knickpoint was likely induced by additional stormwater runoff from this outfall structure, which is located just at the head of the knickpoint.[3]

Downstream of Villa Vista Road, another outfall structure with sackrete is present and being threatened by significant incision. Downstream from this incision, the channel recovers back to the shape similar to the more stable upstream reach, although wider. At some locations, it is also deeper, but in general, the banks average two to three feet.

Continuing downstream, the channel becomes tightly confined, with deep, vertical banks. There are two knickpoints in the section between Silver Estates Road and Creek Estates Road. The first knickpoint is located between the two roads. It has a drop of approximately five to six feet. Upstream from this knickpoint, the channel is about six feet deep and six feet wide. Downstream from the knickpoint, the channel is approximately 12 to 15 feet deep. Further downstream, immediately after the pedestrian bridge west of Creek Estates Road, there is another knickpoint with a drop of approximately eight feet. At this portion of Yerba Buena Creek, near cross-section YB1-5, the channel is deeply incised (approximately 20 to 25 feet) and very narrow (see Figure 3-11), and the clay hardpan is exposed on the channel bed. This narrow and deep section is relatively short (about 700 feet) and ends downstream of Sunny Creek Road.

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[3] During significant rains in mid-December 2002, we repeatedly found discharges of more than three cubic feet per second (cfs) emanating from this outfall during rainfall events, while the channel upstream remained dry. Even when it was not raining up to 0.25 cubic feet per second (cfs) of water was flowing from the outfall structure.

Downstream from Sunny Creek Road, the channel reverts to a geometry with five to six feet of depth and approximately eight feet of width, and meanders tightly. Further downstream and immediately upstream of the confluence, the channel is wider and the banks are more shallow.

The bed material varies between fine gravel and coarse gravel depending on the sand and cobble content. There is significant local supply throughout the segment, with active transport of sediment from the upper watershed to downstream portions of the creek.

The large knickpoints in Yerba Buena Creek will likely continue to propagate upstream and therefore Yerba Buena Creek will continue to supply high amounts of sediment to Thompson Creek.

3.6 Discussion

This section of the report discusses what the field observations may mean, primarily with respect to:

- Using certain indices to compare conditions in the Thompson Creek subwatershed with other watersheds in the Santa Clara Basin
- Developing criteria for managing hydromodification
- Working toward design criteria for evaluating likely future channel configurations

3.6.1 Range of values

The project team compared the values of the data collected for Thompson Creek to data recorded from other streams. Some parameters, such as slope and width to depth ratio, appear typical of other stream systems in the region that are affected by hydromodification.

Width to depth ratios recorded in Thompson Creek are typically in the range of three to five, compared to ratios of four to six reported for channels throughout clayey soils in southern Contra Costa and central Alameda Counties. The difference is not large and may be due to recent incision along Thompson Creek and the fact that the banks there have not yet retreated to a semi-stable position. The field measurements and reconnaissance indicate that most channel banks in the Thompson Creek subwatershed can hold steep, nearly vertical angles. This is especially true in Yerba Buena Creek. It is possible that some sections of the creek may not retreat into a semi-stable position in the near future and will instead preferentially incise instead of widen (such as the canyon-like banks of Yerba Buena Creek where the banks are over 20 feet deep – see Figure 3-11). This is most likely to occur where the banks are composed of very cohesive clay and silt material.

3.6.2 Stable versus unstable cross-sections

The Thompson Creek subwatershed is fairly diverse in terms of channel form, geology, hydrology, vegetation, and the type of erosion problems it experiences, which is reflected in the classification of ten distinct geomorphic reaches along Thompson Creek and its major tributaries. Even with such complexity, much of Thompson Creek (except the upper portions of Thompson and Yerba Buena Creeks) is considered unstable or excessively eroding, where the hydrology has changed and the existing channel form is no longer stable.

The terms “stable” and “unstable” are often used when conducting geomorphic assessments, with stable indicating that all forces (erosive and resisting) are in balance, or equilibrium. Generally, the designation of a cross-section, site, reach or watershed as stable or unstable is qualitative and based on visual inspection (see Chapter 5 for a discussion of stability).

The field crew identified three stable cross-sections during the field campaign: YB1-0, TC5-6 and TC5-7. These cross-sections can be cautiously extended to state that Geomorphic Reaches F, G and I are ‘stable’ reaches. Geomorphic Reaches F and G are located above most existing development (Figure 3-1). Downstream changes in channel form as a result of hydromodification have not yet influenced these upstream reaches. Geomorphic Reach I is stable because the channel bed in this reach is cut into bedrock or hard, dense clay. It is also possible that Reach D is stable due to the dense vegetation cover that is protecting the channels banks throughout the reach. However, no cross-sections are located in this reach and visual inspections of channel bed stability were not conducted.

The remaining thirty-four cross-sections, including all cross-sections in Segments TC1, TC2 and TC3 were identified as unstable. The lower portions of Thompson Creek have experienced incision of *at least* three feet and as a result channel banks are steep, bare, and failing in many places. Although some individual cross-sections appear in a relatively stable configuration, there is high potential for instability to develop. Active incision is still occurring along the lower to mid portion of Segment TC5 and in Yerba Buena Creek, causing the cross-sections located in these reaches to be defined as ‘unstable.’

3.6.3 Role of Vegetation

Vegetation appears to be a significant stabilizing element for many of the channel banks along Thompson and Yerba Buena Creeks. In the Thompson Creek subwatershed, the principal means by which vegetation stabilizes the channels appears to be:

- Banktop vegetation. Such vegetation holds the looser soils in place, and the roots strengthen the banks or (when exposed to high flows) reduce the velocities impinging on

the bank. The banktop vegetation often includes large coast live oaks or bays, but sometimes includes deciduous trees or brush.

- Roots as grade control. Root systems or major roots of larger trees frequently serve to inhibit incision, even sometimes serving as a local base level. With a very few exceptions, roots inhibit incision only in channels up to a certain size. Stabilizing roots are found on upper Thompson Creek beginning perhaps one mile upstream of the Yerba Buena confluence, and also on Yerba Buena Creek as far downstream as the lower end of Evergreen College.

- Smaller woody vegetation. Vines and brush are the predominant stability-lending element in some of the channels, at least up to certain thresholds. Thompson Creek upstream of the mouth of Yerba Buena Creek provides a good example of stabilizing brush covering the banks.

- Small woody debris jams. While small woody debris jams temporarily stabilize the channel, their effects are considered transient and are not as long-lasting as those imparted by large-conifer logjams.

The role of vegetation in stabilizing the banks and bed is considered in the stability assessment through the selection of the hydraulic roughness coefficient. Higher values of roughness slows velocity and reduces shear stress on the boundary.

3.7 Summary and Conclusions

- Ten geomorphic reaches are identified along Thompson Creek based on fundamental geomorphic characteristics, seven along Thompson Creek and three defining its major tributaries. In general, these reaches do not correspond to the designated hydrographic segments defined by water input. Instead, the reaches may extend over several segments or two or more reaches may be located within a single segment. The geomorphic reaches provide a united framework based on geomorphology that can be used to interpret the results of the modeling effort and aid in targeting specific reaches for in-stream solutions.

- Three stable cross-sections were identified in the upper portions of Thompson and Yerba Buena Creeks. These cross-sections are generally located upstream from major development and are not currently experiencing incision or excessive bank erosion.

- Vegetation has an important role in channel bank stability in the Thompson Creek subwatershed. In most instances, vegetation stabilizes channel banks by shielding banks from erosive flows and holding banks together via root structures. The thickness of the riparian corridor may also be an important factor in stability, as much of the lower

reaches of Thompson Creek—the most eroded ones—have either a sparse or discontinuous riparian corridor or only one row of woody vegetation.

- Thompson Creek is generally dominated by cohesive banks that are fairly resistant to erosion, and the channel bed is composed of mainly gravel with some sand. Based on observations of the subwatershed (and prior to dating specific developments and outfall structures), the project team estimates that the effects of hydromodification are observed within five to 15 years. The timeframe will vary among geomorphic reaches and is extremely dependent on the amount of rain that occurs in the years following the construction of upstream development. Sections of Thompson and Yerba Buena Creeks with channel banks and beds composed of consolidated silty clay (hardpan) or that have dense bank vegetation will respond less quickly to changes in stream flow than will channel sections composed of unconsolidated sandy silt material with little to no bank vegetation.

4 Glossary

Aggradation: The deposition and accumulation of sediment that was eroded and transported from the upstream watershed, resulting in an elevated streambed.

Alluvium: Silt, sand and gravel deposited by flowing water.

Armor: A layer of rocks on the surface of a streambed that resists erosion by water flows. The rock can be naturally occurring, caused by the scour of smaller particles from high discharges, or placed by humans to stop channel erosion.

Bankfull: The flow at which a stream with a natural, self-formed floodplain just exceeds the capacity of the banks.

Bar: A sand or gravel deposit found on the bed of a stream that is often exposed during low-water periods.

Basin: An area confined by topographic divides encompassing a number of watersheds that ultimately drain to a common point. In this report, *basin* is the term used to describe the Santa Clara Basin that contains a number of watersheds that drain to the Lower South Bay. The Santa Clara Basin is designated by the USGS as Hydrologic Cataloging Unit No. 18050003.

Bedload: Medium-grained sand and coarser material such as gravel that rolls and saltates along the bottom of the stream by the flow of water.

Clay: Hydrous aluminum silicate minerals with platy structure, typically less than 1/256-mm in diameter.

Colluvium: Material deposited by gravity at the foot of a slope.

Cross-section geometry: The geometry of a channel from which you can estimate the width, depth, area, wetted perimeter, hydraulic radius and channel conveyance.

Dominant discharge: The channel-forming discharge responsible for creating the primary channel that transports the majority of the sediment load.

Flood control levees: An embankment raised to contain the floodwaters of a stream or river.

Fluvial Geomorphology: The study of forms and characteristics of streams and the physical processes that create them. The processes of hydrology, geology, and sediment supply and transport interact with the watershed and material making up the channel boundary, creating

features such as terraces, floodplains, channel planform and geometry, and instream channel features, such as pools, riffles, bars, and secondary channels.

Geomorphology: The study of forms and characteristics of the earth's surface and the physical and chemical processes that affect landforms. Weathering, erosion and transport are the fundamental geomorphic processes that break down mountains and supply sediment to stream channels.

Geomorphic reaches: Stream segments that are fairly homogenous in terms of bed and bank characteristics, as well as channel geometry.

Grade control structures: Structures installed in a stream channel intended to reduce the energy of flow by reducing the slope of the streambed. Examples include cross-vane grade control structures, weirs and sackrete terrace structures.

Gravel: Sedimentary matter having a diameter between 4.75 and 75-mm.

Hardpan: A layer of hard subsoil or clay.

Hydrology: The scientific study of the properties, distribution, and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere.

Hydrologic processes: The extent to which precipitation is intercepted by vegetation, infiltrates into the ground, or results in overland flow, influencing the rate and magnitude of stream flows.

Hydrographic segments: Segments of a stream that have similar water inputs. Segments are identified based on significant flow increases in the downstream direction due to confluences with major tributaries.

Hydromodification: The change in the natural watershed hydrologic processes and runoff characteristics (i.e., interception, infiltration, overland flow, interflow and groundwater flow) caused by urbanization or other land use changes that result in increased stream flows and sediment transport.

Impervious surfaces: A hard surface area that either prevents or retards the entity of water into the soil mantle. A hard surface area which causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development. Common impervious surfaces include: roofs, roadways, walkways, driveways, parking lots, patios, concrete or asphalt paving, gravel roads, and packed earthen material.

Imbrication: A shingling effect of deposited sediments, creating a protective barrier on the streambed.

Incision: The hydrologic processes of stream flow that exceeds the available sediment load and erodes streambeds, resulting in a deepening channel.

Knickpoint: The point of a stream bed where there is an abrupt change in slope, governed by regimen and by the structure and composition of the bed and bank materials of the river.

Loam: Soil composed of a mixture of sand, clay, silt, and organic matter.

Meander Bends: A bend in the course of a stream, developed through lateral shifting of its course toward the convex side of the bend.

Overland flow: Sheets of surface runoff created by excess precipitation that is not infiltrated or intercepted by vegetation.

Physiography: The study of the physical features of the earth's surface.

Planform: Stream channel patterns (braided, straight or meandering).

Pool: A location in an active stream channel, typically located in the outside bend of a meander, that exhibits relatively deep waters and reduced flow velocities.

Pool-riffle morphology: Alternating, regularly shaped deep and shallow areas of a stream.

Shale: A fissile rock composed of layers of claylike, fine-grained sediments.

Silt: particles with diameters between 0.75 and 0.002-mm.

Siltation: The settling of soil and sedimentary particles in lakes, rivers and streams.

Sinuosity: The ratio of stream length to valley length.

Stratigraphy: The study of rock strata, including the distribution, deposition, and age of sedimentary rocks.

Subwatershed: The catchment area of a stream tributary or series of stream tributaries.

Tributary: A stream or river flowing into a larger body of water.

Urbanization: The transformation of land into residential, commercial, and industrial properties and associated infrastructure such as drainages, roads, and sewers.

Watershed: A region drained by a single major river system.

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APPENDIX 3A-20

CULTURAL RESOURCES REPORTS

DRAFT

July 27, 1998
5:02 PM

XI Cultural Resources

Background

A records search utilizing the resources of the now Northwest Information Center, California Historical Resources File System, was conducted in May 1982. At that time no recorded archeological or historical properties were noted within or adjacent to the project area. Archeological surveys were conducted along Lower Silver Creek in 1973 and 1975. No evidence of archeological sites were noted within or adjacent to the project area.

Results of the records search and the archeological surveys conducted for the SCVWD along the entire length of Lower Silver Creek from Lake Cunningham to Coyote Creek were sent to the State Historic Preservation Officer for review.

The above information is contained in the Lower Silver Creek Watershed Final Watershed Plan and Environmental Impact Statement/Report, Santa Clara County, California, July 1983 (EIR).

The Existing Resources portion (page 28) of the EIR contains an inventory of buildings located in the floodplain. This was last updated in late 1981. This section contains information on the types of buildings and the age of the buildings. Of significance is that in 1981 300 to 400 buildings in the floodplain were built prior to 1950. Locations were not identified. It is possible some of these structures are within the area of potential effects for work proposed to be accomplished. It is also possible some could be listed as historic structures and/or others are eligible for inclusion in the National Register of Historic Places.

NRCS Applicability and Exceptions

NRCS technical assistance which doesn't result in any change to cultural resources or provided as information at the request and subsequent control of the landowner is not considered an undertaking as defined in the Programmatic Agreement (PA) between the Advisory Council on Historic Preservation and the National Council of State Historic Preservation Officers. This includes NRCS activities that are considered forms of nonintrusive data collection such as the Lower Silver Creek Watershed Plan Update.

Project Implementation

Lead Agency Responsibilities

Natural Resources Conservation Service:

The NRCS is responsible for cultural resources compliance in all actions where NRCS is considered the lead agency. NRCS activities would include when NRCS has legislated responsibility or designated Departmental authority to administer specific Federal programs or when providing to nonfederal participants direct, single agency actions of technical and/or financial assistance that may effect cultural resources.

In these situations NRCS will fulfill its National Historic Preservation Act Section 106 requirements in accordance with its Programmatic Agreement (PA) by:

a. determining if the proposed activity is considered an undertaking by the PA.

b. conduct a cultural resources review by contacting the appropriate Information Center of the California Historical Resources File System and requesting information on known resources and surveys in the area of the proposed activity.

c. conduct a site visit to the location and complete a field inspection of the area to relocate previously known cultural resources and/or possibly locate new cultural resources.

Other Federal Agencies:

Other Federal agencies involved in a proposed project or activity are responsible for initiating and completing the Federal review process designed to ensure that historic properties are considered during Federal project planning and execution (Section 106 process).

State Agencies:

SCVWD and other state agencies

The California Environmental Quality Act (CEQA) (Public Resources Code Sections 21000 et seq.) requires that lead agencies must identify and examine the significant adverse environmental effects from a project before approving it.

When a project may adversely affect a unique archeological resource Section 21083.2 of CEQA requires the lead agency to treat that effect as a significant environmental effect. If an archeological resource is listed in or eligible to be listed in the California Register of Historical Resources, Section 21084.1 of CEQA requires that any substantial

adverse effect to that resource be considered a significant environmental effect. In both cases an environmental impact report (EIR) must then be prepared.

Private Individuals:

The State legislature recognizes the preservation and enhancement of historical properties is largely based on the good will and cooperation of the general public along with the owners of historic resources. California Public Resources Code, Government Code, Health and Safety Code, and Penal Code contains numerous references to the preservation and enhancement of historical resources.

At the very minimum, the destruction, defacement or destruction of any object or thing of archeological or historical value, whether on public or private lands is in violation of the penal code.

/home/reioux/word/cultres/waterresources/lsilver1.dcx

April 29, 1996

Jerry Reioux
Bob Snieckus

Here is documentation of compliance with 36 CFR 800 for the Lower Silver Creek project. This is referred to on pages 27 and 88 of the 1983 FEIS. In addition, Appendix A in the FEIS includes a letter from the State Resources Agency that specifically identifies the Department of Parks and Recreation (which included the SHPO) as participating in the review and says that the state had no comments or recommendations. In other words, the EIS itself already demonstrates compliance, at least to those who know the procedure.

There is also earlier correspondence in the file if you need it.

Walt Sykes

36 CFR 800

Disagreement about National Register eligibility of properties found

(4) If the Agency Official and the State Historic Preservation Officer do not agree, or if the Council or the Secretary so request, the Agency Official shall obtain a determination from the Secretary of the Interior pursuant to applicable National Park Service regulations.

(5) If the State Historic Preservation Officer does not provide views, then the State Historic Preservation Officer is presumed to agree with the Agency Official's determination for the purpose of this subsection.

Agency's actions if no historic properties are found

(d) When no historic properties are found. If the Agency Official determines in accordance with Sections 800.4(a)-(c) that there are no historic properties that may be affected by the undertaking, the Agency Official shall provide documentation of this finding to the State Historic Preservation Officer. The Agency Official should notify interested persons and parties known to be interested in the undertaking and its possible effects on historic properties and make the documentation available to the public. In these circumstances, the Agency Official is not required to take further steps in the Section 106 process.

Agency's actions if historic properties are found

(e) When historic properties are found. If there are historic properties that the undertaking may affect, the Agency Official shall assess the effects in accordance with Section 800.5.

Agency's assessment of project effects on historic properties found

800.5 Assessing effects.

Agency's use of Criteria of Effect

(a) Applying the Criteria of Effect. In consultation with the State Historic Preservation Officer, the Agency Official shall apply the Criteria of Effect (Section 800.9(a)) to historic properties that may be affected, giving consideration to the views, if any, of interested persons.

Agency's actions if no effect is found

(b) When no effect is found. If the Agency Official finds the undertaking will have no effect on historic properties, the Agency Official shall notify the State Historic Preservation Officer and interested persons who have made their concerns known to the Agency Official and document the finding, which shall be available for public inspection. Unless the State Historic Preservation Officer objects within 15 days of receiving such notice, the Agency Official is not required to take any further steps in the Section 106 process. If the State Historic Preservation Officer files a timely objection, then the procedures described in Section 800.5(c) are followed.

Agency's use of Criteria of Adverse Effect

(c) When an effect is found. If an effect on historic properties is found, the Agency Official, in consultation with the State Historic Preservation Officer, shall apply the Criteria of Adverse Effect (Section 800.9(b)) to determine whether the effect of the undertaking should be considered adverse.

Agency's actions if effects are not adverse

(d) When the effect is not considered adverse.

(1) If the Agency Official finds the effect is not adverse, the Agency Official shall:

(i) Obtain the State Historic Preservation Officer's concurrence with the finding and notify and submit to the Council summary documentation, which shall be available for public inspection; or

2828 Chiles Road
Davis, CA 95616
(916) 758-2200

October 4, 1982

Dr. Knox Mellon
State Historic Preservation Officer
Office of Historic Preservation
P.O. Box 2390
Sacramento, CA 95811

Dear Dr. Mellon:

This letter is in reference to your letter of July 20, 1982 and a subsequent telephone conversation in August with Mr. Del Cioppo of your staff regarding the concerns you have on impacts of the Lower Silver Creek watershed project to archaeological and historical resources.

We sent copies of the East Zone Flood Control EIR and the EIR for the proposed Lower Silver Creek Flood Control Project for review by the California Archaeological Inventory at Sonoma State University. They concur that no archaeological sites will be affected by the project. A copy of their letter is enclosed for your information.

Two concerns you had and also expressed by the Center, were the source of materials to be used for construction of levees and the need to evaluate the historical significance of structures that will be altered or demolished by the project.

Fill material to be used for construction of levees will come from channel excavation in the project right of way which has already been surveyed for archaeological resources. Should archaeological resources be discovered during channel excavations, we will immediately notify your office and follow the requirements of SCS Procedures for the Protection of Archaelogical and Historical Properties Encountered in SCS-Assisted Programs (CFR-656).

The only structures to be removed by the project are five bridges, four of which were built in 1958 and one in 1979. These bridges have no historical significance.

Based on this information, we feel that the Lower Silver Creek watershed project will not impact any archaeological or historical resources. We would appreciate any further comments you may have.

If there are any questions, please contact Steve Crow, Watershed Planning Staff, at (916) 758-2200.

Sincerely,

EUGENE E. ANDREUCCETTI
State Conservationist

Enclosure

USDA:SCS:SCROW:yf:10/04/82

California
Archaeological
Inventory

ALAMEDA
CONTRA COSTA
DEL NORTE
HUMBOLDT
LAKE
MARIN
MENDOCINO
NAPA
SONOMA

Northwest Information Center
Department of Anthropology
Sonoma State University
Rohnert Park, California 94928
(707) 664-2494

20 August 1982

File No.: 6080-1440-U

Steven Crow
Soil Conservationist
Soil Conservation Service
U.S.D.A.
2828 Chiles Road
Davis, CA 95616

re: Lower Silver Creek Watershed Work Plan in San Jose, Santa Clara County.

Dear Mr. Crow:

I write in response to your letter dated 13 August 1982 which was accompanied by two archaeological survey reports. These surveys were conducted in 1973 and 1974. At that time, archaeological information for Santa Clara County was archived at Cabrillo College in Santa Cruz. Archaeological information for the county has since been transferred to us. Evidently, neither Cabrillo nor this office ever received copies of the reports on Lower Silver Creek. This was common for the "early days" when the prototypes of existing Information Centers were just developing.

Apparently the two survey reports written by staff of the Adam E. Treganza Anthropology Museum covered the present project area. In view of this, and since no archaeological sites that could potentially be impacted by this project were discovered, I hereby rescind our previous recommendation dated 4 June 1982 for archaeological survey. However, the 1973 recommendations for consulting an historian (pg. 24) and in regards to borrow areas (also pg. 24) should be noted.

Thank you for forwarding the reports to us. They will be mapped and filed so that future studies can benefit from their results. If you have any questions or if we can be of further assistance, please call or write us at the Center.

Sincerely,

Allan G. Bramlette

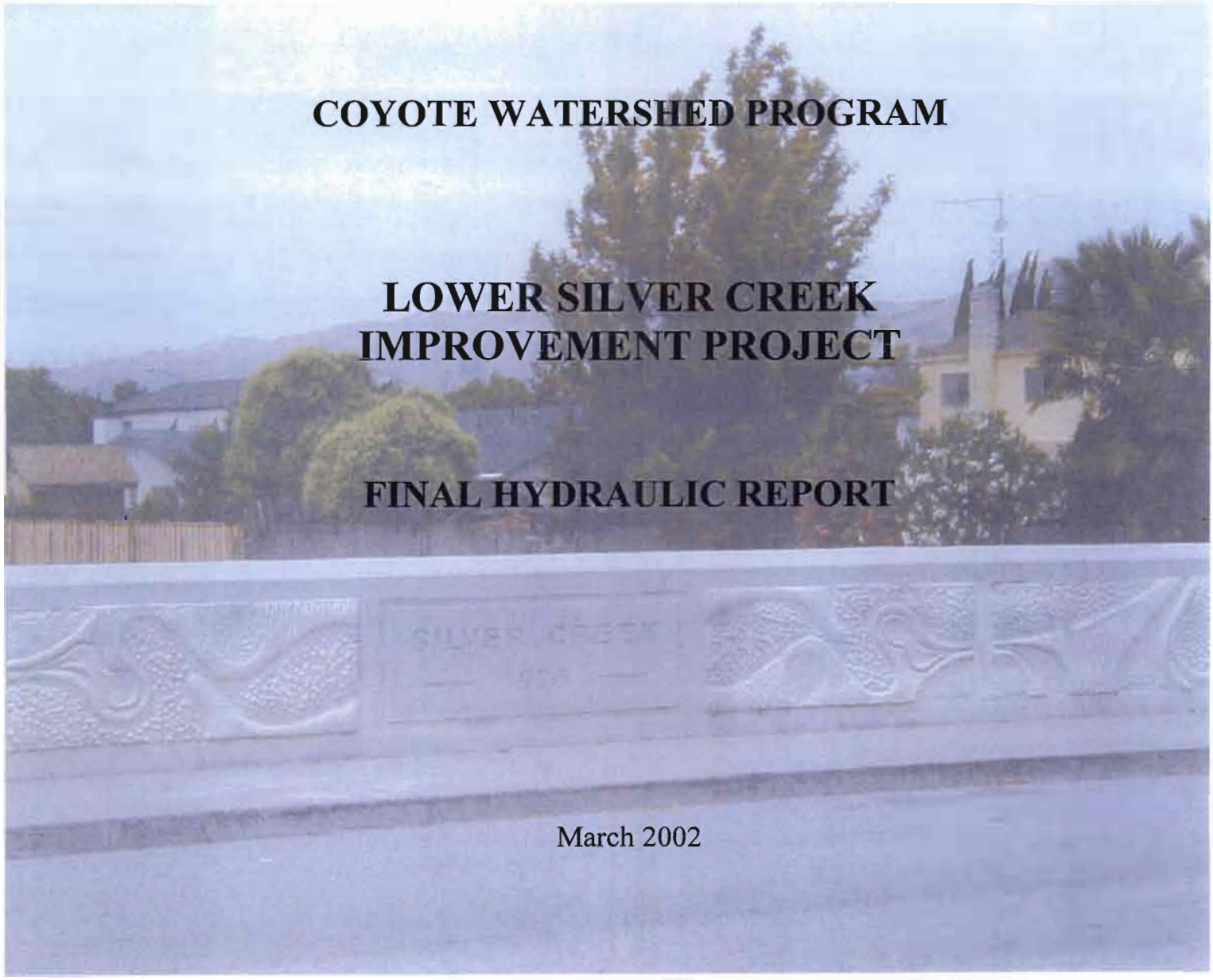
Allan G. Bramlette
Assistant Coordinator

AGB:lm

APPENDIX 3A-21

LSC FINAL HYDRAULIC REPORT – SWCE 2002

Santa Clara Valley Water District



COYOTE WATERSHED PROGRAM

LOWER SILVER CREEK IMPROVEMENT PROJECT

FINAL HYDRAULIC REPORT

March 2002

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Santa Clara Valley Water District

COYOTE WATERSHED PROGRAM

LOWER SILVER CREEK IMPROVEMENT PROJECT

FINAL HYDRAULIC REPORT

March 2002

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STATE OF CALIFORNIA

COYOTE WATERSHED PROGRAM
LOWER SILVER CREEK RESTORATION PROJECT
FINAL HYDRAULIC REPORT

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CHAPTER 1
OVERVIEW

The Lower Silver Creek Improvement Project Hydraulic Report has been prepared for the Coyote Watershed Program to document preliminary hydraulic and sediment transport analyses. This work is intended to confirm the feasibility of the National Resources Conservation Service (NRCS) planning study, and to serve as overall guidance during design of the channel improvement plans. Upon completion of those plans, design features should be checked against the content of this report for consistency. The Coyote Watershed Program operates under the auspices of the Santa Clara Valley Water District. This report is written to provide engineering guidance during design. It is assumed that the reader is familiar with the engineering concepts discussed herein.

PROJECT OBJECTIVES

The basic objective of the Lower Silver Creek Reaches 1-6 Improvement Project is to provide a level of flood protection along Lower Silver Creek consistent with (NRCS) and Santa Clara Valley Water District (District) policies, and the policies of the Federal Emergency Management Agency (FEMA) as administered through the National Flood Insurance Program (NFIP). District and NFIP regulations define the "base flood" as a flood having a one percent chance of being equaled or exceeded in any given year.

Although the primary project objective is to provide a level of flood protection along Lower Silver Creek meeting District, NRCS and FEMA standards, additional project objectives include:

- balancing flood reduction with environmental restoration, community beautification, and recreational opportunities.
- providing efficient and cost-effective flood control maintenance to ensure that the District is able to maintain design system performance in the future;
- allowing for more natural geomorphic processes in Lower Silver Creek; and
- engendering community support for the proposed project.

SCOPE OF HYDRAULIC REPORT

Within this hydraulic report, design one-percent discharges are estimated using a watershed model built under the direction of the District. Discharges for other return periods of interest are also calculated. Lake Cunningham is examined as a flood control facility, and conceptual modifications are proposed to help reduce the downstream discharge without placing permanent park facilities at jeopardy.

Steady-state backwater and forewater analyses have been made to evaluate proposed channel improvements over a range of possible roughness conditions. Hydraulic stability is addressed, and the process of selecting bridges for replacement is documented.

Finally preliminary sediment transport analyses have been made to assess the potential for long-term channel stability, potential sediment accumulations, and the need for bank slope protection.

BACKGROUND

Lower Silver Creek flows generally northward from Silver Creek Road at Barberry Lane to Coyote Creek in east San Jose. The creek drains about 15 percent of the Coyote Creek watershed at the confluence. Nearly one-half of the creek's drainage basins are tributary to Lake Cunningham, with the remainder influent to the creek downstream of Cunningham Avenue. This hydraulic report includes an evaluation of the hydrologic and hydraulic regime within the Lower Silver Creek watershed from Lake Cunningham to Coyote Creek.

Historic Flooding

Recorded flooding problems within the Lower Silver Creek watershed include runoff events in December 1889, January and March 1911, January 1952, December 1955, April 1958, January 1963, February 1983, and March 1983. During the February 1998 El Niño, the creek was flowing bank-full downstream of Lake Cunningham, although no overtopping was witnessed.

Flood Insurance Requirements

In its current state, Lower Silver Creek cannot contain estimated one-percent flood discharges within its banks. Residents in adjoining neighborhoods must purchase federally sponsored flood insurance to carry a mortgage. Since Lower Silver Creek was excavated through a broad alluvial plain, when floodwaters leave its banks, they generally flow away from the channel as shallow sheet flow. Urbanization has tended to concentrate the flow of floodwater within street rights-of-way.

CREEK RESTORATION PROJECT ELEMENTS

In 1998, the NRCS prepared a set of conceptual drawings for the Lower Silver Creek Improvement Project. The NRCS only performed preliminary hydraulic calculations using methods that did not factor in backwater effects from Coyote Creek or other channel transitions. No water surface profiles or hydraulic models are available to the District for verification of the NRCS plan. No analyses were performed at existing bridges, although the bridge at Jackson Avenue was proposed for replacement.

Channel Improvements

The Program has since refined and enhanced the original NRCS plan to reduce the amount of concrete lining, utilize more natural and environmentally sensitive materials and configurations, provide for more natural channel geomorphologic processes, improve maintenance, and allow greater public access to the creek. As a result, the channel configuration has been revised in a few reaches, including the acquisition of additional rights-of-way to facilitate the channel enhancements. This report is based upon a model developed with channel geometry available to Schaaf & Wheeler in December 2001.

Lake Cunningham Modifications

The NRCS based its conceptual channel improvements for Lower Silver Creek on a set of discharge values of unknown origin that are within ten percent of earlier base flood flow estimates made by the Santa Clara Valley Water District. Within the District's hydrologic model, HEC-1 storage routing routines are used to account for attenuation provided by Lake Cunningham, which reduces large-event flows downstream of Cunningham Avenue. The intent of this work is to reconfirm the performance of Lake Cunningham, and propose feasible operating modifications that can minimize downstream one-percent design discharge, while providing for the safe storage of excess runoff volume in a reasonable fashion to which the City of San Jose can agree.

Hydraulic Performance

Proposed modifications at Lake Cunningham would reduce the design discharges in Lower Silver Creek by up to twenty percent. Channel improvements will enable the one-percent water surface profile to be carried at or below the natural bank elevation throughout most of the project reach. To meet FEMA and NRCS freeboard criteria, some reaches require additional protection in the form of floodwalls. The length of wall height in excess of three feet is very limited.

The hydraulic analyses contained herein indicate that the following bridges or culverts require replacement or modification so that the enhanced NRCS plan can work without excessively high floodwalls. It may be noted, however, that the proposed enhancements to the NRCS plan have not, in and of themselves, caused the need for bridge replacement. The NRCS was also planning to modify the Jackson Avenue culvert.

Bridge Replacements or Modifications

Alum Rock Avenue

Sunset Avenue

Jackson Avenue

Capitol Expressway

Story Road

Cunningham Avenue

Sediment Transport

Within most of the project reach, the channel bottom will be unlined and subject to erosive velocity. Some of the eroded material will move downstream, and where channel velocity decreases, may accumulate as sediment deposits. Reaches 1 through 3 of Lower Silver Creek will be excavated through cohesive material such as clay, silty clay, and sandy clay; while the soils in Reaches 4 through 6 are clayey sands with gravel. Tractive force analyses show that *if vegetation does not become well established to provide erosion protection, both the channel bed and banks will be subject to erosive velocities and will scour in the design flood event.* Consequent deposition may be expected in channel reaches with lower flow velocities, particularly in backwater areas. Areas with potential for local deposition during extreme runoff events include the reach between Interstate 680 and Capitol Expressway, the Sunset Avenue culvert, the reach between McKee Road and Alum Rock Avenue, and the McKee Road culvert itself.

CHAPTER 2
PROJECT BACKGROUND

This chapter introduces the Lower Silver Creek study area, discusses the history of flood protection efforts within this part of east San Jose, summarizes previous project plans, and introduces the Program's project objectives.

WATERSHED DESCRIPTION

Lower Silver Creek flows generally northward from Silver Creek Road at Barberry Lane to Coyote Creek in east San Jose. The creek drains about 44 square miles of watershed, or roughly 15 percent of the 291 square miles tributary to Coyote Creek at the confluence (Figure 2-1). Major tributaries to Lower Silver Creek are listed in Table 2-1. Nearly one-half of the creek's drainage basins are tributary to Lake Cunningham, with the remainder influent to the creek downstream of Cunningham Avenue. This hydraulic report includes an evaluation of the entire hydrologic and hydraulic regime within the Lower Silver Creek watershed from Lake Cunningham to Coyote Creek, with the exception of detailed hydraulic analyses of tributaries.

Table 2-1: Lower Silver Creek Watershed

Drainage Area	Square miles
Direct Drainage to Lower Silver Creek	1.8
Thompson Creek	16.9
Norwood Creek	2.5
Ruby Creek	1.6
Flint Creek	2.0
(Total Tributary Watershed at Lake Cunningham)	**26.3**
South Babb Creek	3.7
North Babb Creek	2.8
Miguelita Creek	3.3
Direct Drainage to Lower Silver Creek	7.7
(Total Tributary Watershed at Coyote Creek)	**43.8**

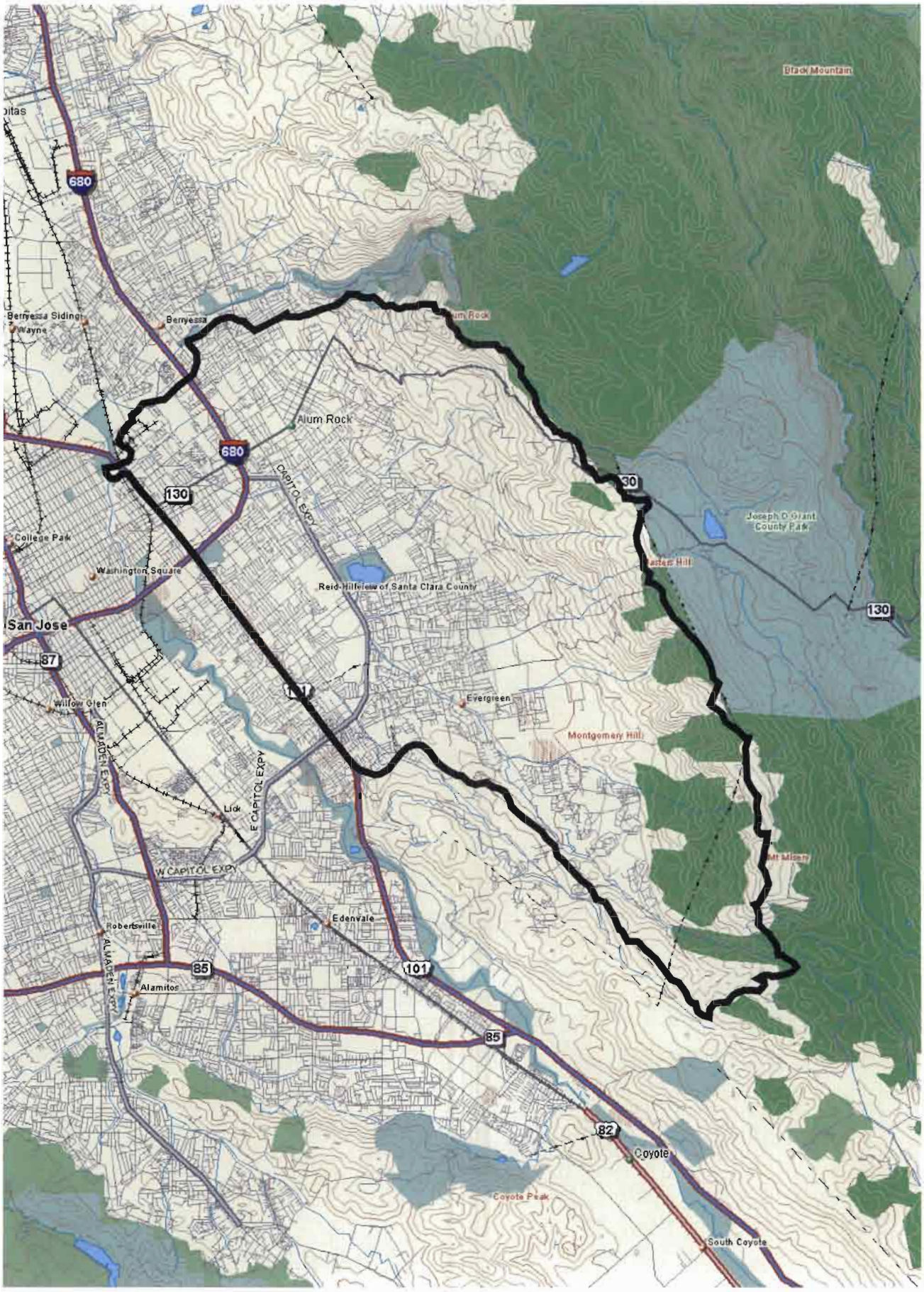

Figure 2-1. Lower Silver Creek Watershed

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GEOLOGICAL AND HYDROLOGIC SETTING

The study area sits atop broad alluvial fans that were formed as streams emerged from the eastern foothills onto the Santa Clara Valley floor and deposited unconsolidated materials as their slopes flattened. Streambed deposits and alluvial fans generally slope toward San Francisco Bay to the northwest. Fine sands, silts and clays characterize native soils underlying the area. Natural drainage and flooding tends to be as shallow sheet flow through much of the study area, with the predominant direction of flow to the north and west.

Identifying the proposed improvements as a "stream restoration project," is somewhat spurious. Historically the Silver Creek channel was generally undefined downstream of Lake Cunningham, as an examination of the 1899 USGS Quadrangle for the area reveals (Figure 2-2). A broad alluvial plain was formed downstream of a marsh located at present-day Cunningham Avenue. Frequent flooding would have been characterized by broad, shallow flow generally to the north and west toward Coyote Creek.

As the area developed for agricultural use, an incised channel was created to drain the marsh and contain the frequent flood flows. Silver Creek was later bifurcated into "upper" and "lower" segments to reduce flows in the lower reaches. Subsequent quadrangles show the drainage channel laid out for convenience rather than necessarily following the natural contours (Figure 2-3). As a result, the channel does not always run downhill. This situation creates significant challenges for the present project, since as one moves upstream, top of bank elevations do not increase commensurately with design water surface profiles. Containing flood discharges within the natural banks can therefore be rather difficult.

ENVIRONMENTAL SETTING

Lower Silver Creek and its tributaries flow through a mixture of land uses, from rural open space areas in the foothills, through lower-density hillside residential areas, and eventually through higher density urban areas of east San Jose.

Downstream of Lake Cunningham, Lower Silver Creek has been excavated within natural earth. Various forms of slope protection are provided, ranging from nearly bare vegetation, to more established vegetation, sacked concrete slope protection, and full concrete lining.

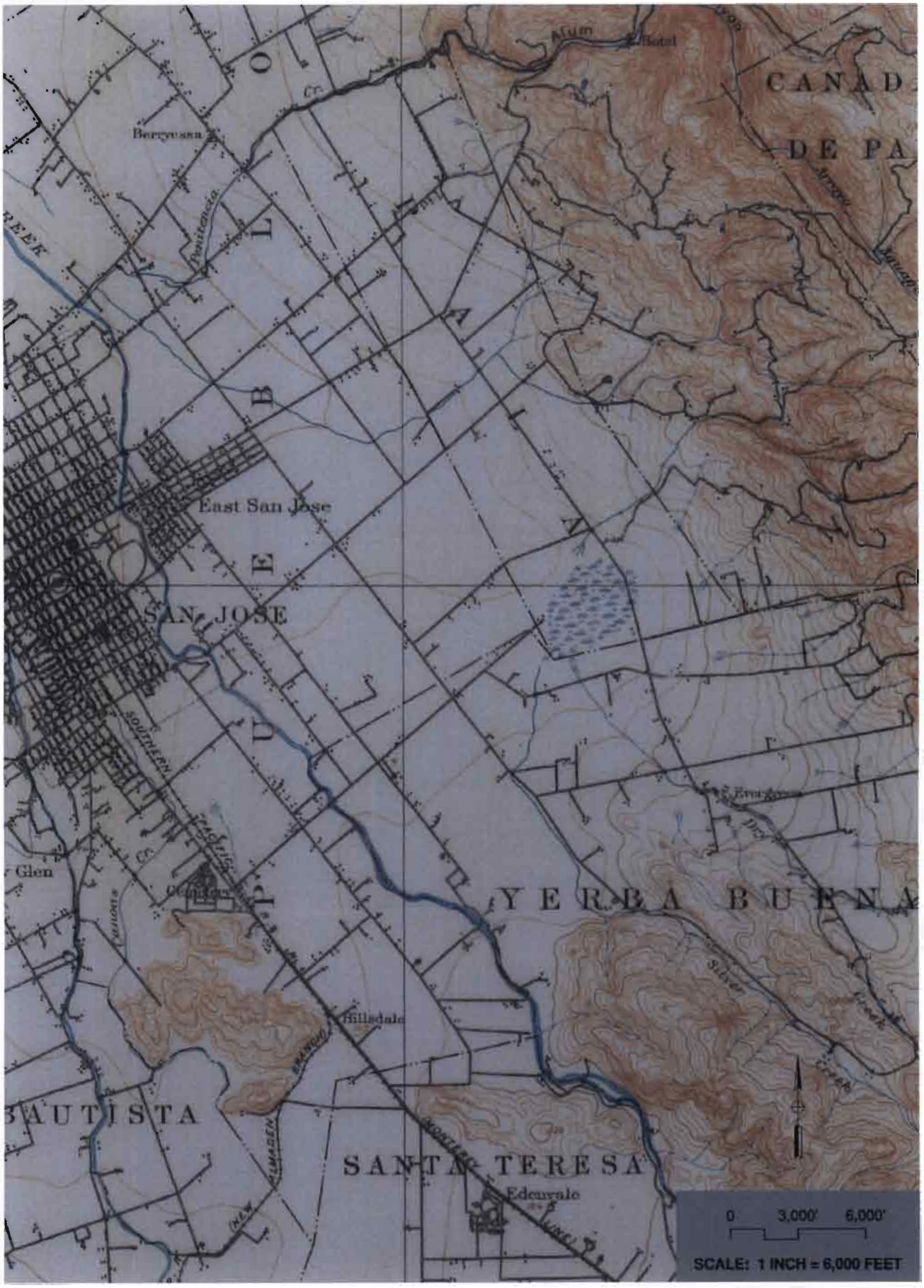

Figure 2-2. Portion of 1899 USGS San Jose Quadrangle

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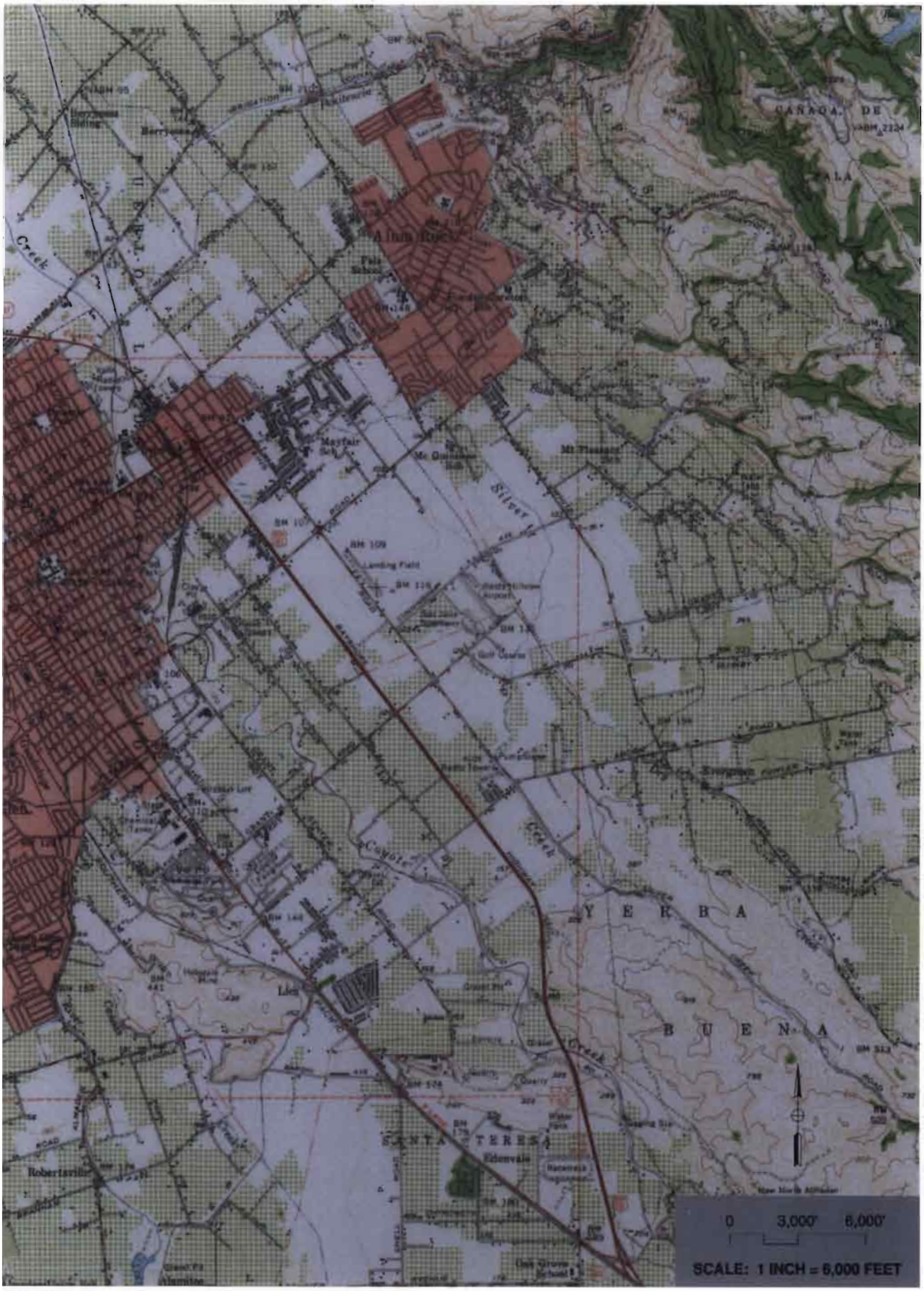

Figure 2-3. Portion of 1953 USGS San Jose Quadrangle

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For convenience, the Lower Silver Creek project area has been broken into six reaches, as shown on Figure 2-4 and summarized by Table 2-2. Photographs keyed to the table are presented on the following pages along with brief descriptions of the current environmental setting.

Table 2-2: Lower Silver Creek Reaches

Reach	Limits	Photo #s	Description of Existing Channel
1	Coyote Creek to Miguelita Creek	1 – 6	Excavated earth channel
2	Miguelita Creek to McKee Road	7	Excavated earth, concrete U-frame
3A	McKee Rd thru Plata Arroyo Park	8 – 13	Excavated earth channel
3B	U/S Plata Arroyo Park	14	Excavated trapezoidal channel
3C	D/S Lausett Avenue	15	Concrete-lined trapezoidal channel
3D	Lausett Ave. to San Antonio St.	16 – 18	Excavated trapezoidal channel
3E,F	San Antonio St. to Interstate 680	19 – 21	Excavated earth channel
4A	Interstate 680 to Jackson Avenue	22, 23	Concrete lined banks, earth bottom
4B,C	Jackson Ave. to North Babb Creek	24 – 26	Excavated trapezoidal channel
5	N. Babb Creek to South Babb Creek	27 – 29	Excavated trapezoidal channel
6	S. Babb Creek to Cunningham Ave.	30 – 32	Excavated trapezoidal channel

Channel photographs taken after the winter seasons of 2000 and 2001 provide a baseline indication of channel conditions including sediment transport and vegetal growth. Since the 2000-2001 winter season was fairly mild, observed channel conditions did not substantially change from one year to the next. Recent flood events occurred in February 1998 and February 2000 (the 1998 event was the flood of record in many South Bay locations). The following photographs represent recent channel conditions.

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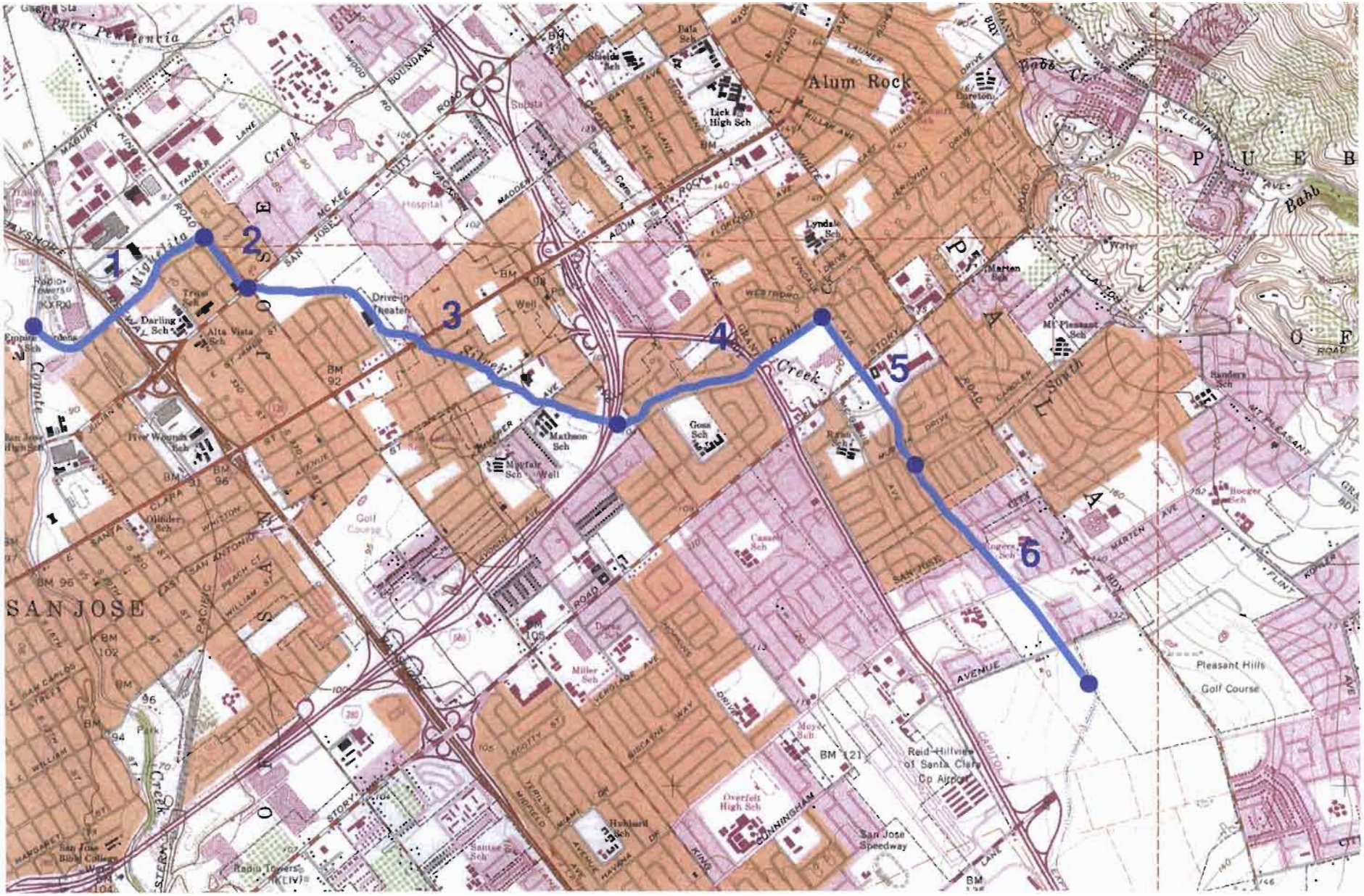

Figure 2-4. Reach Locations

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Reach 1: Coyote Creek to Miguelita Creek

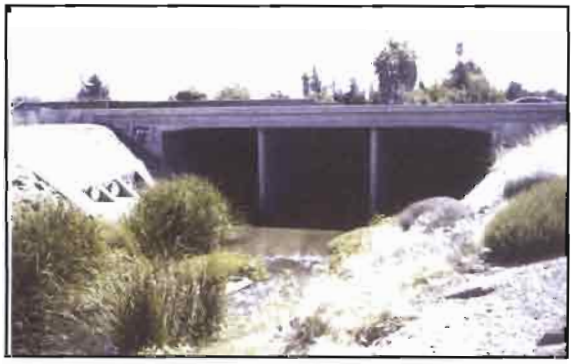
Within Reach 1, flow in Lower Silver Creek is influenced by backwater conditions in Coyote Creek. From the confluence upstream to Highway 101, Lower Silver Creek is situated in the regulatory one-percent floodplain that results from Coyote Creek overbanking to the south. It is essential that any proposed improvements on Lower Silver Creek do not impact the Coyote Creek floodplain.

Photo 1. Reach 1 Near Confluence: From the confluence with Coyote Creek to the Wooster Avenue Bridge, creek banks are lined in places with riprap and sacked concrete. Brush and tall trees line the upper banks. At the base of the banks grow tall reeds, with open water from toe to toe. →

Photo 2. Wooster Avenue Bridge: At the Wooster Avenue Bridge, short grasses and some brush cover the banks. Here the width of open water narrows; in some locations reeds have grown all the way across the bed. Bridge abutments and piers have been scoured by creek head-cutting.

Photo 3. WPRR Bridge: At the railroad, the channel appears to be relatively clean and stable. Accumulations of debris are evidenced on each trestle bent.

Photo 4. Reach 1 D/S Highway 101: This channel reach is uniform and clean, with grass lining the north bank and large shade trees along the top of the south bank. The creek invert is characterized primarily by open water with some vegetation just above the toes. Just below the Highway 101 Bridge, reeds, cattails and other brush increase to cover the creek bed. →



Photos 5 and 6. Reach 1 from Highway 101 to Miguelita Creek: Some vegetation has been established in the sediment upstream of the bridge. Bank vegetation is in the form of short grass and sparse brush.

Reach 2: Miguelita Creek to McKee Road

Beginning at the confluence with Miguelita Creek, Lower Silver Creek parallels King Road as an excavated channel, generally trapezoidal in section, but with some sloughing of the easterly bank. A new bridge has been built to connect King Road with the Walgreen's shopping plaza. From this location to the McKee Road culvert, vertical channel walls have been constructed. The channel bottom is also concrete-lined for about 100 feet downstream of the McKee Road culvert.

Photo 7. Reach 2 downstream of McKee Road: Just downstream of the triple box culvert, about two-thirds of the creek bed is covered with tall grasses, brush and reeds that have been established in sediment that has deposited on the concrete channel bottom. This condition is likely to continue in the future, so this reach will require periodic vegetation and sediment removal. The photograph was taken prior to the completion of the Walgreens Shopping Center Bridge.

Reach 3: McKee Road to Interstate 680

This is the most varied reach in terms of channel configuration. From McKee Road through the Plata Arroyo Park (Reach 3A), the channel is excavated from native materials with substantial creek and bank vegetation. An earthen levee provides flood protection to residents on the east bank, while the park itself floods during significant runoff events. Above the park, the trapezoidal channel is concrete lined upstream almost to San Antonio Street. The excavated channel is more natural as it passes Mayfair Park and Mathson Junior High before ending at Interstate 680.

Photos 8, 9. U/S Face of McKee/King Culvert: Note sediment deposits immediately upstream of bridge.

←Photo 10. Sediment Inside Eastern McKee Road Culvert Barrel.

Photo 11. Reach 3A (July 2000)

Photo 12. Reach 3A (May 2001)

Photo 13. End Reach 3A

Photo 14. Reach 3B→

Photo 15. Reach 3C: Trapezoidal lining will be eliminated in much of this reach.

Photo 16. Reach 3D: Downstream of San Antonio

Photo 17. San Antonio Street: Downstream Face of Bridge, which will remain intact.↓

Photo 18. Reach 3D: US from San Antonio Bridge.

Photo 19. Reach 3E: Lower Silver Creek taken from Kammerer Bridge looking DS in Mayfair Park→

Photo 20. Reach 3F: From I680 (below)
Photo 21. Reach 3F: From Kammerer (below, right)

Reach 4. Interstate 680 to North Babb Creek

Above Interstate 680, Lower Silver Creek flows in a relatively uniform, clean, straight trapezoidal channel. Between the freeway and Jackson Avenue, the channel slopes are lined with concrete. Sediment accumulates within the nearly dead flat reach of creek between the 680 culvert and Jackson Avenue Bridge, particularly along the inside of the sweeping bend. From Jackson Avenue to Capitol Expressway, channel slopes are covered with short grasses, and there is some emergent wetland vegetation. Between Capitol and North Babb Creek, the channel is not quite as uniform, with some sloughing of the banks, and the available right-of-way diminishes from 90 feet to 65 feet.

Photo 22. Reach 4A: Upstream Face of Interstate 680 Bridge

Photo 23. Reach 4A: From Jackson Avenue Bridge. Note sediment deposition on inside bend between Jackson Avenue and the freeway. This channel reach will continue to require regular vegetation and sediment removal.→

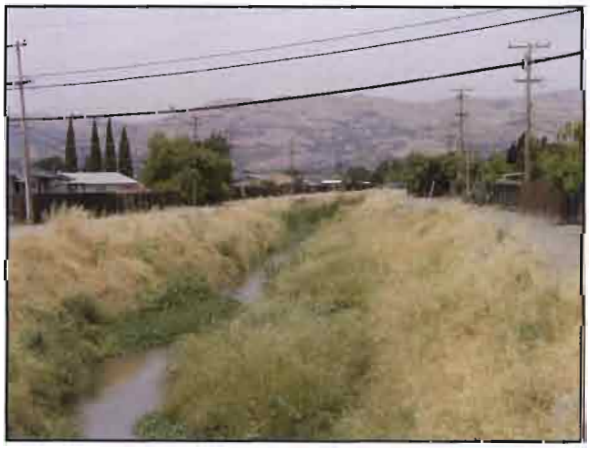


Photo 24. Reach 4B: From Jackson Ave Bridge (6/01). Note that bank grass is longer than one year earlier as shown in Photo 25.

Photo 25. Same View of Reach 4b (August 2000) Note sparser bank vegetation but taller emergent wetland vegetation. →

Photo 26. Reach 4B: From Capitol Expressway.

Reaches 5 and 6. North Babb Creek to Lake Cunningham

Similar in nature to Reach 4, Reaches 5 and 6 of Lower Silver Creek are also excavated trapezoidal channels, albeit with more generous rights-of-way than the upper part of Reach 4. High groundwater elevations in the vicinity appear to cause year-round standing water, particularly further upstream. The two tributaries in this reach deliver sediment into Lower Silver Creek. South Babb Creek appears to have conveyed significant volumes of sediment in the recent past.

Photo 27. Reach 5 Above Murtha Drive: Note sediment deposition from South Babb Creek in June 2001. In the fall of 2000, sediment was removed from the confluence of South Babb Creek with Lower Silver Creek.

Photo 28. Reach 5 at South Babb Confluence: Note relative lack of sediment and standing water at the time of photography in June 2001. This photograph was taken after sediment removal was conducted by the District in the fall of 2000 →

Photo 29. Reach 5 Upstream of Story Road.

Photo 30. Reach 6A D/S Moss Point Road.→

Photo 31. Reach 6B D/S Cunningham Avenue.

Photo 32. This view, looking upstream from the Cunningham Avenue Bridge, shows banks lined with dense brush and short grass. Reeds and brush also grow within the channel bed. In the distance is the levee bordering Lake Cunningham Park. Note the standing water, believed to be the groundwater table.→

FLOODING WITHIN THE WATERSHED

Recorded flooding problems within the Lower Silver Creek watershed include runoff events in December 1889, January and March 1911, January 1952, December 1955, April 1958, January 1963, February 1983, and March 1983. (FEMA, 1986.) During the February 1998 El Niño, the creek was flowing bank-full downstream of Lake Cunningham, although no overtopping was witnessed (personal observation).

Flood Protection Projects

Flood damages experienced during the 1950s led to a series of flood protection projects intended to increase the capacity of Lower Silver Creek. Table 2-3 lists those projects and their approximate date of construction.

Table 2-3: Past Flood Protection Projects

Year	Description
1950	McKee Road Culvert Replacement
1955	Capitol Avenue Culvert Extension
1958	Channel Excavation from McKee Road to Kammerer Avenue
1958	New Culverts at Alum Rock Avenue and Sunset Avenue
1961	Jackson Avenue Culvert Replacement
1971	Interstate 680 Culvert and Moss Point Drive Bridge
1972	Channel Excavation and Bank Protection from Capitol to Murtha
1973	Capitol Expressway Culvert Replacement
1974	San Antonio Street Bridge Replacement
1976	Channel Lining and Maintenance Road from Capitol to Cunningham
1976	New Bridges at Murtha Drive, Ocala Avenue and Cunningham Ave.
1978	Sumset Avenue Culvert Replacement.
1983	McKee Road Culvert Expansion.

Flood Insurance Requirements

In its current state, Lower Silver Creek cannot contain estimated one-percent flood discharges within its banks. Figure 2-5 shows areas prone to flooding in a one-percent runoff event based on information provided by the Watershed Program. Since Lower Silver Creek was excavated through a broad alluvial plain, when floodwaters leave its banks, they generally flow away from the channel as shallow sheet flow. Urbanization has tended to generally concentrate the flow of floodwater within street rights-of-way.

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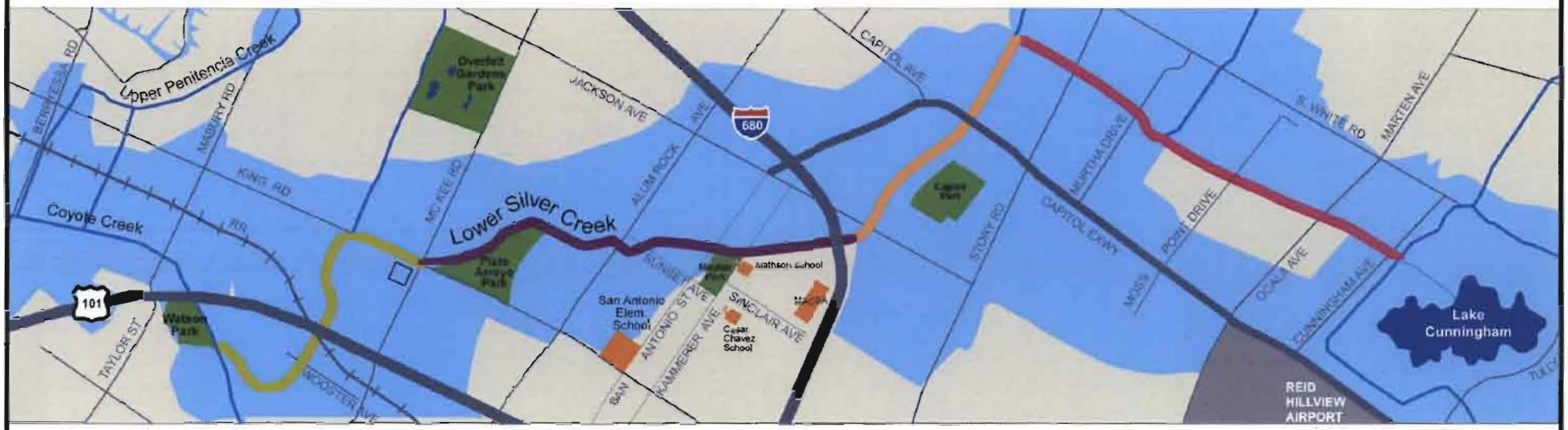
Figure 2-5. Flood Prone Areas



Flood Prone Areas

Reaches 1 and 2
Reach 3
Reach 4
Reach 5 and 6

NOT TO SCALE

Source: Coyote Watershed Program
CH2M Hill

Schaaf & Wheeler

PREVIOUS PLANNING STUDIES

A planning study prepared by the District in 1976 proposed to provide a concrete-lined trapezoidal channel for most of Lower Silver Creek between Highway 101 and Cunningham Avenue. This plan was abandoned in the early 1980s in favor of the NRCS (formerly SCS) plan of 1983. The original watershed plan examined five non-structural and three structural measures to provide one-percent flood protection. Of these eight plans, three were formulated for further alternatives analysis.

1) No Project;

2) Non-structural Floodplain Protection; and

3) Channel Enlargement and Floodproofing.

1998 NRCS Plan

In 1998 the NRCS developed a major update to their 1983 plan. They investigated new alternatives in an attempt to minimize the lineal feet of proposed concrete channel and incorporate more environmentally sensitive design elements. After examining eleven more non-structural and structural measures, three new alternatives were selected for further study and refinement:

1) Geomorphic Stream Restoration with Detention Basins;

2) Geomorphic Stream Restoration with Diversion Channels; and

3) Hybrid Vegetated Block Wall Channel.

The third alternative was recommended, and has been carried forward to the present project, refined as described in Chapter 5 of this report.

PROJECT OBJECTIVES

The basic objective of the Lower Silver Creek Reaches 1-6 Improvement Project is to provide a level of flood protection along Lower Silver Creek consistent with NRCS and District policies, and the policies of the Federal Emergency Management Agency (FEMA) as administered through the National Flood Insurance Program (NFIP).

District and NFIP regulations define the "base flood" as a flood having a one percent chance of being equaled or exceeded in any given year. Often this is referred to as a "one-percent" or "100-year" flood. This should not be confused with a flood that *will* occur once every one hundred years, but one that might occur once every one hundred years or so *on the average* over a very long period of time. In fact, over the life of a 30-year mortgage, there is a 26 percent chance of experiencing a flood equal or greater in magnitude than the base flood as demonstrated by Table 2-4. These probability concepts may have an impact on construction staging, particularly the timing of bridge replacements and protecting newly the excavated channel prior to the re-establishment of vegetation.

Table 2-4: Relative Risk of Various Flood Events

	5-year	10-year	100-year
Annual risk of event	20%	10%	1%
Risk of at least one event in 5 years	67%	41%	5%
Risk of at least one event in 10 years	89%	65%	10%
Risk of at least one event in 30 years	99.88%	96%	26%
Risk of at least one event in 50 years	99.998%	99%	39%
Risk of at least one event in 100 years	really high	99.997%	63%

Other Project Goals

Although the primary project objective is to provide a level of flood protection along Lower Silver Creek meeting District, NRCS and FEMA standards, additional project objectives include:

- balancing flood reduction with environmental restoration, community beautification, and recreational opportunities.
- providing efficient and cost-effective flood control maintenance to ensure that the District is able to maintain design system performance in the future;
- allowing for more natural geomorphic processes in Lower Silver Creek; and
- engendering community support for the proposed project.

CHAPTER 3
WATERSHED HYDROLOGY

This chapter documents hydrologic analyses within the Lower Silver Creek and Coyote Creek watersheds undertaken for this project. Design discharges are presented, and a conceptual plan for modified operation of Lake Cunningham as a flood control facility is described. These analyses:

1) Provide a basis for further hydraulic analysis, sediment transport consideration, and facility design within Lake Cunningham Park and the adjacent upstream reaches of Lower Silver Creek. Another consultant will perform this work.

2) Estimate design one-percent discharges for Lower Silver Creek from Cunningham Avenue downstream to Coyote Creek (Reaches 1 through 6).

3) Provide discharge estimates for more frequent return periods, at the request of several interested parties. Channel discharges for the two-year, five-year, and ten-year flow conditions are given.

BACKGROUND

The NRCS based its conceptual channel improvements for Lower Silver Creek on a set of discharge values of unknown origin that are within ten percent of earlier base flood flow estimates made by the Santa Clara Valley Water District. Within the District's hydrologic model, HEC-1 storage routing routines are used to account for attenuation provided by Lake Cunningham, which reduces large-event flows downstream of Cunningham Avenue. The intent of this work is to reconfirm the performance of Lake Cunningham, and propose feasible operating modifications that can minimize downstream one-percent design discharge, while providing for the safe storage of excess runoff volume in a reasonable fashion that the City of San Jose can agree to.

Analytical Methods

In November 2000 Nolte Associates, Inc. completed a hydrologic study of the Lower Silver Creek watershed above Lake Cunningham for the District. Their analysis is based on methods and procedures outlined in the District's 1998 Hydrology Procedures Manual. The District directed Schaaf & Wheeler to expand the study to include the entire Lower Silver Creek watershed to its confluence with Coyote Creek. Further direction was given to follow the same procedures and methods provided in the Nolte study. Any modifications to the methodologies outlined by Nolte or the District are fully explained within this chapter.

Nolte prepared an HEC-1 rainfall-runoff model of the Lower Silver and Thompson Creeks watershed from the drainage boundary to Lake Cunningham. Hydrologic methodologies and assumptions are outlined in Table 3-1. The same methodologies and assumptions are made for the new watershed model downstream of Lake Cunningham as were made for the upstream model prepared by Nolte.

Table 3-1: Hydrologic Methodologies

Hydrologic Parameter	Upstream and Downstream Models
Design Storm	100-year, 24-hour, 15-min Standard Project General Storm for Northern California Coastal Streams
Precipitation Depth	SCVWD Precipitation Gages at City of San Jose Haskins Ranch United Technology Corporation
Sub-basin Areas	USGS 7.5-minute Quadrangle
Land Use	City of San Jose 2020 General Plan
Soil Infiltration	SCS Curve Number Methodology
SCS Soil Groups	Santa Clara Valley Water District
Antecedent Moisture Conditions	"Lower Silver/Thompson Creeks Hydrology Study," Nolte Associates, November 15, 2000
Unit Hydrograph	Clark Synthetic
Storm Drain Routing	SCVWD urban area storage-discharge relationships
Channel Routing	Muskingum-Cunge

WATERSHED MODEL

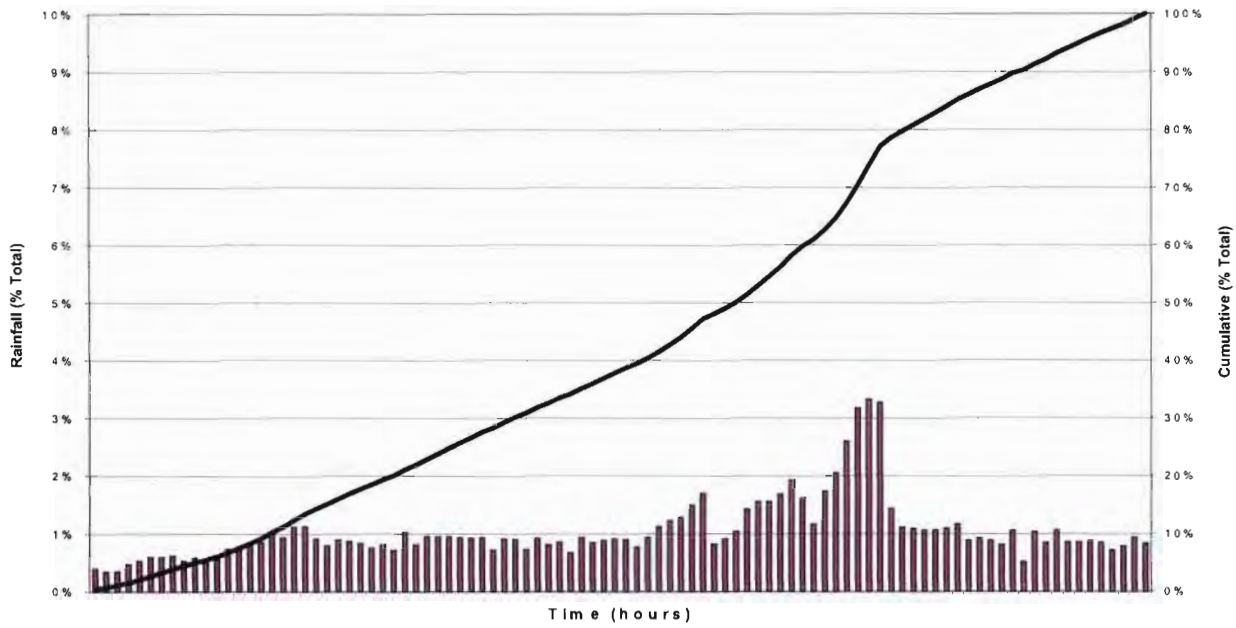
The aforementioned hydrologic methodology has been applied to the Lower Silver Creek watershed downstream from Lake Cunningham to construct a new watershed model.

Design Storm

The assumed rainfall distribution pattern is the District's normalized 24-hour, 15 minute Standard Project General Storm for Northern California Coastal Streams. This is the same storm pattern used in the Nolte study, and is shown graphically in Figure 3-1.

While this rainfall distribution pattern differs from the one used in the District's earlier model of the watershed, peak discharge estimates from the present study correlate well with previous estimates (see Table 3-3 on Page 3-13), as long as the same Lake Cunningham operating scenario is assumed.

Figure 3-1:
24-hour Standard Project General Storm for Northern California Coastal Streams



The selection of a particular precipitation pattern for design can affect peak discharge estimates and the timing of those peak discharges. To a lesser extent, the precipitation pattern can also alter the volume of predicted runoff depending upon soil infiltration; i.e. the pattern may affect the "initial abstract" depending upon antecedent moisture conditions. The new precipitation pattern peaks about ten hours later than the old pattern. Therefore, it is extremely important for anyone comparing the coincident timing of Lower Silver Creek and Coyote Creek discharges to be using consistent precipitation patterns.

Precipitation Depth

Table 3-2 provides a summary of rainfall depths at the three precipitation stations that surround this watershed. Following the Nolte methodology, precipitation depth is assumed to be the average depth of the three precipitation stations. Neither the 24-hour precipitation depth nor pattern is assumed to vary within the watershed.

Table 3-2: Precipitation Depths

Station	Precipitation Depth (inches)			
	2-year	5-year	10-year	100-year
UTC	1.57	2.31	2.76	4.01
Haskins Ranch	1.94	2.57	2.95	4.00
City of San Jose	1.52	2.25	2.76	4.42
Average	1.68	2.38	2.83	4.15

Basin Parameters

Sources for sub-basin areas, land use types and soil groups may be found in Appendix D. The Nolte model used an Antecedent Moisture Condition (AMC) of II¾ with the SCS methodology for soil loss (infiltration). This provides a close replication of previous estimates of peak inflow at Cunningham Avenue. Antecedent Moisture characterization by the SCS is given as:

AMC I soils are dry

AMC II average conditions

AMC III heavy rainfall, or light rainfall with low temperatures; saturated soil.

Past hydrologic experience in the South Bay indicates that for a typical 24-hour storm, AMCs between II½ and II¾ tend to match statistical stream flow analyses for one-percent runoff. Therefore, using an AMC of II¾ for one-percent discharge estimation is reasonable. Estimates for two-year runoff use AMC I, since the Program is interested in how frequent sediment flushing flows might occur (see Chapter 6). Five-year discharge estimates assume average soil saturation equivalent to AMC II, while extreme event runoff estimates (10- and 100-year) assume AMC II¾.

The only modification made to the District's methodology as used by Nolte is that within urban sub-basins, District formulae for times of concentration apply only to the initial time of concentration, usually on the order of 15 minutes. A travel time from the most distant hydrologic element to the basin outlet has been added, calculated from basin slopes and gutter velocities. Without this final calculation, basin lag times tend to be underestimated with a consequent increase in peak discharge.

LAKE CUNNINGHAM

An examination of Lake Cunningham is integral to the watershed modeling effort. Lake Cunningham is a dual-purpose recreational and flood control facility. Its flood control function occurs during high runoff events when floodwater spills out of Silver Creek over a weir near Cunningham Avenue into the park. This analysis is intended to establish a preliminary weir elevation and describe the improvements necessary to control the flow of water downstream.

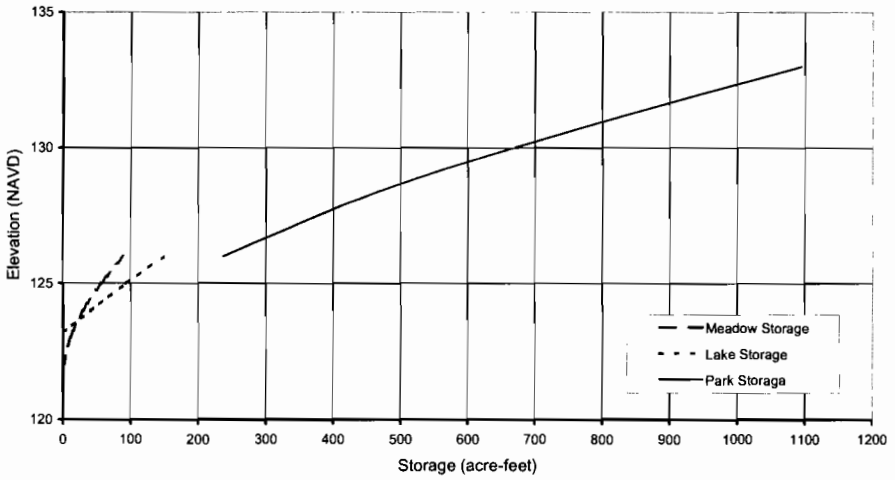
A May 2, 1978 agreement between the Santa Clara Valley Water District and the City of San Jose set forth acceptable conditions of operation for Lake Cunningham. According to this agreement, 380 acre-feet of flood storage are to be provided below an elevation of 125 feet NGVD (equivalent to roughly 128 feet NAVD), and at least 860 acre-feet of total storage must be provided below elevation 130 feet NGVD, or 133 feet NAVD. Correspondence to the City of San Jose in December 1981 indicated that the overflow weir from the creek into the park (set "temporarily" at elevation 127 feet NGVD) would be lowered to elevation 125.9 feet NGVD after Lower Silver Creek was improved. The maximum ponding elevation in the park was given as 127 feet NGVD, or 130 feet NAVD. In March 1982, the District wrote to the Soil Conservation Service (now NRCS), indicating that the maximum elevation of flooding would be elevation 125.9 feet NGVD, but this letter may have mistaken the ultimate weir elevation for the maximum level of flooding. The 1983 NRCS plan was based on the use of 590 acre-feet of flood storage to attenuate downstream flood flows.

Available Storage

Topographic surveys provided by the District indicate that 425 acre-feet of storage are available at elevation 128 feet NAVD, and 1,100 acre-feet are provided at elevation 133 feet NAVD. The NRCS's maximum storage volume of 590 acre-feet equates to an actual flood elevation of roughly 129 feet NAVD. Additional detailed surveying will be required, but a cursory examination of available topography suggests that park inundation could be allowed to an elevation of 131 feet NAVD before water would reach permanent structures.

Based on recent surveys, the as-built park grading provides more storage volume than required by the 1978 agreement, which was the basis of the 1983 NRCS analysis and watershed plan. The scope and cost of channel improvements to Lower Silver Creek downstream of Lake Cunningham have increased since 1983, so the objective of this analysis is to utilize additional available lake storage to minimize downstream releases while maintaining maximum flood levels at or below elevation 130 feet NAVD. Figure 3-2 shows available storage volume for the Big Meadow, Lake Cunningham, and the combined park.

Figure 3-2: Storage in Lake Cunningham Complex



Proposed Control Structures

Three variables are available to optimize lake storage and reduce flow down Lower Silver Creek: the size of the culvert/bridge opening at Cunningham Avenue, the length of the weir into the park and the elevation of the weir. The crossing at Cunningham Avenue works as a choke, allowing lower flows through and holding higher flows back. The weir elevation and length determine when and how much flow spills into the park. If the weir allows too much flow into the lake early in the storm, the volume will be used up and the peak will not be reduced enough. Likewise, if the weir is undersized it won't let enough flow into the lake, sending too much flow down the creek.

A preliminary hydraulic model of the downstream creek system has been used to establish backwater conditions at Cunningham Avenue. The model represents 30-percent design improvements from Coyote Creek to Interstate 680, and NRCS conceptual improvements from 680 to Cunningham. (Additional modeling will be required using the final hydraulic model once design for Reaches 1 through 6 is complete to confirm backwater conditions at Cunningham Avenue.) Because the final location of the weir is unknown, this analysis does not consider the effects of backwater upstream of Cunningham Avenue. This too will need to be refined by others at final design. Analysis assumes that flow leaves Silver Creek only at the weir. A rating curve of spill flow versus elevation follows the equation:

$$Q = C_w L h^{\frac{3}{2}}$$

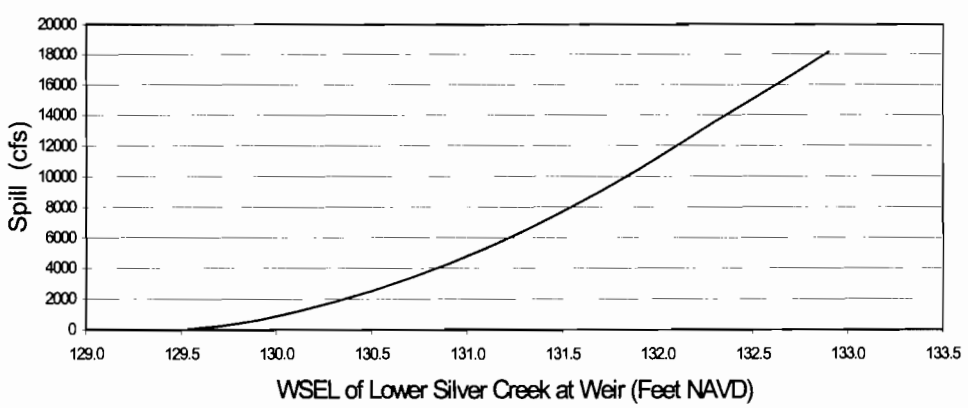
where Q = discharge over weir (cfs)
C_w = weir coefficient (dimensionless)
L = weir length (feet)
h = distance between the creek's energy grade line and weir crest (feet)

Since the actual weir cross section is subject to further evaluation within the context of park function, a value of 2.6 for C_w based on a broad-crested weir is assumed.

Combinations of varying culvert widths, weir lengths and elevations have been modeled to establish a workable preliminary design concept. In one scenario, the Cunningham Avenue Bridge would be modified using vertical walls to restrict the width of opening to 34 feet, and a concrete base slab would fix the height of opening to 8 feet. A hard floor at the bridge is essential to maintain the size of the control structure opening by preventing scour. (An enlarged opening would allow additional flow down the creek.) In combination with this control structure, a 900-foot long weir with a crest elevation of 129.5 feet (NAVD), near the Cunningham Avenue crossing, diverts a significant amount of runoff into the park without jeopardizing permanent structures.

Figure 3-3 provides a rating curve of overflow from Lower Silver Creek to the Big Meadow, based on the parameters listed previously. Subsequent work will be necessary to re-establish this rating curve based on actual backwater profiles between Cunningham Avenue and Tully Road that result from necessary channel improvements within this reach. Sedimentation may also affect the backwater profile on the weir crest. In addition, the final design configuration of the weir, both its location and cross section, may change the rating curve. Hence it may be necessary to modify the preliminary weir length and crest profile to achieve the flow attenuation described in this report.

Figure 3-3: Rating Curve for Spill to Big Meadow



Proposed Lake Operation

Previously described storage-elevation and weir flow rating curves have been used in conjunction with HEC-RAS backwater analyses to model stream releases and weir overflows. (See Appendix D for documentation.) A passive system of controls is proposed to operate Lake Cunningham during flood events. Between the Big Meadow and Lake Cunningham, a secondary weir 1,000 feet in length at elevation 126 NAVD (consistent with existing topography) is proposed to control the overflow of floodwater from the meadow into the lake. Neither the Cunningham Avenue control structure nor the weirs require monitoring or actual operation.

Meadow inundation may be fairly rapid as Figure 3-4 shows; with the entire meadow flooded to a depth of about three feet in two hours, and to a depth of six feet within five hours. Ultimately the park should be inundated to a maximum elevation of 129.4 feet NAVD during the design 100-year event. Total inflow at the control structure (Nolte hydrograph), downstream releases, and water surfaces in both the Big Meadow and Lake Cunningham are represented in Figures 3-4 and 3-5.

Figure 3-4: Lake Cunningham Design Operation

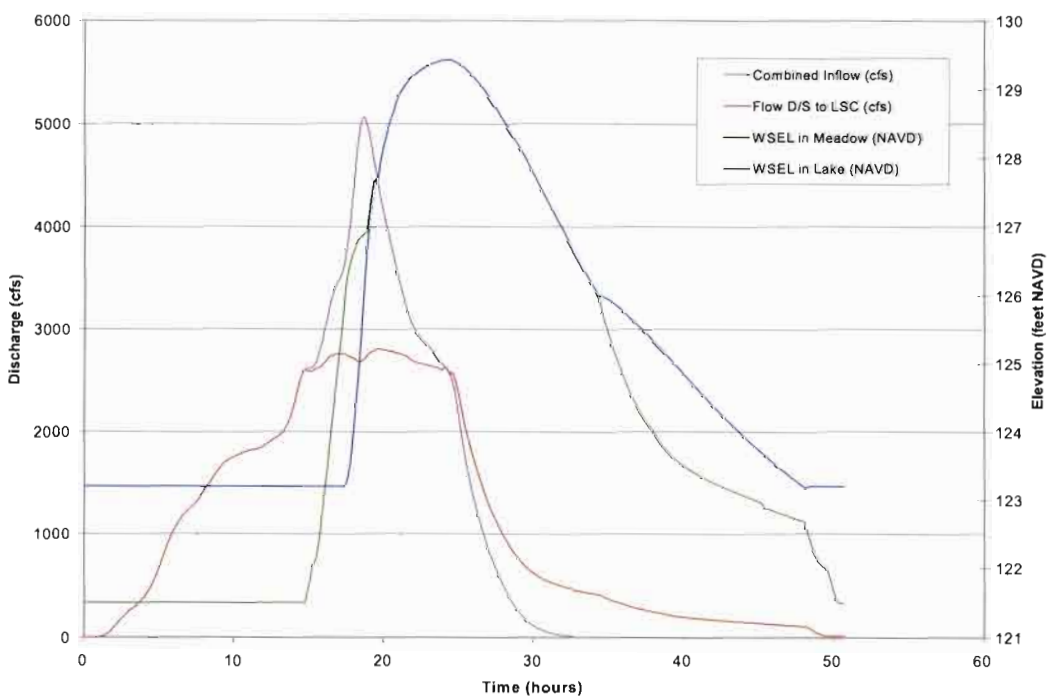
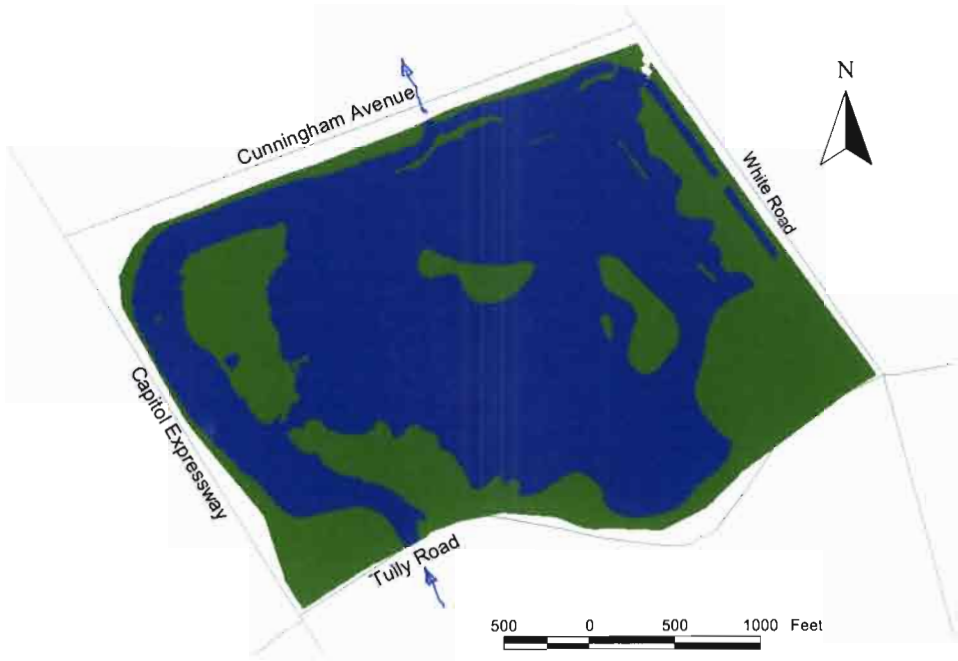
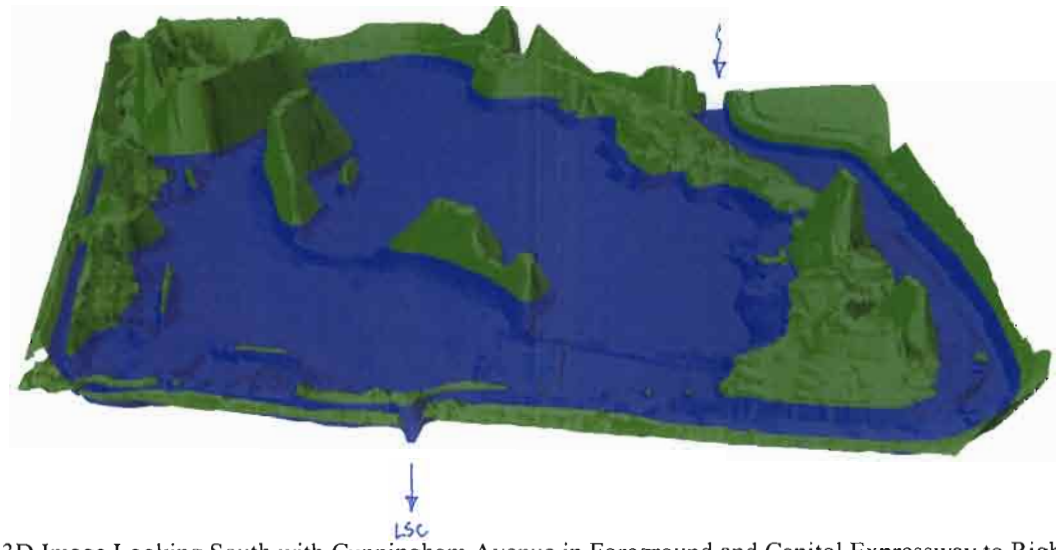


Figure 3-5: Lake Cunningham Inundation During Design Runoff Event

(Limit of maximum one-percent inundation shown in blue.)





3D Image Looking South with Cunningham Avenue in Foreground and Capitol Expressway to Right
(Note exaggerated vertical scale.)

The peak inflow of 5,060 cfs is reduced to 2,800 cfs by the system of controls, which spills 590 acre-feet of water into the park. This volume of water floods the park to an elevation of 129.4 feet NAVD, which is below the crest of the Lower Silver Creek weir at elevation 129.5 feet.

Conceptual Drainage Facilities

Provisions to drain floodwaters back out of Lake Cunningham and the Big Meadow are necessary to restore the recreational use of the park, and to prepare the flood control system for the next event. Figure 3-6 shows a conceptual section of a siphon between the lake and Big Meadow, which would be used to control the normal lake level. Currently the normal lake surface is at elevation 123 feet NAVD, but the City of San Jose would not necessarily be opposed to lowering this level to drop the permanent groundwater table in the Big Meadow. A siphon allows for the most efficient drainage of lake water, even with falling lake levels. The drainage cycle in Figure 3-4 is based on three 36-inch diameter siphons from the lake into Big Meadow.

Figure 3-7 shows a conceptual system that drains the Big Meadow concurrently. Six 36-inch diameter pipes have been assumed for the calculations. Under this scenario, the lake and meadow are drained within 18 hours of direct runoff cessation, or about 36 hours after water first spills over the control weir. A sub-drain system and pumps are recommended to dewater the meadow area. Flapgates are required on both drainage systems to prevent premature flooding. Faster drawdowns could be achieved by adding more siphons. Since the invert of Lower Silver Creek has been raised over time due to sedimentation, more refined improvement plans should examine methods for keeping the outfall clear and preventing local sediment accumulation. It is anticipated that this may be an area that requires extensive regular maintenance.

Performance Sensitivity

Proposed Lake Cunningham Park flood controls have been tested for hydraulic and hydrologic sensitivity. Calculations presented in Figure 3-4 are based on backwater control at Cunningham Avenue. Once the design of Lower Silver Creek channel improvements are completed, the overflow weir should be adjusted to function with either outlet control or inlet control conditions at the Cunningham Avenue control structure while maintaining the desired downstream release. With inlet control at Cunningham Avenue, the maximum downstream release is about 2,900 cfs.

Hydrologic sensitivity has been gauged by adding 20 percent to precipitation depths throughout the watershed. Under this condition, maximum inflow to the Lower Silver / Ruby Creek confluence increases to 5,860 cfs, the overflow weir is submerged, peak downstream release to Lower Silver Creek is about 3,000 cfs, and 1,050 acre-feet of water is stored within the park (Figure 3-8).

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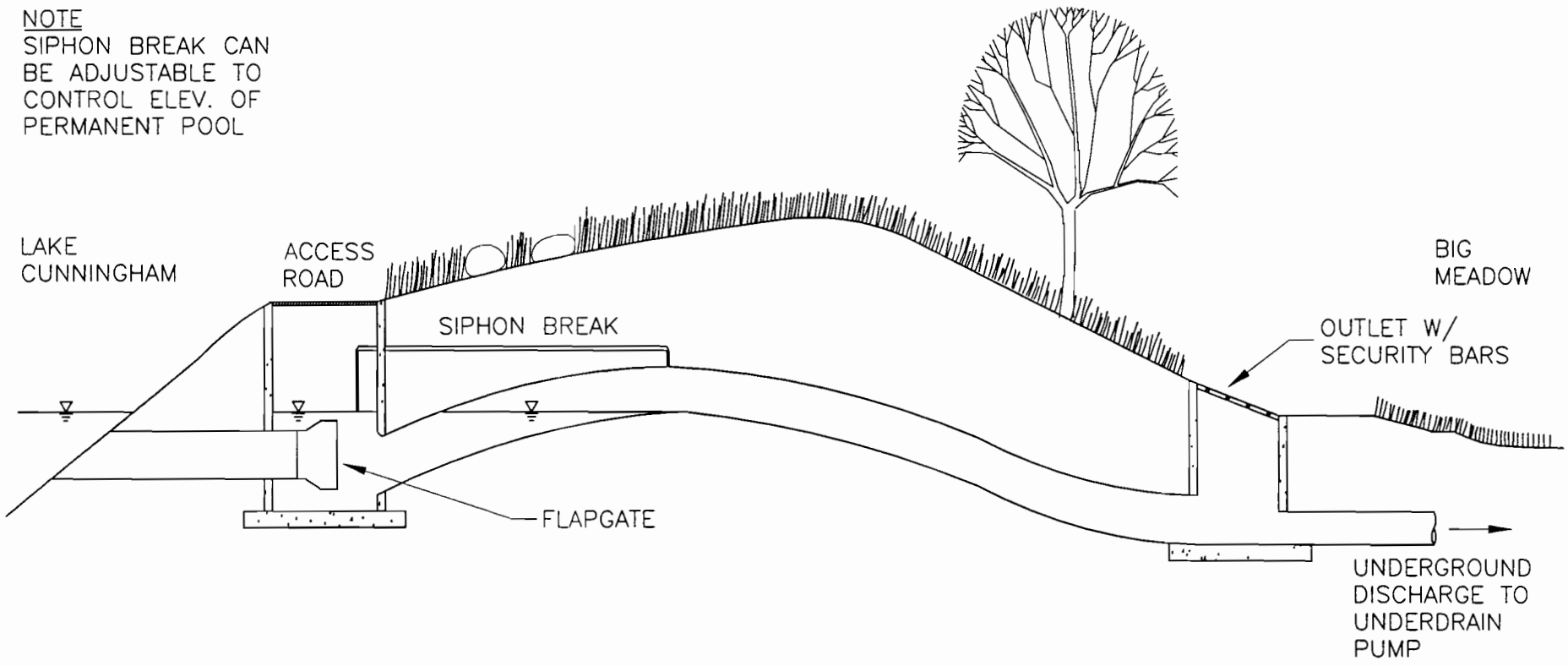

LAKE DRAIN SIPHON

N.T.S.

Schaaf & Wheeler

Figure 3-6

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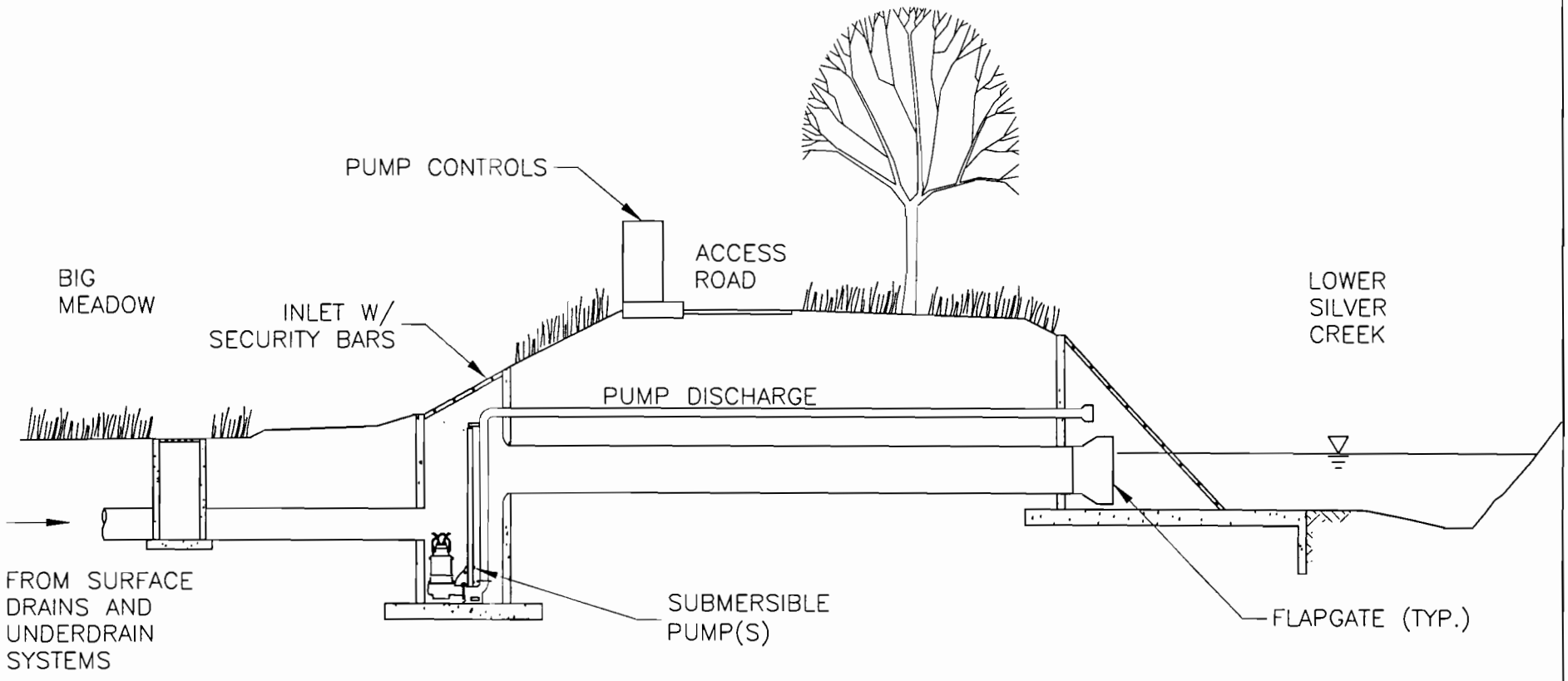


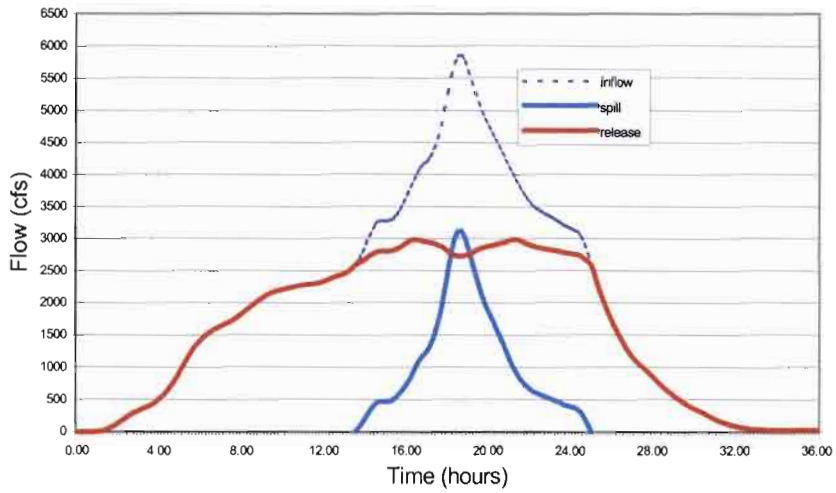
BIG MEADOW DRAIN

N.T.S.

Figure 3-7

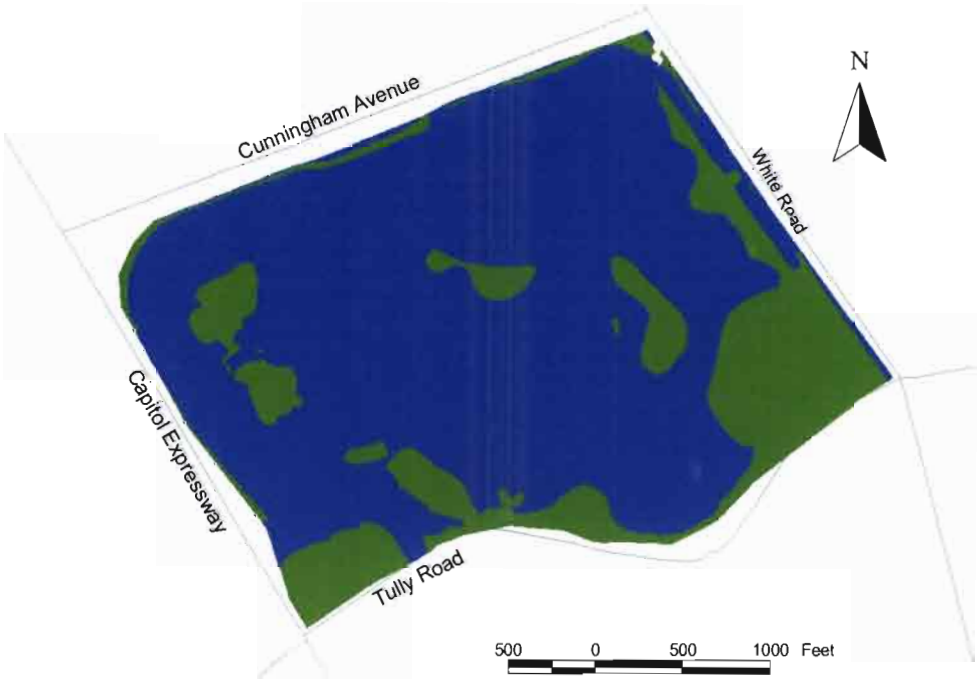
Schaaf & Wheeler

Figure 3-8: Downstream Release w/ 20% Increase in Rainfall



Hydraulic modeling indicates that the additional flows in Lower Silver Creek would be contained within the freeboard of proposed channel improvements. The amount of water stored in the park complex nearly doubles, inundating the park to an elevation of 133 feet NAVD (Figure 3-9), assuming that the flooding is contained. (The current point of first release to Capitol Expressway is at elevation of about 132 feet NAVD just downstream of Tully Road.)

Figure 3-9: Lake Cunningham Inundation w/ 20% Increase in Rainfall
(Limit of maximum inundation shown in blue.)



Design Resolution

Several issues need to be addressed during detailed Lake Cunningham flood control design. Between Cunningham Avenue and Tully Road, Lower Silver Creek and Ruby Creek must convey their design discharges without premature spill into the meadow or lake. Sedimentation and maintenance within these reaches should also be considered. A point of first release from the system (e.g. to Capitol Expressway) is also necessary to establish maximum emergency flood levels within the park, as well as maximum downstream discharges. The release should assure that emergency spills take place only when design inflow exceeds the one-percent magnitude. Finally, the system of levees that contain floodwater within the park must meet state and federal standards.

DESIGN DISCHARGE ESTIMATION

Table 3-3 compares design discharges used by the NRCS in their 1983 watershed plan to predicted NRCS discharges as modified by the proposed lake operation plan discussed in this report, and the results of the new hydrologic methodology with aforementioned lake operation. The table demonstrates that proposed changes to Lake Cunningham could reduce the NRCS design discharges by ten to twenty percent. Applying the new hydrologic methodology in this watershed changes estimated discharges by less than four percent, given the proposed changes at Lake Cunningham.

Table 3-3: Comparison of Design Discharges

Location	Discharge (cfs)			% Δ due to Lake Changes	% Δ due to Methodology
	Original NRCS (590 ac-ft)	NRCS with Proposed Lake Changes	New Method with Proposed Lake Changes		
Cunningham Ave.	3,600	2,810	2,810	-22	0
Ocala Ave.	3,600	2,900	---	-19	---
S. Babb Creek	4,210	3,820	3,670	-9	-4
N. Babb Creek	4,600	4,080	4,160	-11	+2
Interstate 680	4,830	4,230	4,210	-12	0
Alum Rock Ave.	4,830	4,290	4,340	-11	+1
Miguelita Creek	5,630	4,860	4,920	-14	+1
Highway 101	5,630	5,160	5,220	-8	+1
Coyote Creek	29	5,630	5,150	5,220	+1

More Frequent Discharges

Watershed modeling results for more frequent storm events are summarized in Table 3-4. Antecedent moisture conditions for various return periods have been previously discussed. Precipitation depths are taken from City of San Jose rain gauge statistics.

Table 3-4: Design Discharges on Lower Silver Creek

Location	Discharge (cfs)			
	2-year	5-year	10-year	100-year
Lake Inflow	610	2,040	3,400	5,060
Cunningham Avenue	610	2,040	2,650	2,810
S. Babb Creek	680	2,420	3,310	3,670
N. Babb Creek	780	2,630	3,640	4,160
Interstate 680	780	2,650	3,670	4,210
Alum Rock Avenue	810	2,730	3,780	4,340
Miguelita Creek	890	2,940	4,160	4,920
Highway 101	940	3,050	4,360	5,220
Coyote Creek	940	3,050	4,360	5,220

Frequency of Park Inundation

Based on revised watershed modeling, the proposed improvement project should pass a five-year discharge without any spill into Lake Cunningham Park, but spill would occur in a ten-year design event. During a ten-year runoff event, the peak overflow is estimated to be 750 cfs, with spills lasting about two hours. Roughly 125 acre-feet of water would be stored in the park, which exceeds the storage capacity of the meadow (88 acre-feet). Consequently, overflow from the meadow into the lake is anticipated to occur during a ten-year event.

COINCIDENCE WITH COYOTE CREEK

Water surfaces elevations, particularly in the lower reaches of Lower Silver Creek, can be directly influenced by conditions in Coyote Creek at the confluence. Backwater calculations presented in Chapter 5 have been made using the best available information regarding Coyote Creek, since recent detailed hydrologic and hydraulic analyses for the entire Coyote Creek watershed, of which Lower Silver Creek is a part, are not available.

Design Hydrographs

According to the NRCS, increasing the capacity of Lower Silver Creek by improving the channel will have a minimal impact on peak flows and volumes in Coyote Creek. (NRCS, 1998.) During a 100-year runoff event, their peak discharge from Lower Silver Creek occurs about 60 hours before the peak discharge from Coyote Creek. At the time of peak runoff from Silver Creek, Coyote Creek is discharging about 2,000 cfs, or one-sixth of its 100-year peak discharge. When Coyote Creek peaks, Lower Silver Creek is projected to discharge only base flow. The NRCS predictions are not based upon comparison of hydrologic models constructed using similar procedures. Rather, they are made using a "time of concentration graph" without sufficient documentation to verify. An examination of the District's ultimate conditions hydrologic model for the Coyote Creek watershed reveals more coincident 100-year peak discharges than assumed by the NRCS (Table 3-5).

Table 3-5:
Coincidence of 100-year Discharge at the Lower Silver Creek / Coyote Creek Confluence
(Source: HEC-1 Model "COY1" Obtained from SCVWD)

Time (hours)	Description	Coyote Creek Discharge Downstream of LSC (cfs)	Lower Silver Creek Discharge (cfs)
45	Lower Silver Creek Peak	10,770	5,480
69	Coyote Creek Peak	15,740	3,560

Lower Silver Creek peaks at 45 hours, when the combined discharge in Coyote Creek downstream of the Silver Creek confluence is about 70 percent of the estimated peak combined discharge. Coyote Creek peaks at 69 hours when the flow in Lower Silver Creek is 65 percent of its peak discharge of 5,480 cfs as estimated by the District model. (For the ten-year runoff condition, the two creeks are nearly coincident.) It is noted that the Coyote Creek watershed model referenced in Table 3-5 uses a different design storm and methodology than the revised Lower Silver Creek model, but that the older model provides the best available information regarding the relative timing of peak discharge.

Starting Water Surface Elevations in Lower Silver Creek

FEMA has published guidelines for computing water surface profiles in unregulated watersheds, which may be of some assistance in this study even though the watershed is regulated by Lake Cunningham. According to FEMA, the starting water surface elevations for profile computations on a tributary may be based on normal depth unless a coincident peak situation is assumed. Generally the assumption of coincident peaks is appropriate if:

- the ratio of the drainage areas for the two creeks lies between 0.6 and 1.4;
- the times to peak for the combining flows are similar for the two combining watersheds; and
- the likelihood of both watersheds being covered by the design storm is high.

The Lower Silver Creek watershed covers 45 square miles, or only about 18 percent of Coyote Creek's 248 square mile watershed at the confluence. And if the NRCS "time of concentration" analysis is correct, coincident peaks are not likely. Table 3-5, however, suggests that the peak discharges from each creek are 24 hours apart rather than 60 hours, so an assumption of normal depth at the confluence may not be appropriate.

Coupled with the likelihood that intense rainfall typically preceding extreme runoff events in northern California is caused by widely spread storm fronts, it is certainly possible that peak discharges in Lower Silver Creek will occur simultaneously with significant backwater from Coyote Creek. This is the basis for starting water surface elevations assumed for hydraulic analysis in this report. Further refinements of the operation plan at Lake Cunningham may also need to address the potential for downstream impacts to Coyote Creek, based on the timing of lake releases.

If the one-percent discharge in Coyote Creek is about 10,800 cfs when Lower Silver Creek discharge is at its peak, the starting water surface elevation at the confluence should be approximately equivalent to FEMA's published 50-year water surface elevation of 82.75 feet NAVD, which is based upon a combined discharge of 10,300 cfs. If the proposed channel configuration is analyzed with this starting condition, the design one-percent water surface profile does not approach the top of natural bank until upstream of Highway 101 where floodwalls are planned. The water surface appears not to significantly overtop existing banks anywhere in Reaches 1 or 2. By comparison, water surface elevations just upstream of Highway 101 assuming a normal depth starting condition for Lower Silver Creek are about six inches lower.

Also analyzed is the existing condition assuming that Coyote Creek is at its peak one-percent discharge with a water surface elevation at the Lower Silver Creek confluence of 84.75 feet NAVD. For this case, Lower Silver Creek discharges are assumed to be 65 percent of their maximum values. The results of each analysis are superimposed upon one another, and the higher water surface elevation between the two cases governs the recommended design at every location.

The ten-year water surface profile for Lower Silver Creek assumes a coincident ten-year Coyote Creek water surface elevation of 79.75 feet NAVD, as published by FEMA.

CHAPTER 4
DESIGN CRITERIA

This chapter documents hydraulic parameters used to design channel improvements for Lower Silver Creek Reaches 1 through 6. Hydraulic parameters discussed include:

1) channel roughness;
2) bridge modeling techniques and transition losses;
3) freeboard requirements; and
4) maintenance criteria.

CHANNEL ROUGHNESS

In one-dimensional open channel flow analysis as performed using HEC-RAS, a single parameter known as "Manning's n" is used to represent the retarding forces to flow imposed by the channel. Values for "n" are published in the literature, and in the absence of high water marks with which to calibrate stream reaches with known discharge, are often relied upon for channel design. When selecting roughness values for design, it is important to remember that in one-dimensional flow, Manning's "n" accounts for the flow resistance due to a host of hydraulic phenomena beyond boundary shear. Other factors may include the effects of eddies, cross-waves, super-elevation, bed forms, sediment and debris.

Roughness Elements

Several sources have been used to estimate roughness factors for water surface profile determination within Lower Silver Creek. These include "n" values published by Henderson (1966) and Chow (1959), engineering judgment, and procedures outlined by the Corps of Engineers for roughness values within concrete lined channels (ASCE, 1995). Table 4-1 summarizes design channel roughness values of various channel elements proposed for use in hydraulic analysis.

Given the uncertainty in "n" value selection, a range of "n" values is used to examine channel performance. Lower values tend to increase channel velocity, which may be important in terms of scour or wave formation. Higher values tend to maximize water depth, and will generally set freeboard requirements. For vegetal channel linings, typical "n" values for temporary erosion control materials will be used to evaluate high flow velocities. Manning's "n" values that are contingent upon maintenance conditions are so indicated.

Table 4-1: Manning's "n" Values for Hydraulic Analysis

Element	High "n" for depth	Low "n" for velocity
Concrete Lining	0.018	0.011
Bare Earth	0.030	0.020
Erosion Control Blanket	---	0.020
Gravel Maintenance Road	0.025	0.020
Vegetated Gabion Mattresses or Walls	0.045	0.030
Vegetated Block Slopes	0.045	0.030
Grass Lining (Mowed to <12")	0.040	0.020
Emergent Wetland (Maintained)	0.050	0.020
Grass Lining (No maintenance)	0.060	0.020
Emergent Wetland (No maintenance)	0.100	0.020
Trees, shrubs, vines (No maintenance)	0.150	0.020
Rock Slope Protection	$0.034(d_{50})^{1/6}$	$0.034(d_{50})^{1/6}$

Composite Roughness Calculations

By design, the roughness along the wetted perimeter of Lower Silver Creek varies across each cross section. For instance, at an individual cross section location, the channel might contain elements of emergent wetland, grass lining, trees, shrubs, and a maintenance road. To compute water surface elevations in a channel with variable roughness using a one-dimensional model (i.e. with a mean velocity), it is necessary to estimate an effective (composite) roughness value for each cross section. Flow velocities vary across the channel due to variation in both the flow depth and roughness from one channel element to the next. To calculate mean flow velocity without actually subdividing each channel section, several methods have been suggested in the literature for estimating a composite roughness value within non-uniform channels.

HEC-RAS calculates a composite "n" value based on an assumption that average velocities within each channel element are equal and equivalent to the mean channel velocity as a whole. (HEC, 1998) Since this is not the case for Lower Silver Creek, a more appropriate method that weights "n" by channel conveyance is used herein.

As described by Chow (1959), Lotter assumed that the total discharge in each section is equal to the sum of the discharges of individual areas subdivided by roughness (i.e. conservation of mass). The resultant equivalent roughness coefficient formula, consistent with US Army Corps of Engineers engineer manual EM 1110-2-1601, is provided by Chow as Equation 6-19:

$$n = \frac{P\,R^{5/3}}{\sum\left(\frac{P_N\,R_N^{5/3}}{n_N}\right)} = \frac{P\,R^{5/3}}{\frac{P_1\,R_1^{5/3}}{n_1} + \frac{P_2\,R_2^{5/3}}{n_2} + \ldots + \frac{P_N\,R_N^{5/3}}{n_N}}$$

where	n	=	composite roughness coefficient for cross section
	P	=	total wetted perimeter of cross section (feet)
	R	=	total hydraulic radius of cross section (feet)
	P_i	=	wetted perimeter of cross section element i (feet)
	R_i	=	hydraulic radius of cross section element i (feet)
	n_i	=	Manning's roughness coefficient for cross section element i

Appendix E details the calculation of composite roughness values for each channel reach.

Because the distribution of velocities is not uniform across channel sections, the velocity head is generally greater than the value computed when using the mean velocity. (Chow, 1959) The actual velocity head is represented by the term $\alpha V^2/2g$; where V is the mean velocity, and α is known as the energy coefficient, velocity coefficient, or Coriolis coefficient, determined from:

$$\alpha = \frac{\int v^3\,dA}{V^3\,A}$$

where	α	=	velocity coefficient (dimensionless)
	v	=	velocity within an individual channel element (feet per second)
	V	=	mean channel velocity (feet per second)
	A	=	cross sectional area (square feet)

BRIDGE MODELING

In addition to the energy required to overcome channel resistance, structures such as bridges and culverts also cause energy losses, which can result in a raised water surface profile. Methods provided by HEC-RAS for analyzing bridges and culverts under low flow and pressurized conditions are employed in the backwater computations.

Several methods are available through HEC-RAS to compute energy losses through a bridge. The "energy only" or standard step method handles a bridge section without piers in the same manner as a natural river section, except that the area between the low chord of the bridge (soffit) and the top of road is subtracted from the total cross-sectional area, and the wetted perimeter is increased where water is in contact with the bridge. Increased frictional resistance due to the added wetted perimeter is included in the energy loss through the structure.

When bridge piers are present, either conservation of momentum may be applied by using a coefficient of drag, or Yarnell's method may be used for subcritical "Class A" low flow through the bridge. Table 4-2 provides proposed drag coefficients for the momentum method and pier shape coefficients for Yarnell's low flow bridge loss calculations, respectively.

Table 4-2: Pier Coefficients

Pier Shape	Drag Coefficient	Pier Coefficient
Semicircular Nose and Tail	1.33	0.90
Multiple Cylinders	1.33	1.00
Triangular Nose and Tail	2.00	1.05
Square Nose and Tail	2.00	1.25

When the computed water surface elevation is above the bridge soffit, a "pressure/weir" feature can compute losses through the structure for pressure (orifice) flow, weir flow over the top, or a combination of both. (For Lower Silver Creek, weir flow over bridges is not allowed.) Changes to the water surface profile resulting from the bridge are calculated based on hydraulic formulae that estimate the change in energy and water surface elevation through the bridge. Other hydraulic routines are also available to perform the same function for standard culvert shapes.

Coefficients of discharge for orifice flow during bridge pressurization are evaluated on a case-by-case basis using the guidelines outlined in Table 4-3. When an orifice is located close to the bottom or bank of the channel, the approaching flow is guided so that the orifice contraction is suppressed on those sides of the orifice close to such guides. Clear span bridges across trapezoidal or U-frame (rectangular) channels are examples of orifices contracted on three sides.

Table 4-3: Orifice Coefficients

Condition	Orifice Coefficient
Orifice in Thick Wall (typical bridge)	0.80
Submerged, square-edged	0.80
Submerged, well-rounded	0.90
Increase in C per number of contracted sides	0.04

Transition Losses

An energy loss also takes place just upstream and downstream from each structure as flow contracts and expands into and out of the bridge or culvert. The following contraction and expansion coefficients for channel transitions are used in the hydraulic models (Table 4-4). Wherever turbulent conditions create the potential for energy loss, contraction and expansion coefficients are increased. Other transitions include channel bends, resting pools, and maintenance access ramps.

Table 4-4: Expansion and Contraction Coefficients

Transition Type	Contraction	Expansion	Source
Gradual	0.1	0.3	HEC
Warped	0.1	0.2	Chow
Wedge	0.3	0.5	Chow
Square End	0.3	0.75	Chow
Abrupt	0.6	0.80	HEC

FREEBOARD

The use of design "freeboard" provides a measure of safety that compensates for the many unknown and difficult-to-quantify parameters that affect the calculation of flood elevations. These factors include uncertainty in rainfall data, soil loss parameters, watershed urbanization, wave action, debris at bridge openings, and general uncertainties in hydrologic and hydraulic procedures. Freeboard is usually expressed in terms of feet above the design base flood elevation. To meet FEMA standards, freeboard is necessary whenever a levee system, including structural floodwalls, is used to provide flood protection.

When mapping flood-prone areas, FEMA only recognizes those levee systems meeting their criteria, which includes a minimum three feet of freeboard whenever the design one-percent water surface elevation is carried above the natural ground elevation. An additional six inches of freeboard (3.5 feet above the water surface) is required at the upstream end of the levee / floodwall system, tapering to the minimum freeboard of 3.0 feet at the downstream end of the levee. For this reason, the District has adopted a uniform freeboard criterion of 3.5 feet. An additional foot of freeboard (4.0 feet above the water surface) must be provided within 100 feet of each side of any structure, such as a bridge or culvert.

FEMA does not impose a freeboard requirement when the base flood can be carried without the use of a levee system. The District, however, does have additional project freeboard requirements for design projects (SCVWD, 1994), which can be more restrictive than FEMA's actuarial criteria. Table 4-5 provides the respective criteria, where "D" refers to the estimated depth of flow in feet, and "V" is flow velocity in feet per second.

Table 4-5: Freeboard Requirements

Situation	FEMA (Feet)	District (Feet)
Water Surface Above Natural Bank Elevation	3.0	3.5
Water Surface Above Bank within 100 feet of Structure	4.0	4.0
Water Surface Below Natural Bank Elevation	N/A	$0.2(D + V^2/2g)$
Minimum Freeboard	N/A	1.0

District criteria for water surfaces below natural bank elevation are based on NRCS guidelines. Recently the NRCS has approved the use of a slightly different formula for its freeboard criterion within incised channels; that is, where the design water surface is carried below the natural bank. The velocity head term has been omitted, leaving the required freeboard within an incised channel as the minimum of one foot or 0.2D, where D is flow depth. The NRCS has also approved a District-proposed method of weighting depth based upon flow conveyance, as stated in an October 31, 2001 memorandum from NRCS Design Staff Leader Bill Ward, P.E.:

> "[The NRCS] has determined that using a composite freeboard based on weighting the conveyance for individual channel areas within a section is a good approach for multi-staged channels and recommend[s] its use in these cases. To meet NRCS criteria you can simply use this procedure and replace the energy head with depth. Of course the minimum freeboard should not be less than one foot, and other requirements for freeboard (super-elevation, unstable range) are on top of the calculated composite freeboard."

The effect of differing conveyance within multi-staged channels is already accounted for by the calculation of composite roughness and velocity coefficients to produce an average water surface elevation. It is also recommended that the minimum freeboard be based on the hydraulic depth, which is the depth of an equivalent rectangular shaped channel (flow area divided by top width), and produces a weighted depth similar to the District's composite freeboard calculation. (Sample calculations that compare the District's composite freeboard procedure with the use of the hydraulic depth are provided in Appendix E.) Furthermore, the energy grade line shall be contained within the channel or its floodwalls.

LEVEL OF MAINTENANCE

Regular channel maintenance is important to upholding the integrity of channel design. During preliminary and final design phases, proposed maintenance protocols on the part of the District will be iteratively evaluated for their impact on design channel roughness, but within the confines of the approved Lower Silver Creek Maintenance Plan of August 2000. For instance, natural elements including grasses and emergent wetlands that are allowed to become "contaminated" with woody vegetation such as brush, willows, and even trees would be assumed to have higher roughness values in the 0.10 to 0.15 range.

CHAPTER 5
CHANNEL HYDRAULICS

Base flood elevations within Lower Silver Creek are estimated using a one-dimensional steady state flow backwater analysis via the HEC-RAS public domain program. Steady state analyses are performed. The following civil engineering firms and agency have supplied proposed channel geometry information:

Reaches 1 and 2:	MacKay & Somps, Inc.
Reach 3:	Psomas, Inc.
Reach 4:	Ruggieri-Jensen-Azar & Associates
Reaches 5 and 6:	Coyote Watershed Program

Available data include record drawings for previously constructed bridges and culverts, proposed channel design plans, field surveys of existing topography for Lower Silver Creek supplied by the Program, and supplemental surveys performed by firms listed above. This information is supplemented by field surveys performed by Schaaf & Wheeler at every bridge or culvert crossing between Wooster Avenue and Cunningham Avenue.

METHODOLOGY

Flood flows can be carried within channels either as "subcritical" flow or "supercritical" flow, often referred to as "tranquil" and "rapid" flow, respectively. It is not the velocity of flow, however, that distinguishes the flow regime; rather, the flow regime is defined by how fast the water is moving relative to the velocity of the wave that results from a small disturbance in the water surface. Disturbances in subcritical flow move upstream; disturbances in supercritical flow cannot move upstream because such waves must be swept downstream. The Froude number (F_r), which is analogous to the Mach number for gas flow, is defined as the ratio of stream velocity to wave velocity:

$$F_r = \frac{v}{\sqrt{g\,y}}$$

where v = stream velocity (feet per second)
g = gravitational acceleration (feet per second squared)
y = water depth (feet)

A Froude number greater than unity signifies supercritical flow (stream velocity greater than wave velocity), while a Froude number less than one indicates subcritical flow. When the Froude number is between 0.8 and 1.2, however, the flow can be unstable, characterized by standing waves and other disturbances that may tend to propagate upstream or downstream depending upon the state of flow.

Because the Froude number depends on channel roughness, and "n" values are expected to vary within any given reach, the specific energy freeboard criterion has been kept to insure that the channel design provides protection against unexpected changes in the flow regime. Coincident backwater conditions from Coyote Creek (Chapter 3) and design criteria from Chapter 4 are used to establish required freeboard at the upper end of the design channel roughness range. Then normal depth starting conditions and the lower end of channel roughness are simulated to examine channel stability under mixed flow conditions; that is, with both supercritical and subcritical flow. Critical flow is assumed as the upstream boundary condition at Cunningham Avenue for the latter analysis.

Superelevation

At a limited number of locations discussed later in this chapter, the proposed channel is aligned along sweeping bends. The centrifugal force caused by flow around a curve raises the water surface on the outside wall of the curve, and depresses the water surface along the inside wall. This phenomenon is referred to as superelevation. In addition, curved channels tend to create secondary helicoidal flows that may persist downstream of the curve. Superelevation is checked with both high and low Manning's "n" values to determine the most critical case for wall freeboard. The maximum amount of superelevation above the level water surface predicted by HEC-RAS is given by the following equation (ASCE, 1995):

$$\Delta y = C \frac{V^2 W}{g\, r}$$

where	Δy	=	the rise in water surface (feet)
	C	=	a dimensionless coefficient (0.5 for subcritical flow in a simple circular curve in a rectangular channel; 1.0 for supercritical flow in the same type of curve)
	V	=	mean channel velocity (feet per second)
	W	=	channel width (feet)
	g	=	gravitational acceleration (feet per second squared)
	r	=	the radius of channel centerline curvature (feet)

EVALUATION OF PROPOSED CHANNEL IMPROVEMENTS

Before completing a detailed hydraulic analysis of the District's proposed design for the Lower Silver Creek Watershed Project, recent changes made to the NRCS proposed project plans are discussed in terms of hydraulic performance.

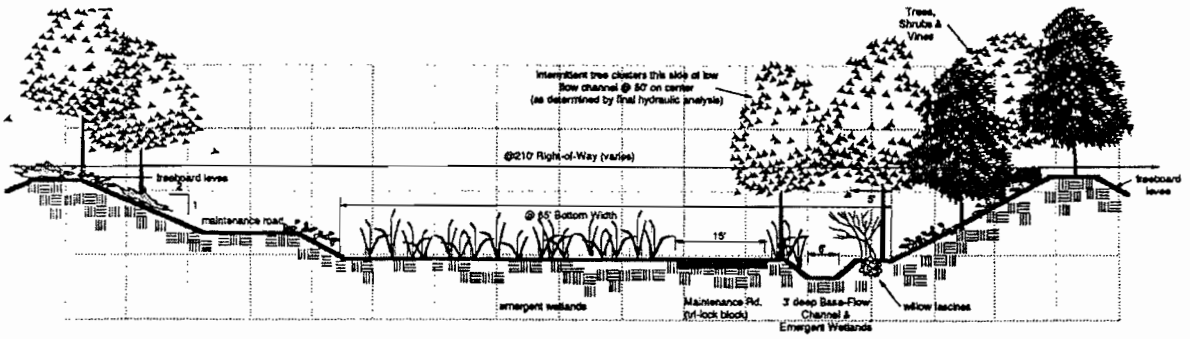
Evolution of Channel Design

In 1998, the NRCS prepared a set of conceptual drawings for the Lower Silver Creek Improvement Project. This set of drawings, portions of which are excerpted herein, was evaluated using preliminary hydraulic calculations that did not factor in backwater effects from Coyote Creek, existing or replacement bridges, or other channel transitions.

The District has since refined and enhanced the original NRCS plan to reduce the amount of concrete lining, utilize more natural and environmentally sensitive materials and configurations, provide for more natural channel geomorphologic processes, improve maintenance, and allow greater public access to the creek. As a result, the channel configuration has been revised in a few reaches, including the acquisition of additional rights-of-way to facilitate the channel enhancements.

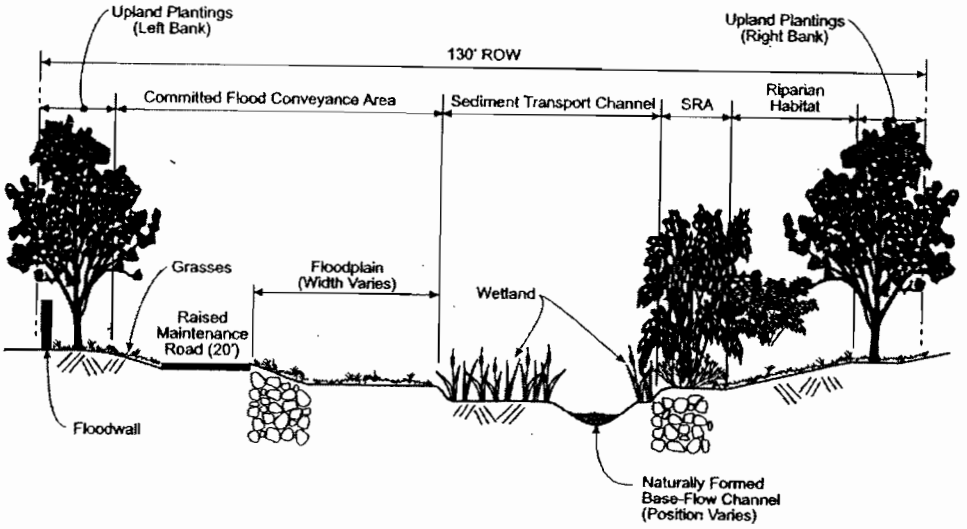
Illustrations provided below show, in a general fashion, changes that have been made to the original improvement plans. The pictures compare channel geometries, habitats, depths of flow, and requisite freeboard measures. In this preliminary analysis, backwater effects due to Coyote Creek, bridges, and other structural features are not included to provide a valid comparison of channel plans. Unfortunately, the NRCS plans are not tied to any physical datum, so it is nearly impossible to verify water surface elevations relative to natural grade.

These pictures are illustrative only, and are not to scale. Actual channel geometries and design details may vary, but the concepts are true to form.



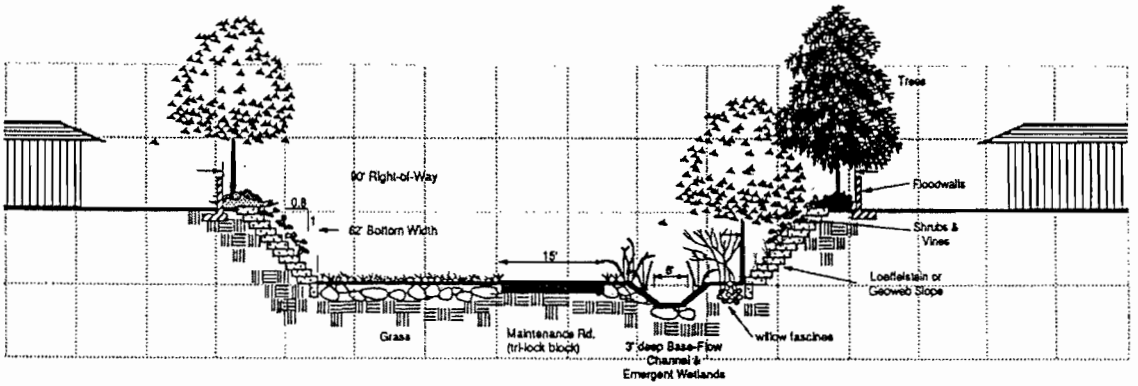
NRCS Reach 1A

Flow Depth = 15.75 feet; freeboard levees



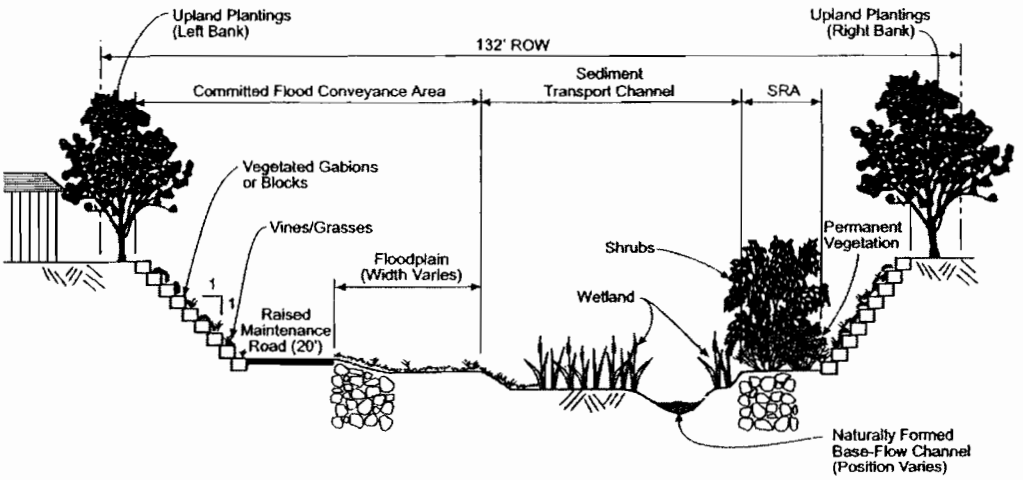
District's Refined Reach 1A

Flow Depth =15.1 feet; no levees



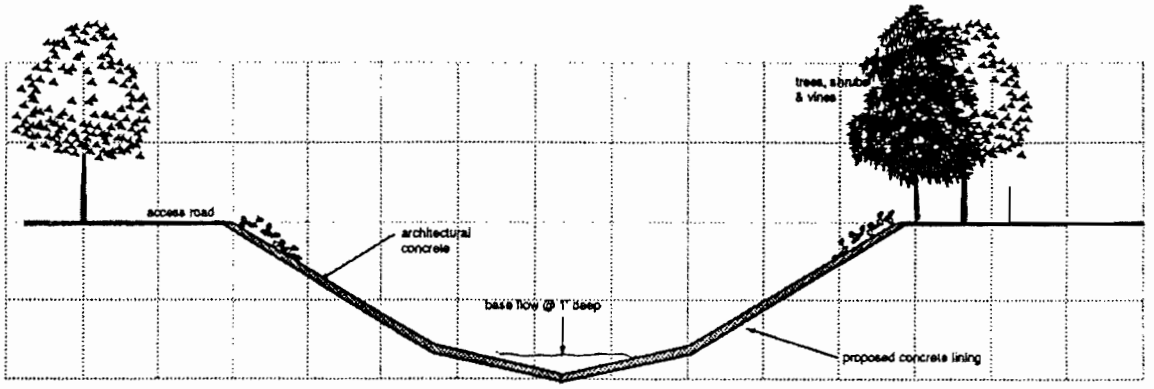
NRCS Reach 1B

Flow Depth = 9.9 feet; floodwalls



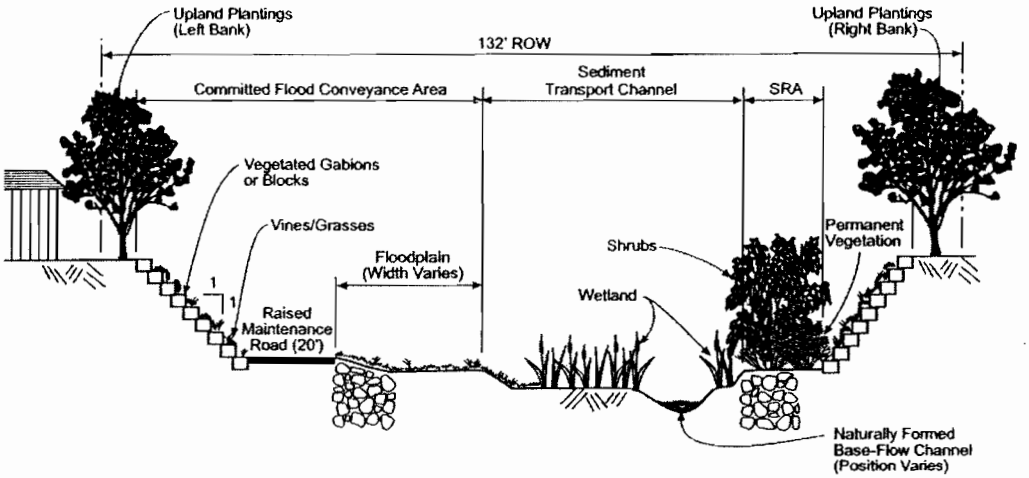
District's Refined Reach 1B

Flow Depth = 10 feet; no floodwalls



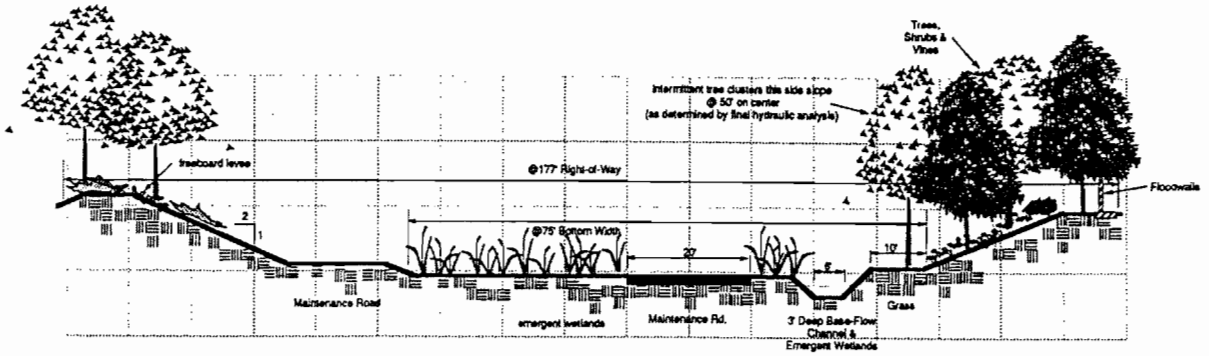
NRCS Reach 1C

Flow Depth = 12.8 feet; No floodwalls shown



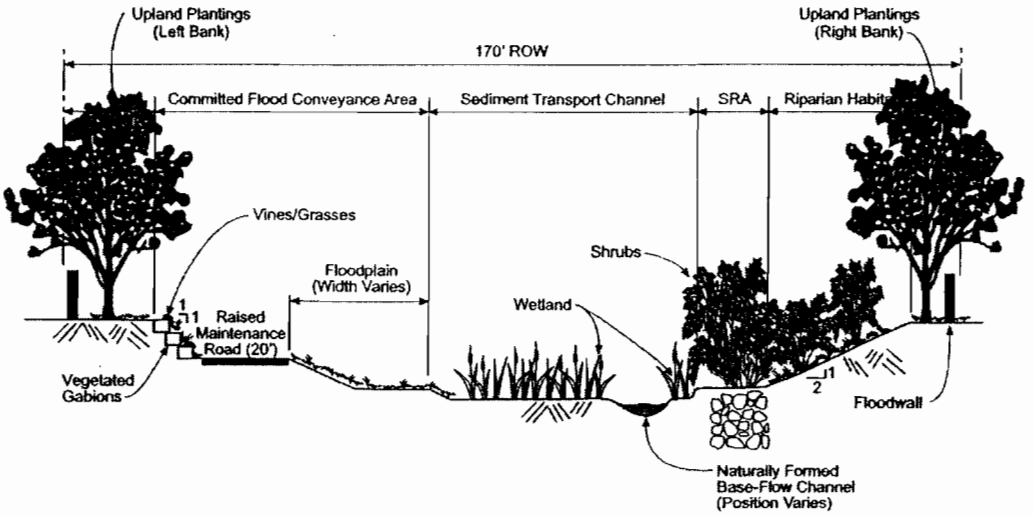
District's Enhanced Reach 1C

Flow Depth = 13.5 feet; Floodwalls as required



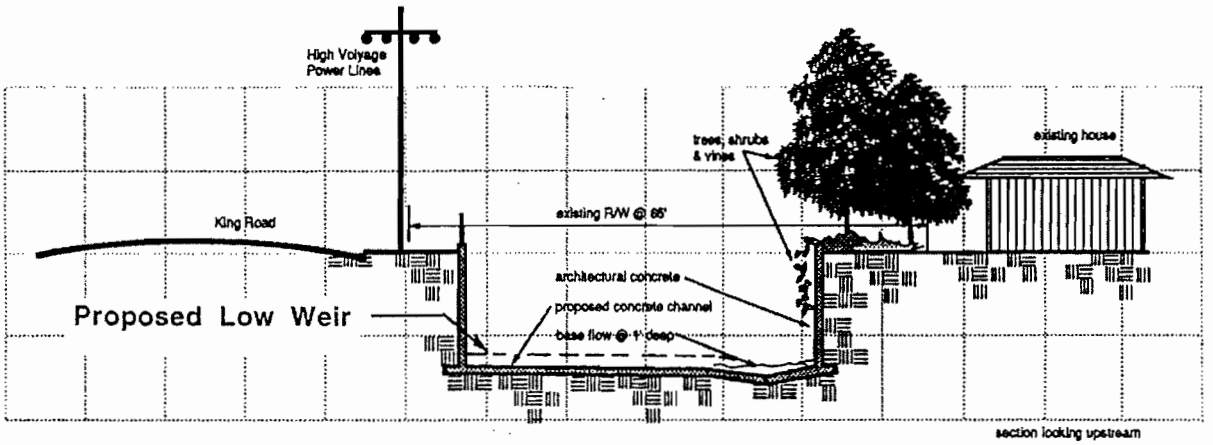
NRCS Reach 1D

Flow Depth = 13.0 feet; Freeboard levees and floodwalls



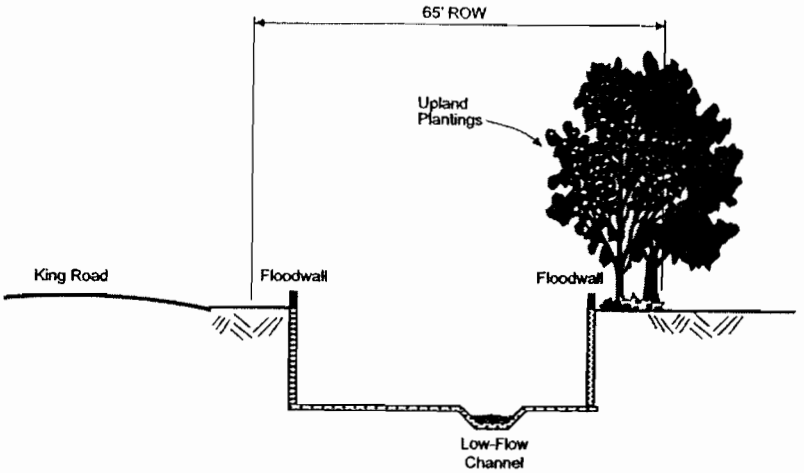
District's Refined Reach 1D

Flow Depth = 13.5 feet; Floodwalls as required



NRCS Reach 2

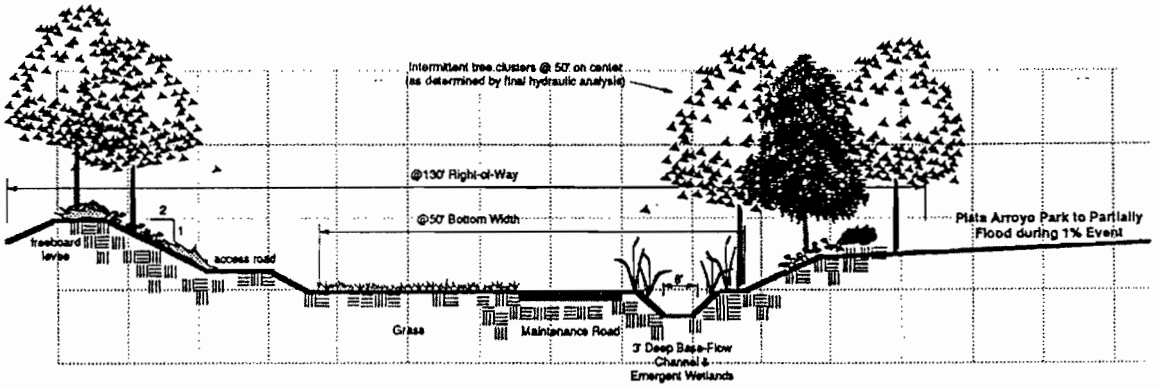
Flow Depth = 11.7 feet; U-frame wall extensions



District's Refined Reach 2

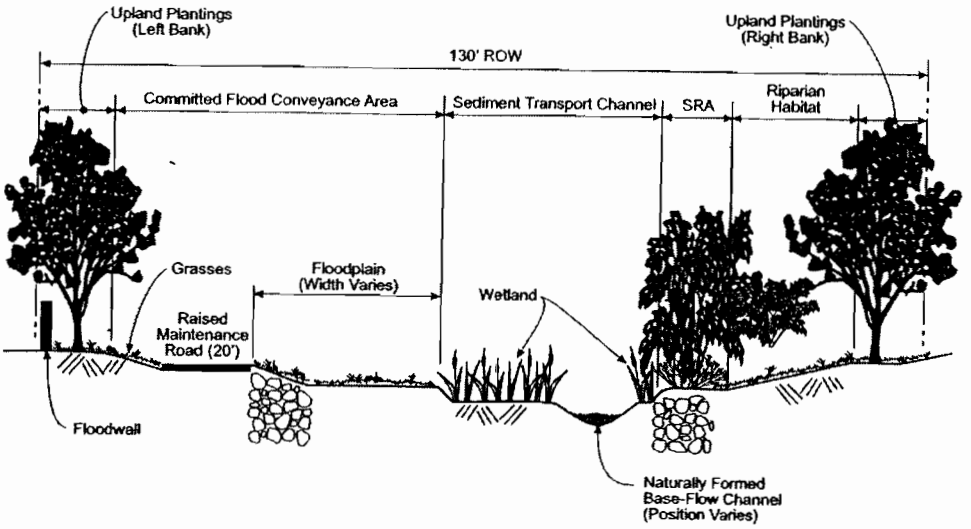
Flow Depth = 13.0 feet; U-frame wall extensions

(Additional depth is from Reach 1D backwater NRCS did not consider)



NRCS Reach 3A

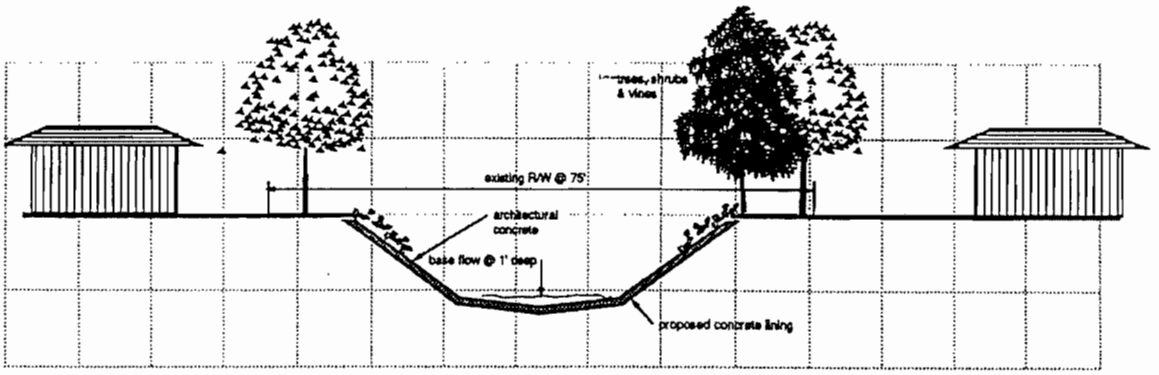
Flow Depth = 10.8 feet; Freeboard levees left bank



District's Refined Reach 3A

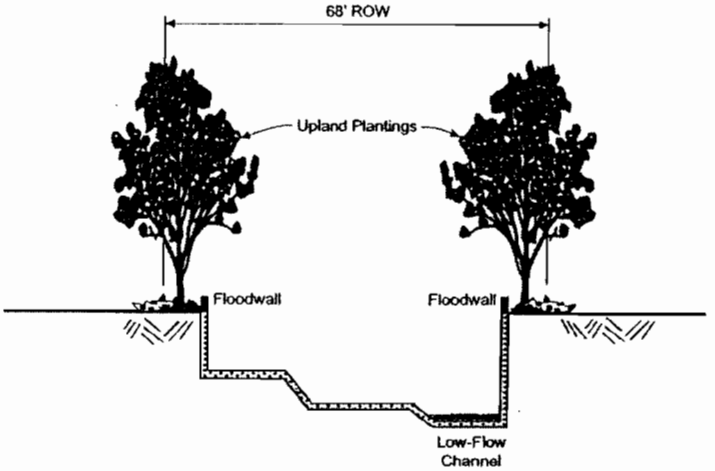
Normal Depth = 10.9 feet; Floodwalls left bank

McKee Road culvert backwater controls in this reach, however, flow depth = 14.6 feet.



NRCS Reach 3B/C

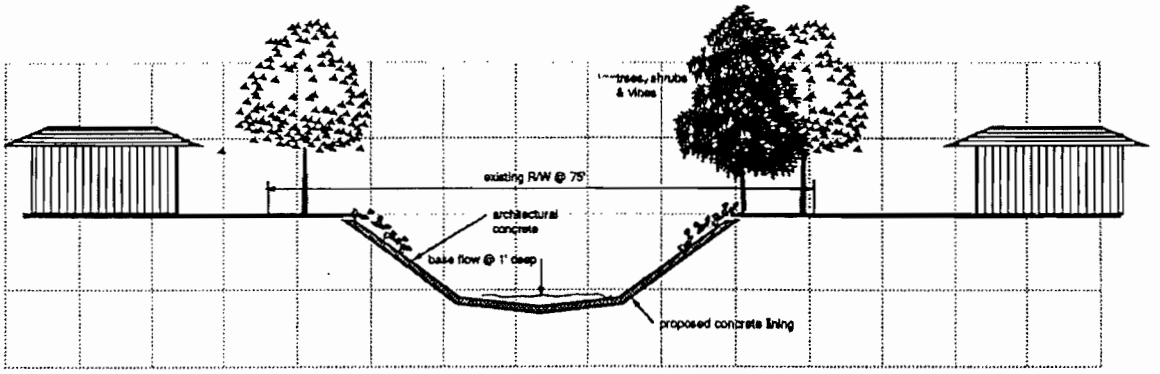
Flow Depth = 9.8 feet, No floodwalls.



District's Refined Reach 3B/C

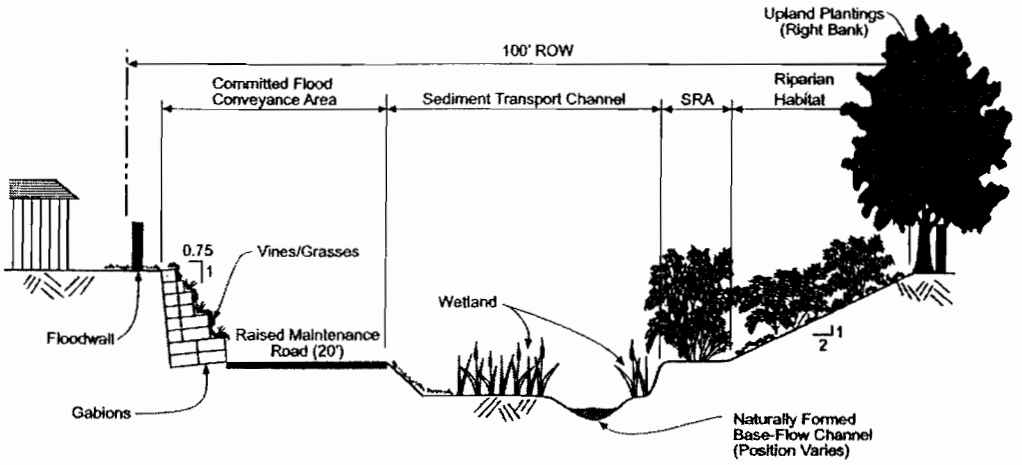
Normal Depth = 11.0 feet, U-frame wall extensions as required.

McKee Road culvert backwater controls in this reach, however, flow depth up to 13 feet.



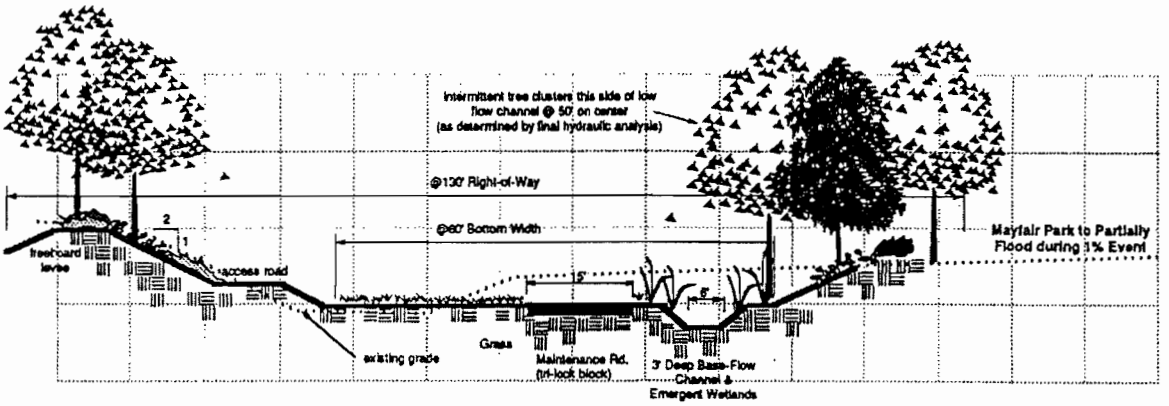
NRCS Reach 3C/D

Flow Depth = 9.8 feet, No floodwalls.



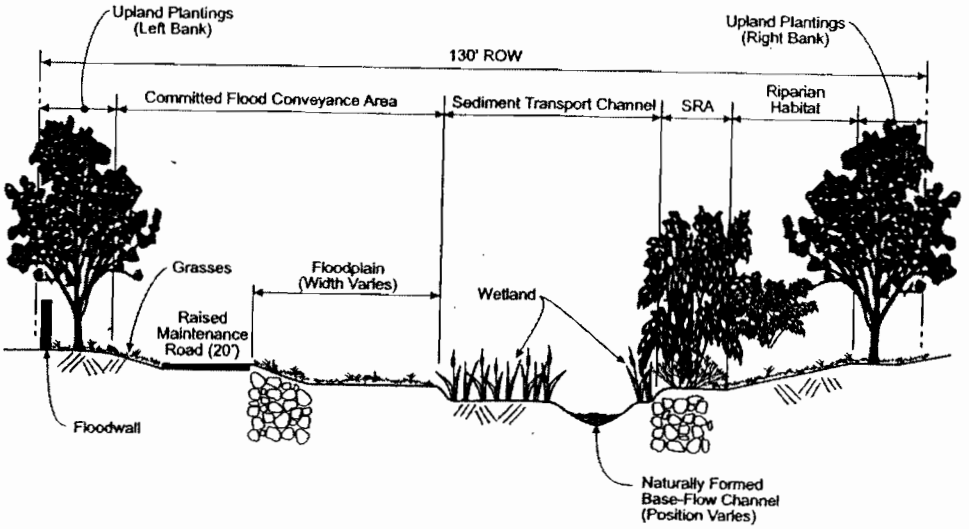
District's Enhanced Reach 3D

Flow Depth = 10.2 feet; No floodwalls.



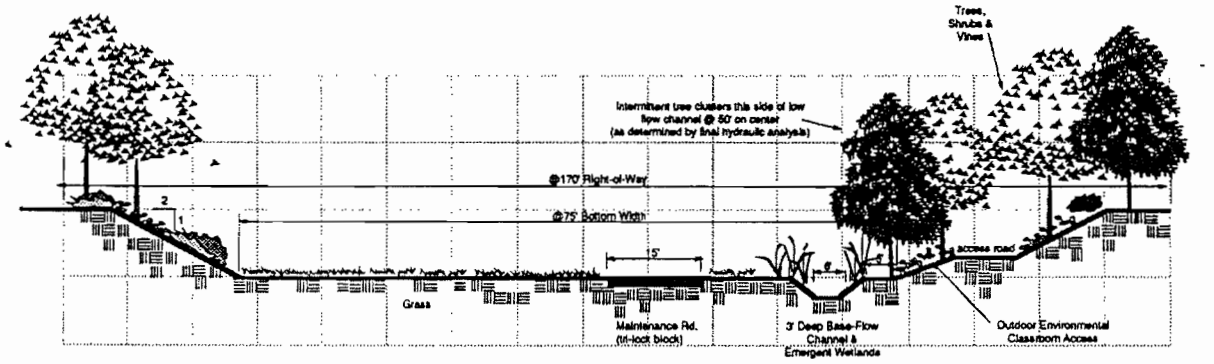
NRCS Reach 3E

Flow Depth = 12.4 feet, Freeboard levee left bank.



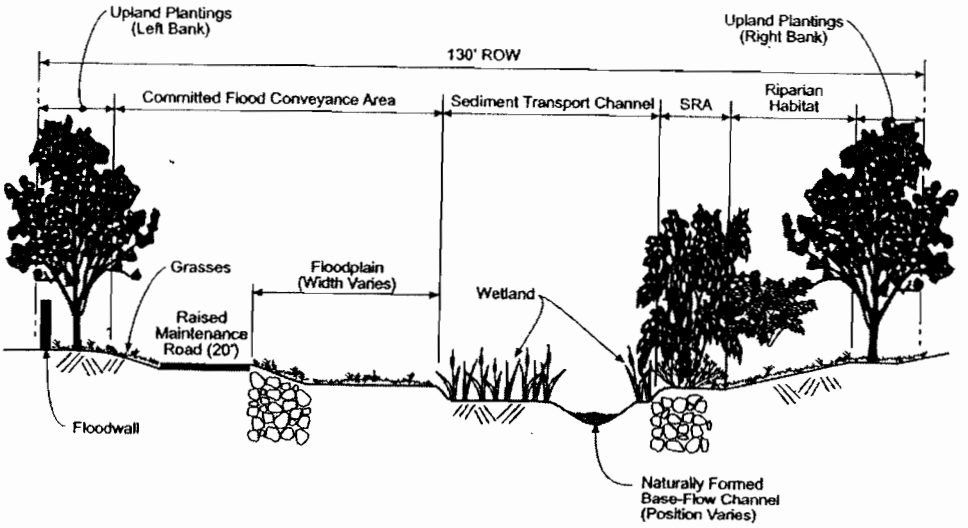
District's Refined Reach 3E

Flow Depth = 10.6 feet, Short freeboard wall left bank.



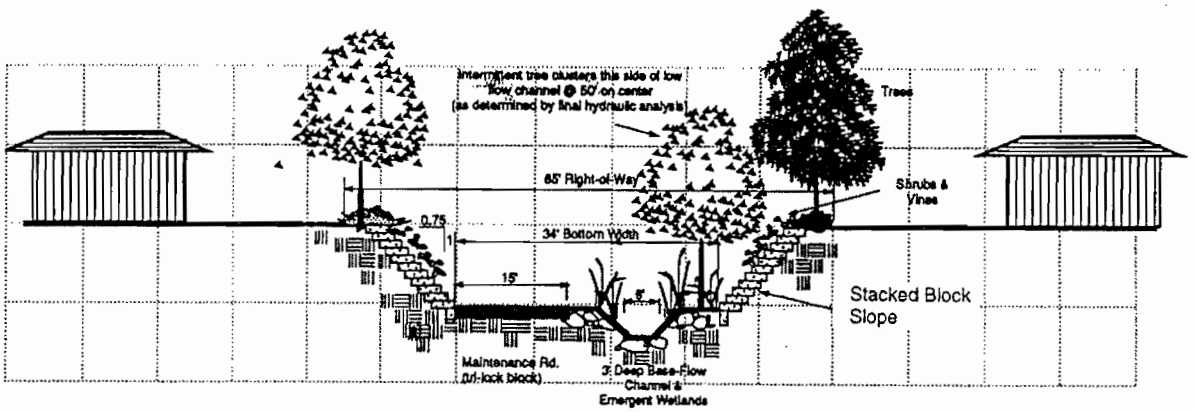
NRCS Reach 3F

Flow Depth = 12.4 feet.



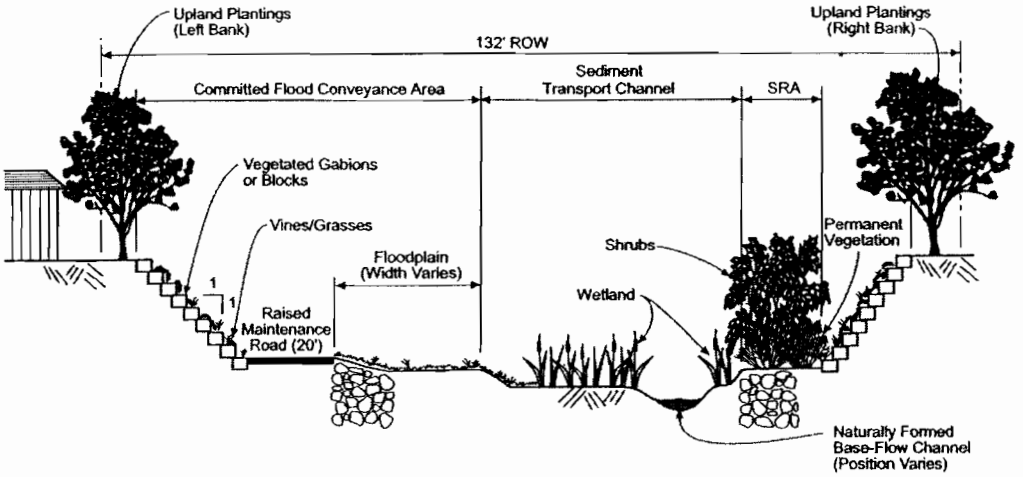
District's Refined Reach 3F

Flow Depth = 9.5 feet, Short freeboard wall left bank.



NRCS Reach 4

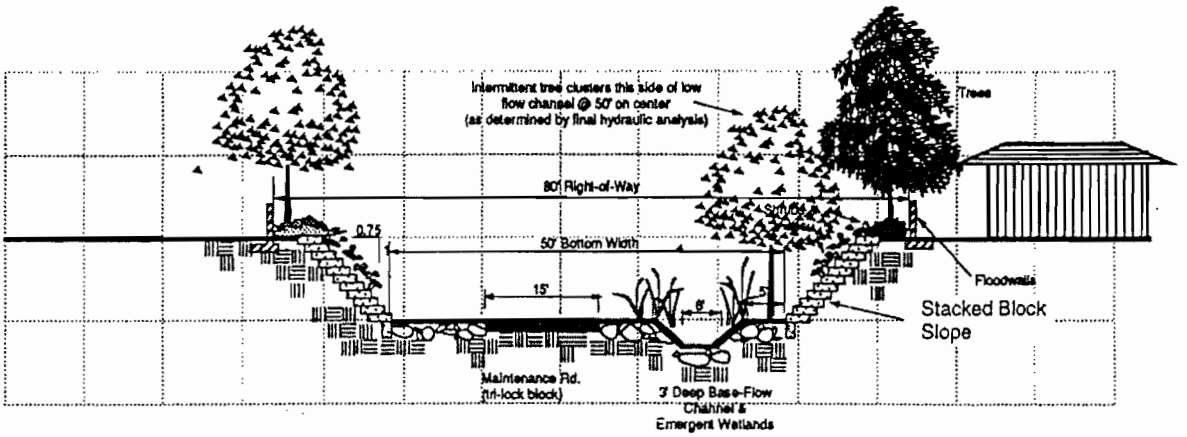
Flow Depth = 9.9 feet. Floodwalls on both banks.



District's Refined Reach 4

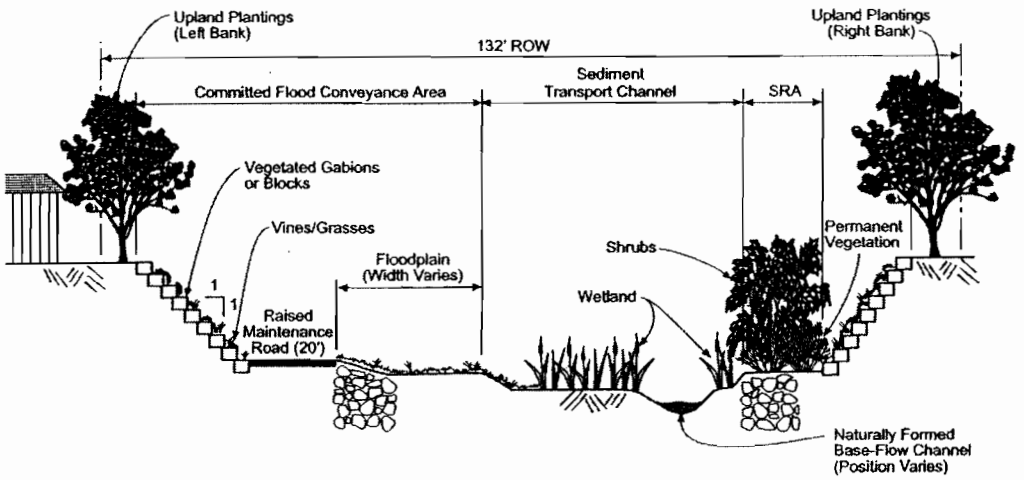
Normal Depth = 8.8 feet. Floodwalls required in backwater area only (800 LF)

Flow Depth = 11.8 feet due to backwater from Interstate 680 culvert.



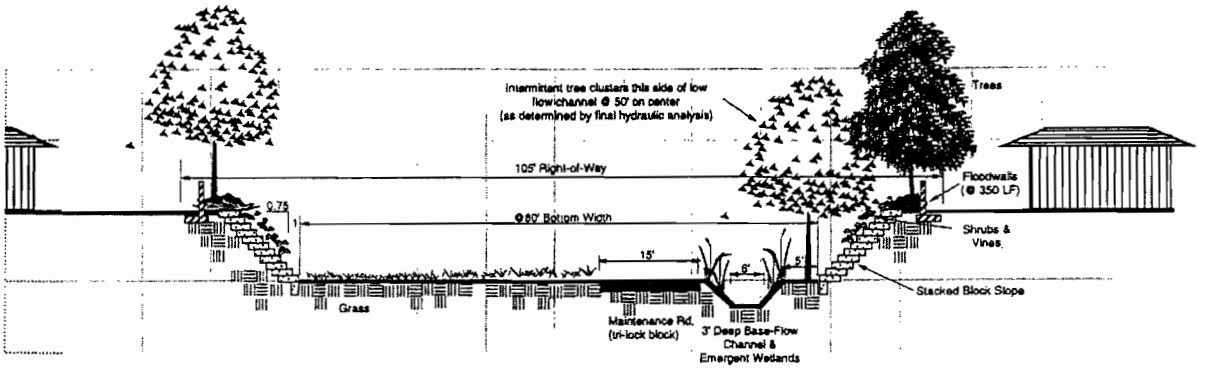
NRCS Reach 5

Flow Depth up to 11 feet. Floodwalls on both banks.



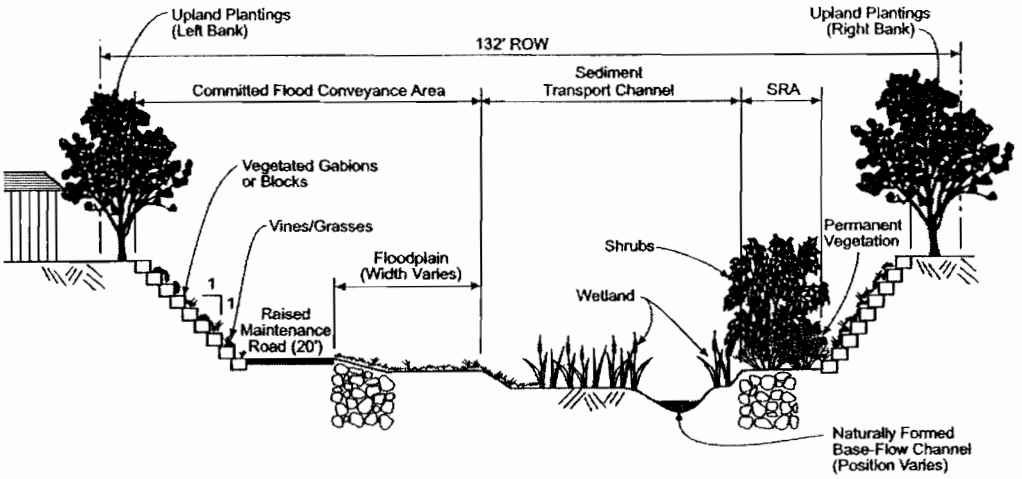
District's Refined Reach 5 (Similar to Reach 4)

Flow Depth up to 12 feet. Freeboard walls as required.



NRCS Reach 6

Flow Depth up to 11 feet. Floodwalls on both banks, Moss Point Drive to Cunningham Avenue.



District's Refined Reach 6 (Similar to Reach 5)

Flow Depth up to 12 feet. Floodwalls on both banks from Ocala Avenue to Cunningham Avenue.

BRIDGE REPLACEMENT

As stated previously, the 1983 NRCS update plans appear to be based on normal depth calculations with no backwater effects due to Coyote Creek, bridges, or other transitions. Under that assumption, the one-percent water surface is carried at or near the natural banks of Lower Silver Creek, as is the case with the refined District plans. Floodwalls and levees would primarily be constructed to meet District freeboard criteria, and would be on the order of no more than about three feet above natural ground. As discussed in this chapter, however, bridges and other structures can have a significant impact on water surface elevations, and to the point where bridge and culvert improvements are necessary to avoid excessively high floodwalls.

Table 5-1 presents a step-wise backwater analysis that looks at the effects of rehabilitating individual bridges beginning downstream at Wooster Avenue, which is currently scheduled for replacement by the City of San Jose. Bridges are recommended for improvement or replacement if the one-percent energy loss through them is sufficient to raise floodwall heights above four feet as measured from nearest adjacent grade, or if there are other compelling aesthetic or economic concerns as explained herein. Bridges off limits to replacement for economic or other reasons include the Western Pacific Railroad, U.S. Highway 101, McKee / King Road, and Interstate 680.

Table 5-1: Stepwise Bridge Replacement Matrix

Bridge Location	Existing Bridge Structures		Replace?	With New Bridge Structures	
	1% WSEL	U/S Floodwall Height		1% WSEL	U/S Floodwall Height
Wooster Avenue	84.83	N/A	Per CSJ	84.93	N/A
Walgreens	88.17	1.8'	NO		
Alum Rock Avenue	107.52	15.5'	**YES**	92.77	N/A
Sunset Avenue	99.39	5.4'	**YES**	95.93	N/A
San Antonio Street	99.84	0.8'	NO		
Jackson Avenue	110.41	8.4'	**YES**	106.81	5'
Capitol Expressway	120.95	9.5'	**YES**	111.86	N/A
Story Road	124.32	3'	**YES**[1]	123.51	2'
Murtha Drive	125.63	N/A	NO		
Moss Point Drive	128.00	N/A	NO		
Ocala Avenue	128.37	3'	NO		

[1]At planners' discretion to reduce upstream floodwall costs.

REACH BY REACH EVALUATION

Design one-percent water surface profiles are included in this Chapter. Appendix E contains numeric information including design water surface elevations, channel velocities, freeboard requirements, and Froude Number (channel stability) for both extremes of channel roughness. Within the following paragraphs, design freeboard and hydraulic stability are addressed. Channel cross sections referenced in this report are oriented looking upstream.

Reach 1. Coyote Creek to Miguelita Creek (Station 0+73 to Station 38+50)

From the confluence with Coyote Creek to Highway 101, the right bank of Lower Silver Creek provides a means for upstream Coyote Creek spills to re-enter the Silver Creek / Coyote Creek system. Therefore, levees or floodwalls should not be constructed along the right bank of Lower Silver Creek until a future Coyote Creek project is completed. The design one-percent water surface elevation assuming coincident flow in Coyote Creek is contained by the natural banks everywhere in this reach between Station 7+00 to Highway 101, with the exception of approximately 100 feet upstream from Station 15+20, where the natural right bank is roughly 0.3 foot too low. Below Station 7+00, the right overbank is also a part of the Coyote Creek overbank, and this area will continue to be flood prone after project completion.

Upstream of Highway 101 the design one-percent water surface elevation is contained by natural grade everywhere except for the left bank between Stations 22+00 and 23+00, where the design water surface is 0.2 foot above the ground surface. To meet FEMA and District/NRCS freeboard criteria, a floodwall is necessary along both banks between the freeway and the new Walgreens Bridge downstream of McKee Road. The top of wall elevation should be a straight grade beginning at elevation 90 feet NAVD at the upstream face of the Highway 101 Bridge, terminating at an elevation of 91 feet NAVD at the Walgreens Bridge in Reach 2. Floodwall heights, as measured from adjacent grade, will vary from approximately six inches to 3.2 feet at a maximum. Average wall height in this reach is roughly two feet.

Reach 2. Miguelita Creek to McKee Road (Station 38+50 to Station 52+35)

At the low range of Manning's roughness values, channel velocities could approach 10 feet per second but Froude numbers remain less than 0.6, indicating stable subcritical flow. The energy grade line is fully contained by proposed floodwalls or natural ground throughout this reach. Predicted superelevation at the tightest curve (a radius of 313 feet) within the 46-foot wide U-frame channel in Reach 2 is less than 3 inches, and still below the natural bank elevation.

Reach 3. McKee Road to Interstate 680 (Station 54+30 to Station 125+00)
Backwater from the constriction formed by the McKee Road culvert influences the design water surface profile upstream to Alum Rock Avenue. Because of this backwater, District levee freeboard criteria will govern the design of floodwalls. Floodwaters will be allowed to back up into the Plata Arroyo Park. 100-year floodwater should inundate the basketball courts and most of the park itself, and will release to Melrose Street unless a small area along the edge of the park is regraded to contain the floodwater as shown in Figure 5-1.

Figure 5-1: Plata Arroyo Inundation

Proposed bridge replacements at Alum Rock Avenue and Sunset Avenue enable the design water surface elevation to be carried well below natural grade with adequate freeboard, even under potentially supercritical conditions (low "n") in the concrete lined portions of this reach. Floodwalls are not required from Station 82+00 to 104+50. Maximum water surface superelevation under potential supercritical flow is could reach almost one foot, but this is well below natural grade. Under subcritical flow conditions, the superelevation is limited to less than 0.2 foot.

At Alum Rock Avenue the constriction in width imposed by the existing bridge causes the severe problems presented in Table 5-1. It is possible to solve the hydraulic problems by replacing this bridge with a longer clear-span structure across the proposed 60-foot wide U-frame channel section carried upstream from Reach 3C, without the need to raise its soffit elevation. It must be emphasized that unless the Alum Rock structure is replaced, upstream channel cannot function, and will not contain the one-percent flood with the proposed system of floodwalls.

Installing two additional 10' x 15' box culverts will rectify a similar but less extreme hydraulic constriction at Sunset Avenue. The new culvert invert will be depressed to allow for a naturally forming low-flow channel to cut itself through this reach.

At San Antonio Street, the existing bridge does not pose a hydraulic problem. To simplify the transitions to the upstream and downstream channel sections, and modify the channel invert as desired, it is recommended that the "floating" channel lining be removed and replaced with vertical walls against the abutments. The floating lining is not structurally tied to the bridge abutments or superstructure, and can be removed without compromising the bridge's structural integrity.

Between San Antonio Street and Interstate 680, freeboard walls are needed primarily along the left bank to protect the overbank where natural ground is slightly low. Floodwater will be allowed to leave the south right-of-way and encroach slightly into Mayfair Park, where the water is contained by higher ground.

If vegetation is not established prior to a large runoff event, or is removed during such an event, there is the potential for a hydraulic jump to form between Stations 123+50 and 124+50, where the unstable energy grade line would not necessarily be contained by the proposed freeboard. This is considered to be an unlikely scenario, but it does emphasize the need to provide temporary erosion protection until vegetation is established.

Reach 4. Interstate 680 to North Babb Creek (Station 128+30 to Station 170+50)
The culvert at Interstate 680 is not especially problematic, and does not pressurize when passing the design 100-year discharge. However, natural bank elevations immediately upstream of the interstate and Jackson Avenue are about a foot lower than the culvert soffit, so the design water surface profile is carried almost one foot above grade upstream of Jackson Avenue.

An 80-foot wide in-stream sediment basin with vertical walls will be established between Interstate 680 and Jackson, with access from Jackson Avenue. (As described in Chapter 2, sediments tend to accumulate within this stretch of the channel.) To minimize upstream floodwall elevations and the difficulty of removing sediments within a more complicated transition, the Jackson Avenue culvert will be replaced with a five-cell structure to match the downstream U-frame channel width. Floodwalls immediately upstream of Jackson will need to be nearly 5 feet above the lowest adjacent ground (right bank), tapering to match higher ground at Station 139+00. Between this location and Capitol Expressway, floodwalls are not needed.

The twin 12' x 12' box culverts at Capitol Expressway are inadequate to pass the design one-percent discharge, so an additional 12' x 12' box culvert will be added without disturbing the Expressway grade. Between the expressway and North Babb Creek, the one-percent water surface profile is contained by natural ground, but freeboard walls ranging in height from 1.5 to 2.5 feet are necessary. Regardless of the relative ground elevations on each bank, each floodwall must have an identical profile to provide equal levels of flood protection to each side.

Flow remains subcritical throughout Reach 4 even with a lower channel roughness assumption. Froude numbers exceed 0.8 in Reach 4C, which indicates possible flow instability. As described in Chapter 6, this sub-reach may be susceptible to erosion.

Reaches 5 and 6. North Babb Creek to Cunningham Avenue (Station 170+50 to Station 244+60)
About 140 feet of the Story Road culvert will be converted to open channel, and an additional 12-foot by 14-foot box culvert cell added to improve upstream hydraulics. Freeboard walls are needed almost to Murtha Drive, primarily on the right bank, which is two feet lower in elevation than the left bank. Between Murtha Drive and Ocala Avenue, the natural banks provide adequate freeboard. Some limited wall construction or a maximum fill of one foot is needed to provide District/NRCS freeboard on the left bank between station 224+00 and 230+00. The Ocala Avenue Bridge would not cause problems during a design runoff event, but ground elevations upstream of the bridge are three feet lower than those downstream, so floodwalls are required.

INTERIOR DRAINAGE ADJACENT TO FLOODWALLS

One major concern with the construction of floodwalls is the possibility of trapping local drainage water against the wall system, and commensurately increasing the depth of local flooding when the natural overland release to the creek is eliminated.

In general, however, Lower Silver Creek is a "perched" channel whereby drainage tends to run away from the creek rather than toward it. Field reconnaissance has confirmed this situation. For the most part, the construction of floodwalls will not adversely impact local drainage patterns, other than perhaps the back half of lots directly adjacent to the creek. Drainage systems shall be provided as needed.

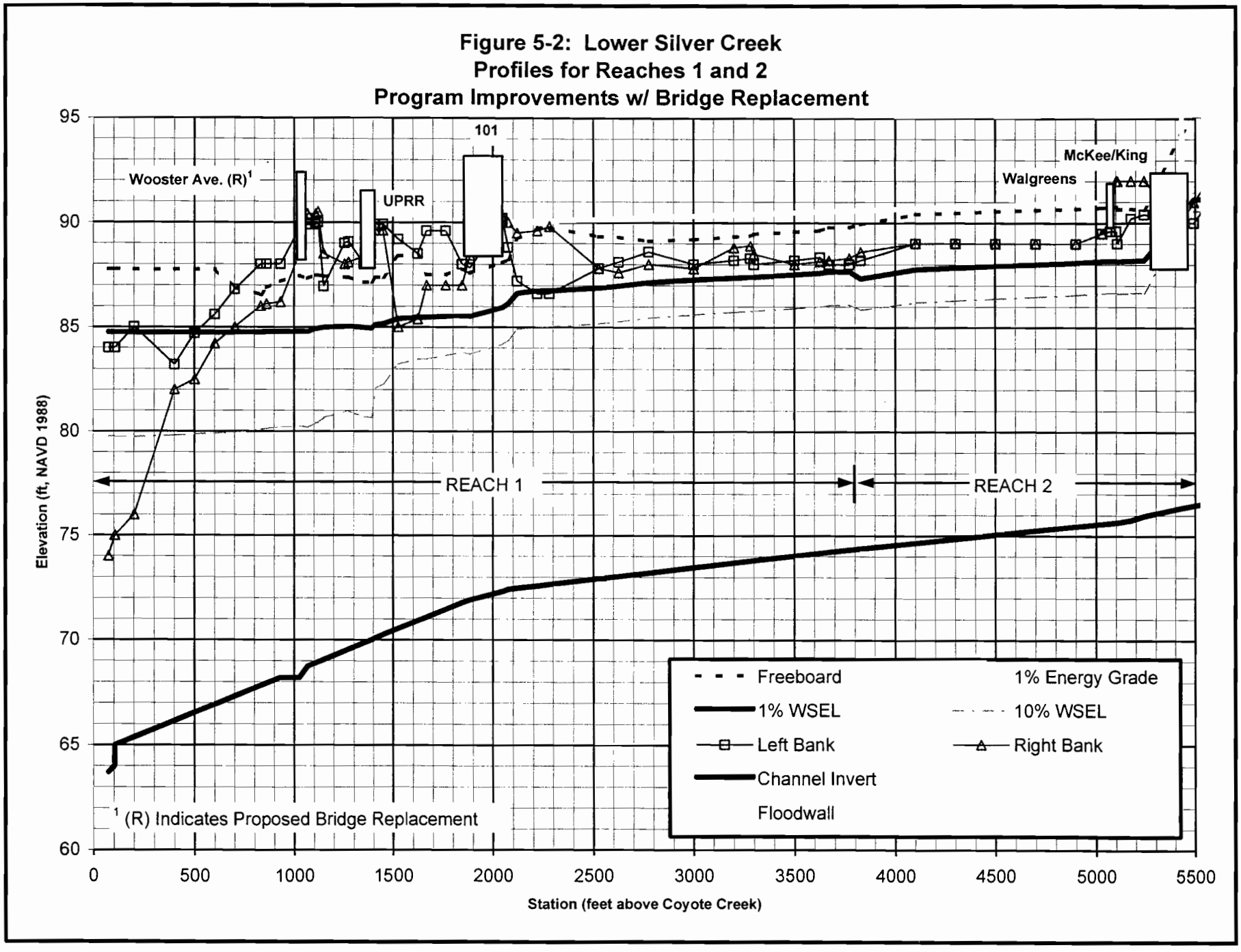


Figure 5-2: Lower Silver Creek
Profiles for Reaches 1 and 2
Program Improvements w/ Bridge Replacement
Wooster Ave. (R)[1]
UPRR
101
Walgreens
McKee/King
REACH 1
REACH 2
Freeboard
1% Energy Grade
1% WSEL
10% WSEL
Left Bank
Right Bank
Channel Invert
Floodwall
[1] (R) Indicates Proposed Bridge Replacement
Elevation (ft, NAVD 1988)
Station (feet above Coyote Creek)
95
90
85
80
75
70
65
60
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500

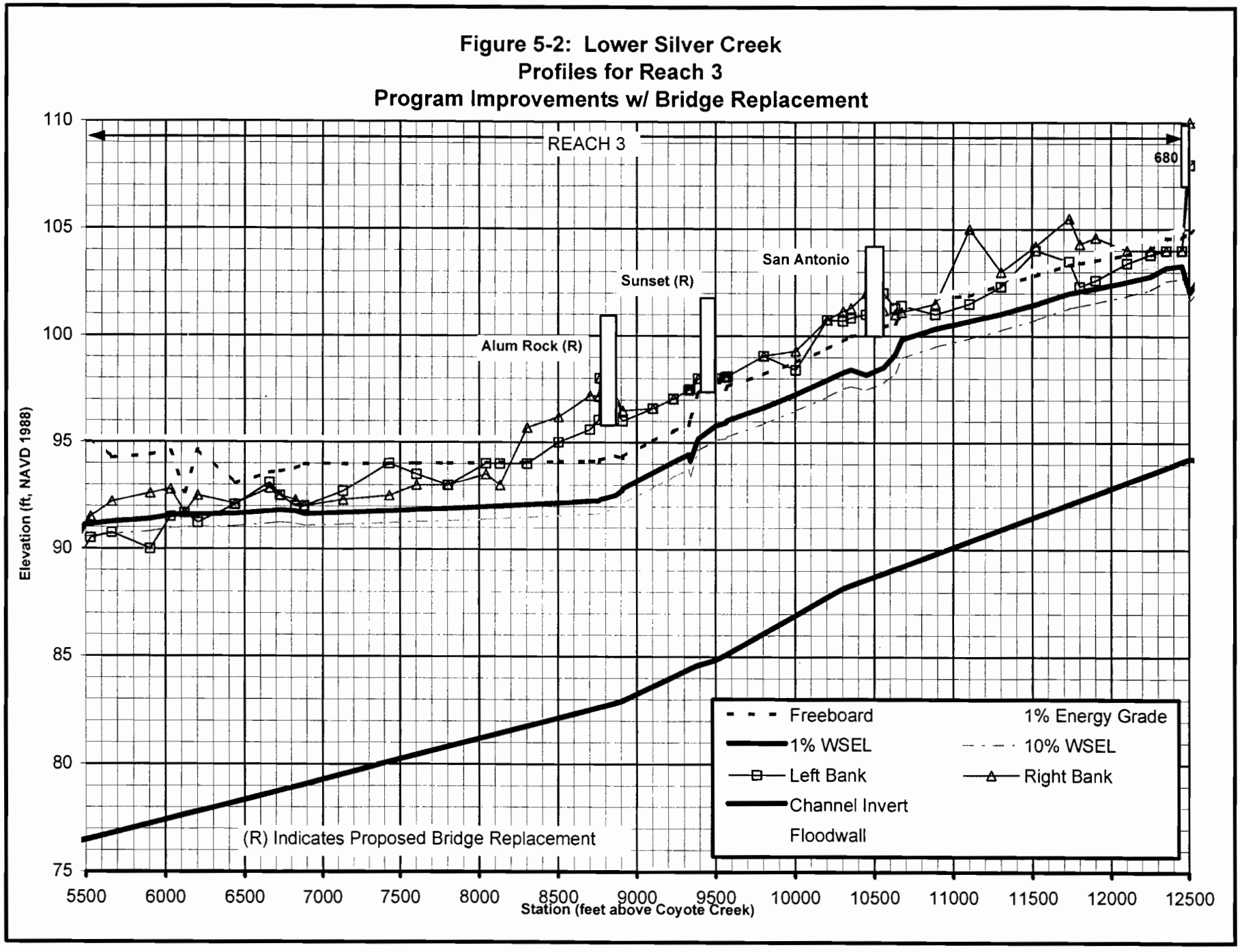


Figure 5-2: Lower Silver Creek
Profiles for Reach 3
Program Improvements w/ Bridge Replacement
REACH 3
680
San Antonio
Sunset (R)
Alum Rock (R)
Elevation (ft, NAVD 1988)
110
105
100
95
90
85
80
75
5500
6000
6500
7000
7500
8000
8500
9000
9500
10000
10500
11000
11500
12000
12500
Station (feet above Coyote Creek)
(R) Indicates Proposed Bridge Replacement
Freeboard
1% Energy Grade
1% WSEL
10% WSEL
Left Bank
Right Bank
Channel Invert
Floodwall

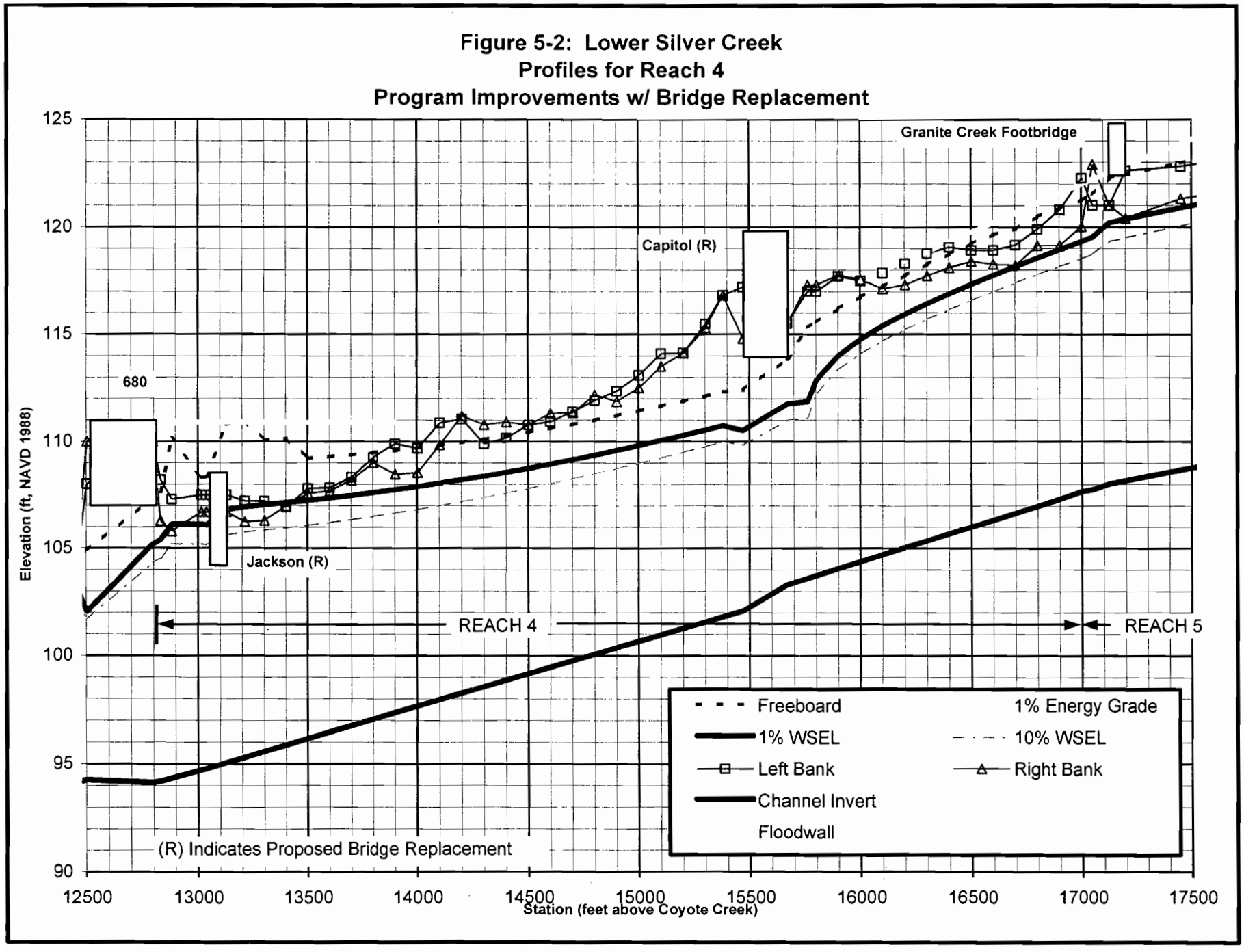


Figure 5-2: Lower Silver Creek
Profiles for Reach 4
Program Improvements w/ Bridge Replacement
Granite Creek Footbridge
Capitol (R)
680
Jackson (R)
REACH 4
REACH 5
Freeboard
1% Energy Grade
1% WSEL
10% WSEL
Left Bank
Right Bank
Channel Invert
Floodwall
(R) Indicates Proposed Bridge Replacement
Elevation (ft, NAVD 1988)
Station (feet above Coyote Creek)
125
120
115
110
105
100
95
90
12500
13000
13500
14000
14500
15000
15500
16000
16500
17000
17500

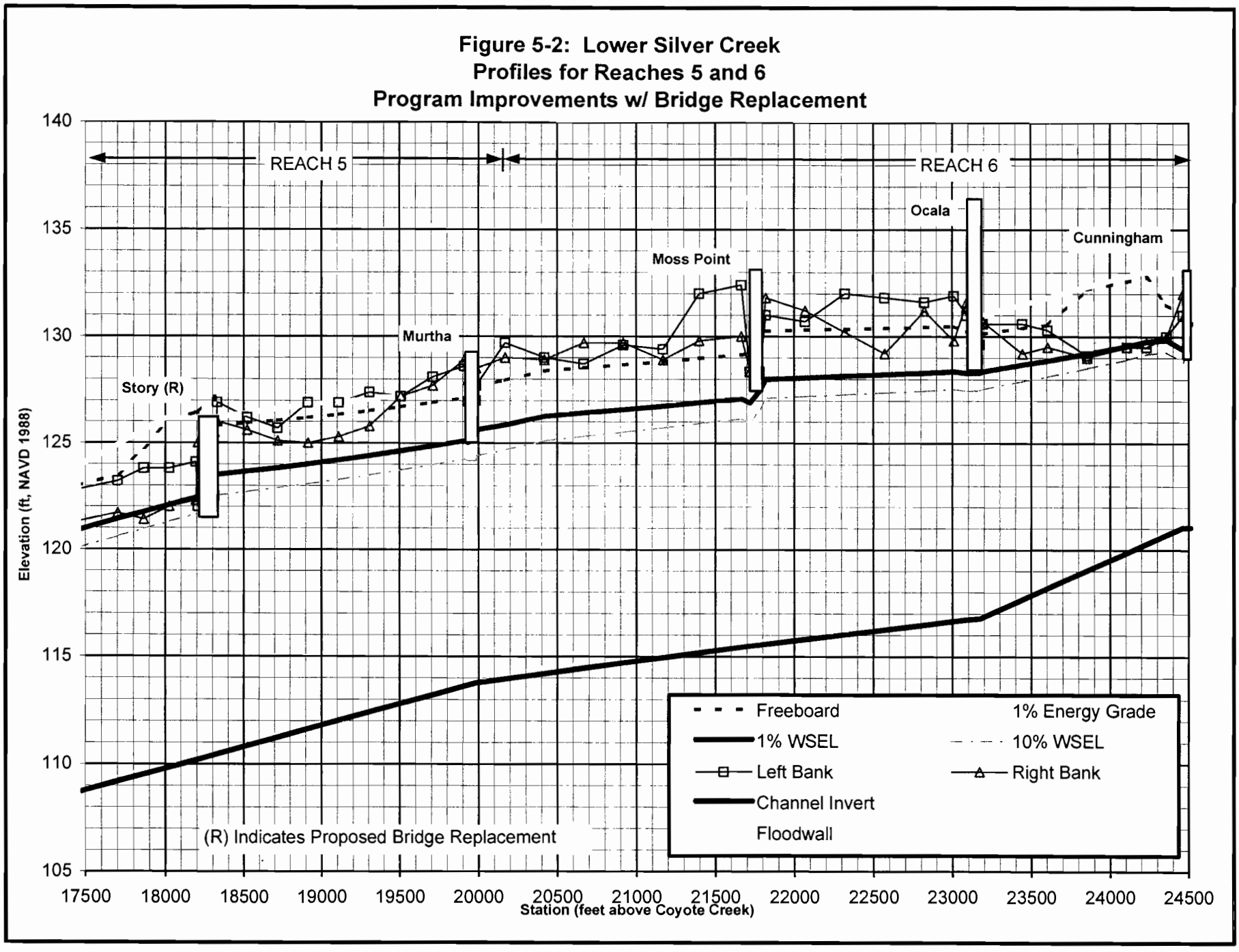


Figure 5-2: Lower Silver Creek
Profiles for Reaches 5 and 6
Program Improvements w/ Bridge Replacement
REACH 5
REACH 6
Story (R)
Murtha
Moss Point
Ocala
Cunningham
(R) Indicates Proposed Bridge Replacement
Freeboard
1% Energy Grade
1% WSEL
10% WSEL
Left Bank
Right Bank
Channel Invert
Floodwall
Elevation (ft, NAVD 1988)
Station (feet above Coyote Creek)
140
135
130
125
120
115
110
105
17500
18000
18500
19000
19500
20000
20500
21000
21500
22000
22500
23000
23500
24000
24500

CHAPTER 6
SEDIMENT MANAGEMENT

The management of scour and sediment deposition within Lower Silver Creek may have a great impact on the future success of proposed flood protection and geomorphic improvements. This chapter addresses low-flow and extreme event sedimentation in a preliminary manner.

BASIC SEDIMENT TRANSPORT CONCEPTS

Sediment originates from the upland areas of the tributary catchments, and is transported down the natural and concrete-lined channels, with a portion of that transported sediment reaching the outfall at Coyote Creek. Significant volumes of sediment have been deposited within certain reaches of the existing creek channel as documented in Chapter 2, particularly at McKee Road, Interstate 680 and above Cunningham Avenue. If this sediment deposition is not properly managed over time, the channel will not perform as designed and could exacerbate the potential for urban flooding.

Sediment Transport Capacity

Sediment transport capacity is defined as the ability of flowing water to move sediment downstream. A variety of variables can be used to quantify the magnitude of sediment transport capacity, but the product of unit weight of water (γ), flow depth (y), flow velocity (v) and energy slope (s) has been found to be a good predictor. This product is known as the stream power per unit area, that is:

$$Stream\ Power = \gamma\ y\ \ v\ \ s$$

The impact of potential changes to a channel design on sediment transport capacity can be assessed with this equation. For example, if water is diverted out of a channel, the product of velocity, flow depth and energy slope of the flowing water remaining in the channel is likely to diminish. This implies that the sediment transport capacity of the water remaining in the channel may decrease.

Sediment Availability

Sediment availability determines, concurrently with the transport capacity, how much sediment water flowing in a stream will carry. If, for example, a stream can carry 10 pounds of sediment per second, but upstream erosion from the river bed and banks, and other sediment input make only 5 pounds of sediment per second available for transport, then the sediment carried by the stream cannot exceed 5 pounds of sediment per second. Conversely, if 10 pounds of sediment per second is available to be transported by a stream, but its sediment transport capacity is only 5 pounds of sediment per second, then only 5 pounds of sediment per second will be transported. The remainder will be deposited.

Sediment Load

Sediment load consists of wash, suspended and bed loads. Wash load is made up of very fine, colloidal particles such as clay, that often remain in suspension even when the sediment transport capacity of the water reduces significantly. Suspended load consists of fine sediment particles, and can settle onto the riverbed or flooded overbank areas if the sediment transport capacity of the water reduces enough. Most of the sediments found in Lower Silver Creek fall into this category. Bed load is coarser material that moves along the riverbed as flowing water drags it along. It ceases to move as the sediment transport capacity of the water diminishes.

If flow in a channel is large enough to overtop its banks, the bed load usually remains in the main channel, while the suspended and wash load are contained in the water column over the main channel and in the water column over the flooded overbank area. The sediment transport capacity in the main channel is often large enough to maintain suspension of the suspended load within this water column, but it can reduce enough in the flooded overbank area to deposit the suspended sediment (and sometimes even the wash load).

Maintenance Flow

A typical natural cross section of a stream consists of a main channel and an overbank (also known as a floodplain). Research and field observations over many years suggest that the water discharge capacity of the main channel (i.e. the volume of water that it can discharge per second when it flows full to the edge of its bank) is equivalent to approximately the two-year recurrence interval flow. When the discharge in the stream exceeds this flow magnitude, it overtops its banks with water flowing onto the floodplain.

LOW-FLOW REGIMES

Annual sediment management is primarily concerned with sediment transport behavior for low-flow events. One of the Program's goals is to provide for naturally occurring sediment transport within significant reaches of the unlined channel. This portion of the report addresses sedimentation during low-flow events and examines the potential for annual sediment loading from influent tributaries.

Sediment Transport Channel

An unlined sediment transport channel has been proposed as a mechanism for providing natural deposition and scour in Lower Silver Creek. As a natural phenomenon, the quantitative geomorphologic behavior of this channel is unpredictable, but since its size and slope will not be significantly different than the existing channel section, past geomorphology is likely to be a good predictor of future conditions, assuming that the average climate remains about the same.

Photographs from Chapter 2 provide one predictor of sediment transport channel behavior. For the most part, the existing low-flow channel is straight with some slight meandering in certain reaches. Sediment deposits at the fringes of the open water support emergent wetland vegetation. Significant accumulations of sediment and more extensive vegetation are seen just upstream of the McKee Road Bridge, Interstate 680, and Cunningham Avenue.

Table 6-1 provides an assessment of minimum discharges required to initiate bed particle movement within the sediment transport channel on a reach-by-reach basis. (For a point of reference, the design depth of the transport channel will vary from 2.5 to 3.0 feet depending upon the reach.) Since the minimum estimated two-year discharge is 600 cfs, there should be some transport of sediment in all reaches at least every other year. At District direction, a roughness coefficient of 0.04 is assumed for this analysis. Based on grain size distributions for sediment near Lake Cunningham, the largest particle size that needs to be transported downstream is approximately 2mm, which represents large sand. The critical velocity for incipient sediment motion is calculated as:

$$V_c = K_u \; y^{1/6} \; D^{1/3}$$

where V_c = critical velocity to transport sediment of size D and smaller
y = average depth of flow
D = median particle size (2 mm)
K_u = 11.17 (dimensionless)

Table 6-1: Threshold of Discharge for Sediment Transport

Reach	Transport Channel Width	Threshold Discharge for Transport	Depth of Flow at Incipient Motion
1A, B	28 feet	60 cfs	0.9 foot
1C, D	50 feet	500 cfs	3.5 feet
3A	30 feet	250 cfs	2.5 feet
3D	26 feet	60 cfs	1.0 foot
3E,F	26 feet	80 cfs	1.3 feet
4B	49 feet	150 cfs	1.3 feet
4C	21 feet	50 cfs	1.1 feet
5	21 feet	120 cfs	2.0 feet
6A	56 feet	525 cfs	3.6 feet
6B	31 feet	80 cfs	1.1 feet

Stream Slope Stability

Without detailed knowledge of the sediment supply from the Lake Cunningham area or tributary creeks, a preliminary slope stability analysis has been made using a tractive force analysis to estimate the equilibrium slope where bed material movement ceases:

$$S_{eq} = \left[K_s D_c \left(\frac{\gamma_s - \gamma}{\gamma} \right) \right]^{(10/7)} \left(\frac{K_u}{qn} \right)^{(6/7)}$$

where	S_{eq}	=	Channel slope at which particles D_c will no longer move
	q	=	Discharge per unit width
	K_s	=	Shield's Parameter
	K_u	=	1.486
	n	=	Manning roughness coefficient = 0.020 as a worst case
	D_c	=	Critical bed material size = D_{90}
	γ	=	Unit weight of water = 62.4 pounds per cubic foot
	γ_s	=	Unit weight of sediment = 165 pounds per cubic foot (specific gravity = 2.65)

The critical size of sediment used in this equation is D_{90} because the streambed will coarsen (armor itself) as degradation occurs. Sediment sizes are based on gradation curves provided by Parikh Consultants, Kleinfelder, and Geotechnical Consultants for soil borings taken near the depth of the finished channel invert. Long-term slope stability is predicated upon the "dominant discharge," which is typically considered to be the two-year flow.

The Shield's Parameter is a function of bed shear and sediment size:

$$U_{*c} = \left(\frac{\gamma \ \mathrm{d} \ \mathrm{S}}{\rho} \right)^{1/2}$$

where	$U_{*,c}$	=	Shear velocity (feet per second)
	γ	=	Specific weight of water = 62.4 pounds per cubic foot
	d	=	Depth of flow (feet)
	S	=	Energy gradient (foot per foot)
	ρ	=	Density of water (1.94 slugs per cubic foot)

The boundary Reynolds Number is:

$$R_* = \frac{U_{*,c}\, d_c}{\upsilon}$$

where $U_{*,c}$ = Shear velocity (feet per second)
d_c = critical bed material size (feet)
ν = kinematic viscosity of water = 0.00001 feet squared per second

Shield's diagram published by ASCE (Sedimentation Engineering, 1975), is used to obtain K_s. The specific gravity of streambed material is assumed to be 2.65 in all calculations. Appendix E provides a table listing equilibrium slopes calculated within each reach, together with a maximum expected depth of upstream degradation, and recommended spacing of channel stability measures that would limit maximum long-term depth degradation to three feet, which is the desired depth of the naturally forming low flow channel. The analysis provided in Appendix E is based on hard maintenance floors at the following bridges or channel sections:

Coyote Creek	Interstate 680
Highway 101	Jackson Avenue
Reach 2	Capitol Expressway
McKee Road	Story Road
Reach 3B	Moss Point Drive
Sunset Avenue	Cunningham Avenue

Calculations show that maximum predicted long-term degradation could be up to 7 feet without additional grade stabilization measures. Although it is not analytically possible to include the effects of the cohesive soils on-site, additional five-foot deep cutoff walls installed at the following locations are recommended to minimize the potential for long-term invert degradation:

Station 7+00	Station 165+00
Station 14+00	Station 173+00
Station 105+00	Station 194+00
Station 115+00	Station 205+00
Station 139+00	Station 227+00
Station 147+00	Station 236+00

SOURCES OF ADDITIONAL SEDIMENT

If the channels that deliver runoff from Tully Road to Cunningham Avenue are utilized as sediment retention facilities as planned, then the inflow of bed-load sediment to Lower Silver Creek should be limited to its downstream tributaries. Based on previous statistical analyses performed by Schaaf & Wheeler for the District's Norwood Creek and Flint Creek debris basins, the average annual debris and sediment loading factor is about 650 cubic yards per tributary square mile per year. This statistic is for rural areas, and if the factor is applied to the rural tributaries of South Babb, North Babb, and Miguelita Creeks, these annual debris loadings might be expected:

South Babb Creek	3.4 mi^2	2,200 CY/year
North Babb Creek	1.1 mi^2	800 CY/year
Miguelita Creek	1.8 mi^2	1,200 CY/year

Predicting the average amount of sediment that will actually reach Lower Silver Creek is difficult, because sediment transport could be limited by the "creek" conveyance facilities through urban areas. (South Babb Creek runs in a concrete box culvert, while North Babb and Miguelita Creeks flow through concrete pipes.)

SEDIMENT TRANSPORT DURING EXTREME EVENTS

The movement of sediment during extreme runoff events has far more damage potential than the previously discussed low-flow regime transport concepts. If sediment transport is severe enough, there is the potential for catastrophic channel damage and flooding.

To assess the potential for in-channel scour and deposition, one can examine a plot of stream power against river station (Figure 6-1 at the end of this chapter). Neglecting the effects of additional sediments from Lake Cunningham and Lower Silver Creek's tributaries, this plot addresses the potential for in-channel scour and deposition during extreme runoff conditions such as the one-percent event. Increasing stream power in the downstream direction indicates a potential for **scour**, where the streamflow entrains additional sediments to balance the transport capacity, such as:

Between Story Road and Capitol Expressway
Between San Antonio Street and Sunset Avenue
Downstream of Highway 101, particularly without Coyote Creek backwater

Decreasing stream power in the downstream direction indicates that the channel reach cannot carry as much sediment as upstream reaches have delivered. When sediment availability exceeds the transport capacity, the excess sediment will be **deposited**, in areas such as these:

Between Jackson Avenue and Capitol Expressway
Sunset Avenue Culvert
McKee Road to Alum Rock Avenue (backwater from McKee Road Culvert)
McKee Road Culvert

Detailed watershed assessments and sediment transport modeling would be necessary to estimate long-term sediment conditions, predict actual scour depths, or analyze sediment accumulations during a design event. These types of analyses are beyond the scope of this report.

Tractive Force Analysis

Flowing water in a channel develops forces, known as tractive forces or shear forces, acting in the direction of flow on the channel bed and sides. This average value of the tractive force per unit wetted are, or unit tractive force, is calculated as:

$$\tau_o = \gamma \; R \; S$$

where	τ_0	=	Unit tractive force (pounds per square foot)
	γ	=	Specific weight of water (62.4 pounds per cubic foot)
	R	=	Hydraulic radius (feet)
	S	=	Energy gradient (foot per foot)

The unit tractive force can be calculated for the flow condition of interest, and compared to the permissible unit tractive force for the type of material through which the channel is excavated. According to Chow, in a trapezoidal channel 97 percent of the unit tractive force is distributed to the bed and 75 percent of the force is distributed to the banks.

Reaches 1 through 3 of Lower Silver Creek will be excavated through cohesive material such as clay, silty clay, and sandy clay. Therefore values of permissible unit tractive forces for cohesive material as converted from USBR data on permissible velocities (Chow, 1959) are compared to actual unit tractive forces. Appendix E provides the comparison.

Permissible tractive force in a cohesive material is a function of the voids ratio and type of soil,

which are obtained from soil testing results along the channel. Soils in Reaches 4 through 6 are clayey sands with gravel. Permissible unit tractive forces are a function of average particle diameter (USBR). Values for channels carrying fine sediments are assumed, with average sediment content.

Tractive force analyses in Appendix E show that if vegetation does not become well established to provide erosion protection, both the channel bed and banks will be subject to erosive velocities and will scour in the design flood event. For unlined reaches of the channel, well-established vegetation is critical to increase channel roughness and reduce the shear force. However, even with increased channel roughness, the design will rely upon vegetation to provide erosion protection, since the estimated tractive force on the banks is still greater than permissible in several reaches.

Bridge Scour

Bridge scour analyses are also beyond the scope of this report, but a detailed assessment has been made for the new Wooster Avenue Bridge under separate contract. That analysis showed the potential for a total scour depth of about 12 feet at the bridge piers under worst-case conditions. Three feet of this scour is long-term degradation (without lateral channel stability measures), with the remainder local contraction and pier scour. Order-of-magnitude estimates for local pier sour have been made at the following bridges that lack concrete protection:

Western Pacific Railroad	5 feet
San Antonio Street	3 feet

MAINTENANCE GUIDELINES

If the sediment transport channel is allowed to completely fill with sediment, the one-percent discharge is passed while leaving no less than about one-half of the design freeboard. The sediment transport channel should be inspected annually. When the average depth of sediment is to within approximately one foot of the level of the maintenance road, the sediment should be removed to original grade. Any sediment that remains on the maintenance road will begin to compromise freeboard and eventually one-percent flood protection.

Figure 6-1: Lower Silver Creek
Sediment Transport Capacity for Reaches 1 and 2
Program Improvements w/ Bridge Replacement

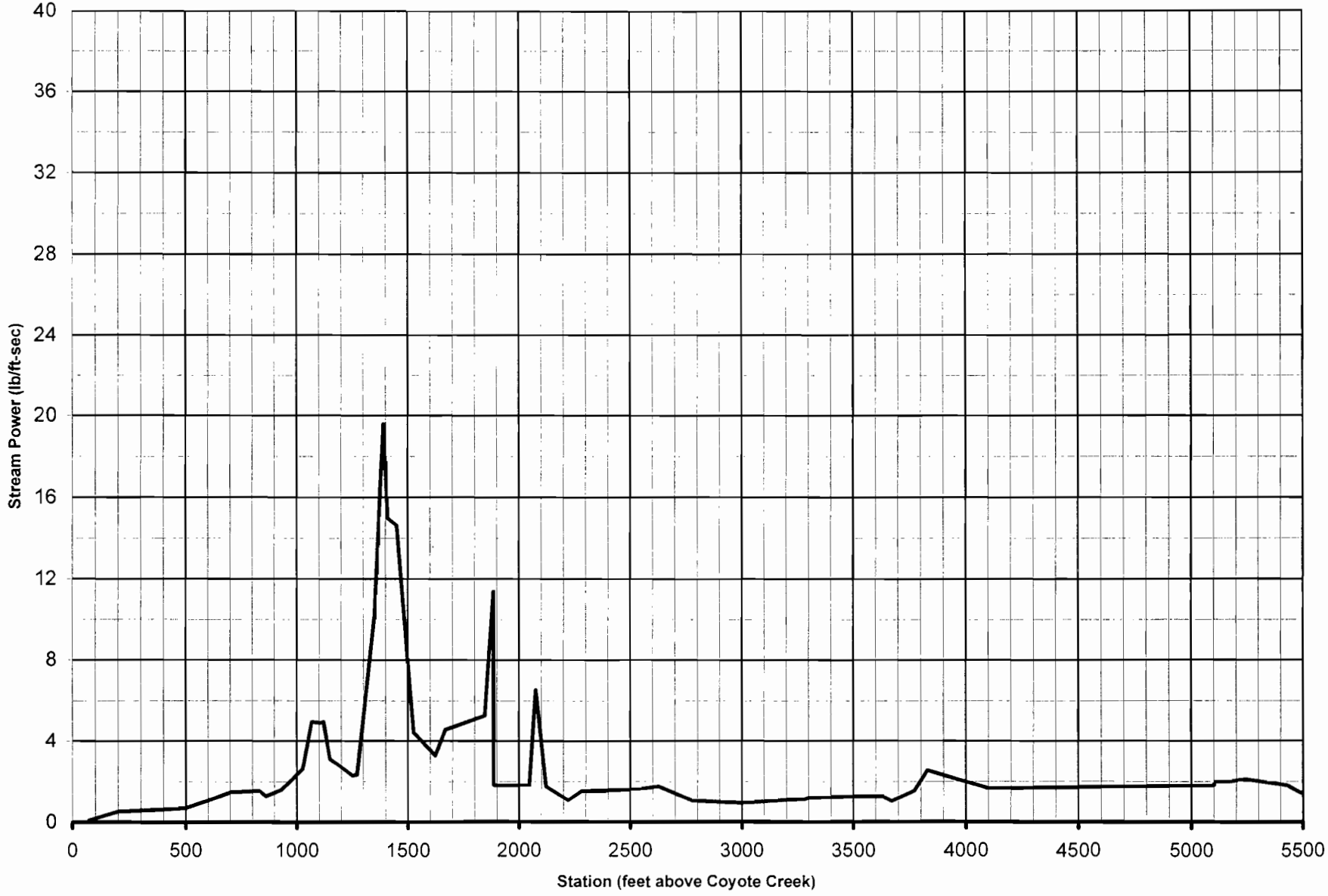


Figure 6-1: Lower Silver Creek
Sediment Transport Capacity for Reach 3
Program Improvements w/ Bridge Replacement

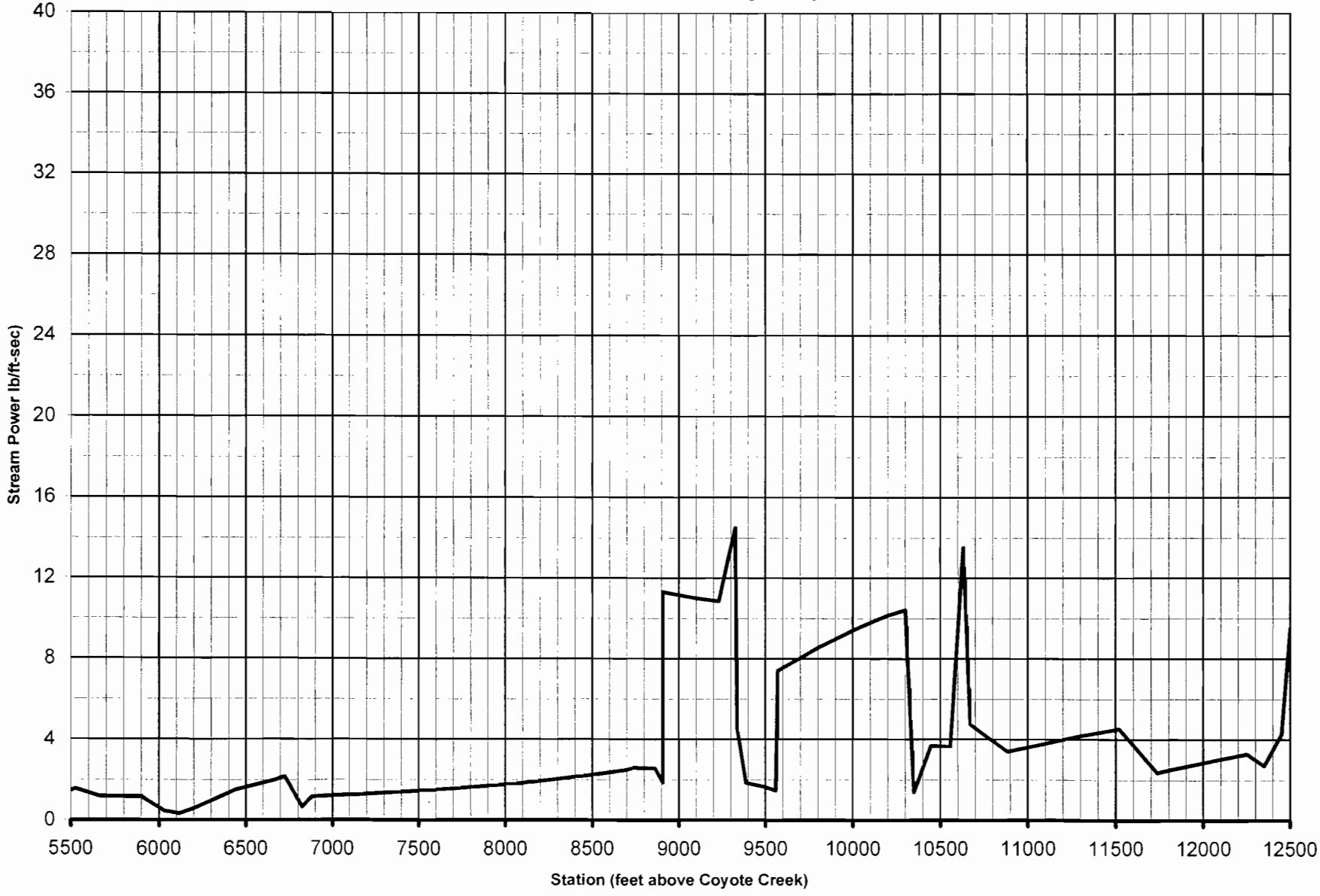


Figure 6-1: Lower Silver Creek
Sediment Transport Capacity for Reach 4
Program Improvements w/ Bridge Replacement

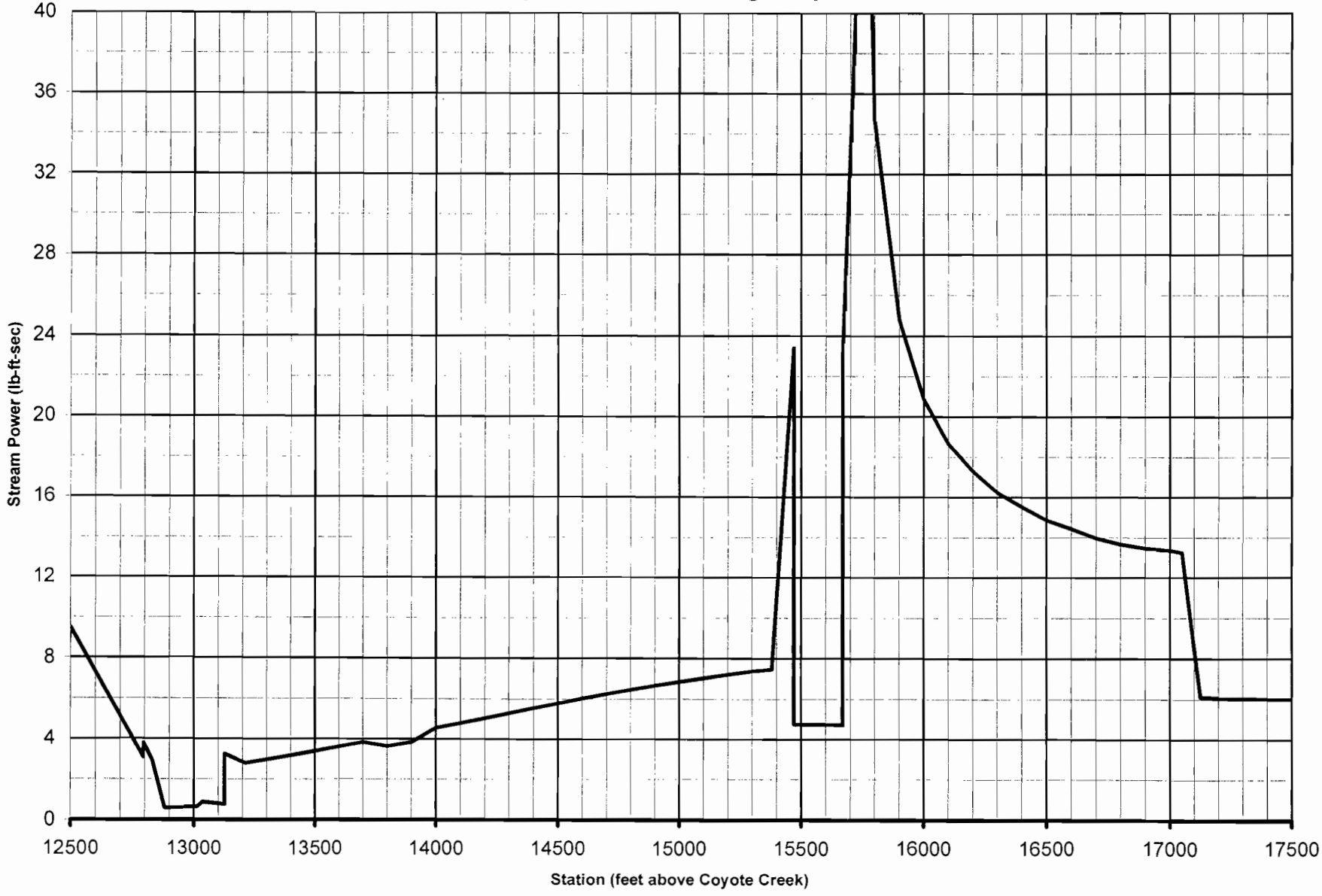
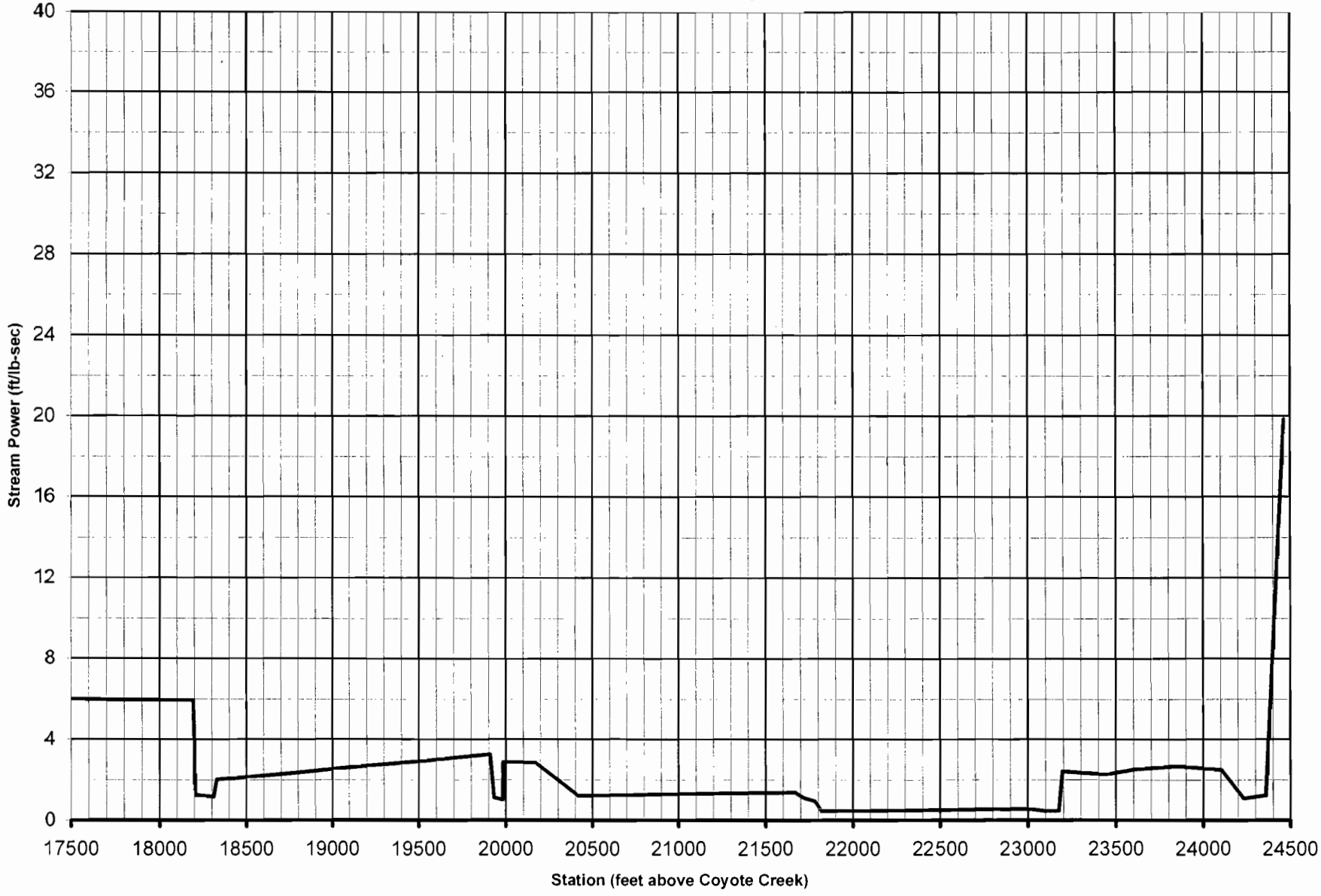


Figure 6-1: Lower Silver Creek
Sediment Transport Capacity for Reaches 5 and 6
Program Improvements w/ Bridge Replacement



APPENDIX A
LIST OF TECHNICAL TERMS AND ACRONYMS

Acre-Foot	A quantity of water that would cover 1 acre to a depth of 1-foot, equal to about 325,000 gallons.
Aggradation	The geologic process by which streambeds and floodplains are raised in elevation by the deposition of material eroded and transported from other areas. It is the opposite of *degradation*.
Alluvial	Deposition by the action of running or receding water.
Antecedent	An event that precedes another event.
Backwater	Water held back by a downstream control such as a bridge, constricted channel, or tide.
Base Flood	See *one-percent flood*.
Bed Load	Sediment bouncing or rolling along the bottom of a stream. See also *suspended load*.
Dominant Discharge	The dominant *discharge* that causes natural channels to form, usually equivalent to the 50-percent (2-year) discharge. Also known as bank-full discharge.
City	City of San Jose, California.
Confluence	The junction of two streams.
Conveyance	The ability of a stream or channel to pass a certain rate of flow.
Critical Flow	Water is moving just as fast, relative to the channel banks, as the wave resulting from a small disturbance moves relative to the water. Standing waves are characteristic of critical flow conditions. Critical flow conditions can be unstable. See also *subcritical flow* and *supercritical flow*.
Cross Section	A vertical section of a stream channel or structure that provides a side view of the structure; a transect taken at right angles to flow direction.
Cfs	A rate of flow equivalent to 1 cubic foot, or about 7 ½ gallons, Passing a point during 1 second (450 gallons/minute).

Degradation	The geologic process by which stream and river beds lower in elevation. It is the opposite of *aggradation*.
Design Flow	The magnitude of streamflow (see *discharge*) that is used in design of channel modifications and structures across channels.
Discharge	The volume of water passing through a channel during a given period of time. Usually measured in cubic feet per second.
District	Santa Clara Valley Water District.
El Niño	A disruption of the ocean-atmosphere system in the Tropical Pacific having important consequences for weather and climate around the globe. An El Niño tends to increase rainfall across the southern tier of the United States. The 1997-1998 El Niño was very strong, and caused destructive flooding throughout Northern California.
FEMA	Federal Emergency Management Agency.
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
Floodplain	An area of land inundated by *floodwaters*. Floodplains may consist of standing or moving water.
Floodwaters	Those flows of water that cannot be contained within the natural stream channel.
Freeboard	Vertical distance between the top of an embankment adjoining a channel and the water level in the channel. It is a factor of safety designed into a project.
Gravel	Sediment particles larger than sand and ranging from 0.25 to 3 inches in diameter.
Hydraulic Jump	The transition of flow from the *supercritical* to the *subcritical* condition; the change characterized by turbulence and energy loss.
Hydrograph	A plot of *discharge* (flow) against time.

Inlet Control	Flow through a bridge, culvert, or pipe where the upstream water surface elevation is determined only from the geometric characteristics of the entrance to the structure.
Low Flow Channel	A subchannel of the main stream channel that is designed to concentrate low flows for biological or aesthetic reasons.
NAVD	Adjusted vertical datum of 1988. Generally 2.75 to 2.9 feet higher than NGVD in project area.
NGVD	The *mean sea level* in 1929. National Geodetic Vertical Datum.
NFIP	National Flood Insurance Program.
NPDES	National Pollutant Discharge Elimination System.
100-Year Flood	The *one-percent flood*.
1% Flood	A flood magnitude that has a one percent chance of being equaled or exceeded in any one year.
Ordinary High Water	The area of a watercourse subject to Section 404 of the Federal Clean Water Act of 1972. The area affected is determined by the elevation of the 2.3-year flood event (ordinary high water flow) which is field checked by biologists using physical characteristics.
Outlet Control	Flow through a bridge, culvert, or pipe where the upstream water surface elevation is determined from the downstream water elevation and/or energy losses through the structure and its entrance.
Overbank	In a river or creek, the area between the main channel and the limits of the *floodplain*.
Overflow	*Floodwater* that leaves a channel over its bank(s).
Pressure Flow	Flow under pressure through a tube, such as formed by a pipe, bridge deck, or culvert. Opposite of open channel flow where there is a free surface.
Reach	A subdivision of the creek for convenience of study and reference.

Riparian	Vegetation and wildlife living within, and immediately adjacent to a river, stream or lake. In this report, riparian means the creek environment.
Roughness	Represents the frictional resistance of a surface to the flow of water. Used in hydraulic computations. Also, Manning's "n".
Sacked Concrete Slope Protection (SCSP)	Burlap bags filled with concrete and placed on a stream bank to protect the bank against erosion.
SCVWD	Santa Clara Valley Water District.
Sequent Depth	Corresponding water depths upstream and downstream of a *hydraulic jump*, also known as conjugate depth.
Soffit	The underside of a bridge deck, or the top of a box culvert. If the water surface elevation is at or above the soffit, *pressure* flow or *inlet* control may occur.
Subcritical Flow	Flow conditions in which a wave from a disturbance moves upstream. Also known as Tranquil Flow. See also *backwater.*
Supercritical Flow	Flow conditions in which a wave from a disturbance moves downstream. Also known as Rapid Flow. Supercritical flow conditions can lead to high velocities and shock wave formation at the location of channel geometry changes.
Suspended Load	The part of the total sediment load that is carried for a considerable period of time at the velocity of the flow, free from contact with the streambed. See also *bed load.*
Wash Load	The part of the *suspended load* comprised of very fine, colloidal particles such as clay.
Watershed	The geographical region or area drained by a stream. Also referred to as a drainage basin or tributary.
Wetlands	As used herein, areas that under normal circumstances have hydrophytic vegetation, hydric soils, and wetland hydrology.

APPENDIX B
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APPENDIX C
TECHNICAL MEMORANDA

Previous technical memoranda are included in chronological order. Technical Memoranda Nos. 2, 6, and 7 (which superceded TM6) are included in the body of this report, and are not repeated in this appendix.

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LOWER SILVER CREEK HYDRAULIC ANALYSIS

TECHNICAL MEMORANDUM: **1**

DATE: July 3, 2000

SUBJECT: ***Existing Hydrology Review and Evaluation*** (Task 2)

Purpose. The purpose of this task is to document the design discharges used by the Natural Resources Conservation Service (NRCS) in their preliminary channel design for Lower Silver Creek. Detailed hydrologic analyses within the Lower Silver Creek or Coyote Creek watersheds are not within the scope of work.

Background. Based on direction from the Coyote Watershed Program, hydraulic analysis for Lower Silver Creek shall proceed using design discharge estimates provided by the NRCS. To date, however, we have been unable to document the basis of the NRCS estimates and evaluate whether their hydrologic calculations are sufficient for submission to FEMA during the LOMR process. Therefore, NRCS estimates have been compared to design discharges provided by the Santa Clara Valley Water District (SCVWD), assuming that the District has sufficient documentation for submission to FEMA, if necessary NRCS documentation cannot eventually be located.

Summary. As Table 1 demonstrates, design discharges for both the NRCS estimates and District estimates are significantly higher than those published in the currently effective Flood Insurance Study (FIS), due to the removal of channel capacity restrictions that will result from the work on this reach of Lower Silver Creek. Since discharge values will increase by more than twenty percent, the submission of Standard Form 3 to document hydrologic analyses will be required to obtain a Letter of Map Revision. It may be noted, however, that NRCS discharge estimates vary no more than ten percent from District design values.

Additional Information Required. To more completely evaluate existing hydrology, documentation from the NRCS is required. The Coyote Watershed Program should obtain this, if it is available, prior to final design. In the meantime, discharges highlighted in bold on Table 1 will be used for preliminary channel design, to cover all bases. The channel can be designed for slightly higher discharge, and subsequently analyzed using SCVWD design discharges for application to FEMA.

TABLE 1

DISCHARGE RECONCILIATION FOR LOWER SILVER CREEK

Location	*SCVWD Point No.*	*Discharge[1] (cfs)* FIS	SCVWD	NRCS	% Δ
Cunningham Ave.	18	2,580	**3,800**	3,600	-5
Ocala Ave.	20	2,000	**3,890**	3,600	-7
S. Babb Creek	22	2,700	**4,230**	4,210	--
N. Babb Creek	23	1,500	4,480	**4,600**	+3
Interstate 680	24	2,400	4,630	**4,830**	+4
Alum Rock Ave.	25	2,400	4,720	**4,830**	+2
Miguelita Creek	27	2,300	5,180	**5,630**	+9
Highway 101	28	2,300	5,480	**5,630**	+3
Coyote Creek	29	2,670	5,480	**5,630**	+3

[1]Discharge in bold used for Prelim. Design

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LOWER SILVER CREEK HYDRAULIC ANALYSIS

TECHNICAL MEMORANDUM: **3**

DATE: July 3, 2000

SUBJECT: ***Summary of Performance Criteria*** (Task 4)

Purpose. The purpose of this task is to document hydraulic parameters to be used in channel design for Lower Silver Creek Reaches 1 through 6. This memorandum has been drafted to provide Coyote Watershed Program staff a chance to review and evaluate proposed performance criteria in advance of more detailed analysis. It is anticipated that additional memoranda may be produced when performance criteria, maintenance criteria, and mitigation planting are further clarified during preliminary and final design stages.

Hydraulic parameters for discussion include:

1) design channel roughness
2) bridge and transition losses
3) freeboard requirements
4) maintenance criteria

Channel Roughness. In one-dimensional open channel flow analysis as performed using HEC-RAS, a single parameter known as "Manning's n" factor is used to represent the retarding forces to flow imposed by the channel. Values for "n" are published in the literature, and in the absence of high water marks with which to calibrate stream reaches with known discharge, are often relied upon for channel design. When selecting roughness values for design, it is important to remember that in one-dimensional flow, Manning's "n" accounts for the flow resistance due to a host of hydraulic phenomena beyond boundary shear. These factors may include the effects of eddies, cross-waves, superelevation, bed forms, sediment and debris.

Several sources have been used to estimate roughness factors for water surface profile determination within Lower Silver Creek. These include "n" values published by Henderson (1966) and Chow (1959), engineering judgement, and procedures outlined by the Corps of

Engineers for roughness values within concrete lined channels (ASCE, 1995). Table 1 summarizes design channel roughness values of various channel elements proposed for use in hydraulic analysis.

Given the uncertainty in "n" value selection, a range of "n" values is used to examine channel performance. Lower values tend to increase channel velocity which may be important in terms of scour or wave formation. Higher values tend to maximize water depth, and will generally set freeboard requirements. For vegetal channel linings, typical "n" values for temporary erosion control materials will be used to evaluate high flow velocities. Manning's "n" values that are contingent upon maintenance conditions are so indicated.

Table 1
Proposed Manning's "n" Values for Channel Design

Element	*High "n" for depth*	*Low "n" for velocity*
Concrete Lining	0.015	0.011
Bare Earth	0.025	0.020
Erosion Control Blanket	---	0.020
Gravel Maint. Road	0.025	0.020
Open-Cell Block Pavers (No vegetation)	0.030	0.025
Open-Cell Block Pavers (w/ vegetation)	0.040	0.025
Vegetated Block Slopes	0.040	0.025
Grass Lining (Mowed to <12")	0.040	0.020
Emergent Wetland (Maintained)	0.050	0.020
Grass Lining (No maintenance)	0.060	0.020
Emergent Wetland (No maintenance)	0.100	0.020
Trees, shrubs, vines (No maintenance)	0.150	0.020
Rock Slope Protection	$0.034(d_{50})^{1/6}$	$0.034(d_{50})^{1/6}$

Bridge and Transition Hydraulics. In addition to the energy required to overcome channel resistance, structures such as bridges and culverts also cause energy losses, which can result in a raised water surface profile. Energy losses also take place in the reaches just upstream and downstream from each structure as flow contracts and expands into and out of the bridge or culvert. The following contraction and expansion coefficients for channel transitions will be used in hydraulic models (Table 2). Wherever turbulent conditions create the potential for energy loss, contraction and expansion coefficients are increased. Other transitions include channel bends, resting pools, and maintenance access ramps.

Table 2
Proposed Expansion and Contraction Coefficients

Transition Type	Contraction	Expansion	Source
Gradual	0.1	0.3	HEC
Warped	0.1	0.2	Chow
Wedge	0.3	0.5	Chow
Square End	0.3	0.75	Chow
Abrupt	0.6	0.80	HEC

Several methods are available through HEC-RAS to compute energy losses through the bridge itself. The "energy only" or standard step method handles a bridge section without piers in the same manner as a natural river section, except that the area between the low chord of the bridge (soffit) and the top of road is subtracted from the total cross-sectional area, and the wetted perimeter is increased where water is in contact with the bridge. Increased frictional resistance due to the added wetted perimeter is included in the energy loss through the structure. When bridge piers are present, conservation of momentum may also be applied by using a coefficient of drag, or through Yarnell's method for "Class A" low flow whereby flow through the bridge is subcritical. Table 3 provides proposed drag and pier shape coefficients for low flow bridge loss calculations.

Table 3
Proposed Pier Coefficients

Pier Shape	Drag Coefficient	Pier Coefficient
Semicircular Nose and Tail	1.33	0.90
Multiple Cylinders	1.33	1.00
Triangular Nose and Tail	2.00	1.05
Square Nose and Tail	2.00	1.25

When the computed water surface elevation is above the bridge soffit, a "pressure/weir" feature can compute losses through the structure for pressure (orifice) flow, weir flow over the top, or a combination of these. (For Lower Silver Creek, weir flow over bridges will not be allowed.) Changes to the water surface profile resulting from the bridge are calculated based on hydraulic formulae that estimate the change in energy and water surface elevation through the bridge. Other hydraulic routines are also available to perform the same function for standard culvert shapes. Coefficients of discharge for orifice flow will be evaluated on a case-by-case basis using the guidelines outlined in Table 4.

Table 4
Orifice Coefficients

Condition	Orifice Coefficient
Orifice in Thick Wall (typical bridge)	0.80
Submerged, square-edged	0.80
Submerged, well-rounded	0.90
Increase in C per number of contracted sides	0.04

A side of a bridge orifice is considered to be contracted if it is located close to the bottom or side wall of the creek channel, whereby the approaching flow is guided so that the orifice contraction is suppressed on those sides of the orifice close to such guides. Clear-span bridges across trapezoidal or U-frame (rectangular) channels are examples of orifices contracted on three sides.

Freeboard. The use of design "freeboard" provides a measure of safety that compensates for the many unknown and difficult-to-quantify parameters that affect the calculation of flood elevations. These factors include uncertainty in rainfall data, soil loss parameters, watershed urbanization, wave action, debris at bridge openings, and general uncertainties in hydrologic and hydraulic procedures. Freeboard is usually expressed in terms of feet above the design base flood elevation. To meet FEMA standards, freeboard is necessary whenever a levee system is used to provide flood protection. NFIP regulations define a levee as a "man-made structure, *usually* an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding." [emphasis added] Structural floodwalls, although not earthen, are included in FEMA's definition of a levee system.

When mapping flood-prone areas, FEMA only recognizes those levee systems meeting the following minimum design criteria [NFIP §65.10(b)]:

> (1) Freeboard. (i) Riverine levees must provide a minimum of three feet above the water-surface level of the base flood. An additional one foot above the minimum is required within 100 feet in either side of structures (such as bridges) riverward of the levee or wherever the flow is constricted...
>
> (ii) Occasionally, exceptions to the minimum riverine freeboard requirements...may be approved. Appropriate engineering analyses demonstrating adequate protection with a lesser freeboard must be submitted to support a request for such an exception. The material presented must evaluate the uncertainty in the estimated base flood elevation profile and include...an assessment of statistical confidence limits of the 100-year discharge; changes in stage-discharge relationships; and the sources, potential, and magnitude of debris, sediment, and ice accumulation. It must also be shown that the levee will remain structurally stable during the base flood when such additional loading considerations are imposed. Under no circumstances will freeboard of less than two feet be accepted."

FEMA does not impose a freeboard requirement when the base flood is carried without the use of a levee system. The District, however, does have additional project freeboard requirements (SCVWD, 1994) which can be more restrictive than those of FEMA, as summarized in Table 5, where "D" refers to the estimated depth of flow in feet, and "V" is flow velocity in feet per second.

Table 5
Proposed Freeboard Criteria

Situation	FEMA (Feet)	District (Feet)
Water Surface Above Natural Bank Elevation	3.0	3.5
Water Surface Above Bank within 100 feet of Structure	4.0	4.0
Water Surface Below Natural Bank Elevation	N/A	$0.2(D + V^2/2g)$
Minimum Freeboard	N/A	1.0

District guidelines suggest that freeboard at new bridges be the same as in the existing or proposed channel either upstream or downstream, whichever is greater, so that a system with a uniform level of protection is provided.

Other Design Criteria. District standards also call for the consideration of other criteria when designing new flood conveyance facilities:

1) An evaluation of bridges under debris loading, by assuming a blockage equal to three times the bridge pier diameter.

2) Freeboard should contain the discharge defined by the 80 percent confidence limit when practical to do so.

3) Channels with supercritical flow shall be designed for sequent depth plus freeboard.

4) Channels shall include freeboard for super-elevation of the design water surface at curves in addition to the requirements listed above.

5) Additional freeboard allowances may be made in areas where continued land subsidence is anticipated.

Maintenance Criteria. Regular channel maintenance is important to upholding the integrity of channel design. During preliminary and final design phases, proposed maintenance protocols on the part of the District will be iteratively evaluated for their impact on design channel roughness. For instance, unmaintained areas including grasses and emergent wetlands that are allowed to become "contaminated" with woody vegetation such as brush, willows, and even trees will be assumed to have higher roughness values in the 0.10 to 0.15 range.

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LOWER SILVER CREEK HYDRAULIC ANALYSIS

TECHNICAL MEMORANDUM: **4**

DATE: August 17, 2000

SUBJECT: ***Analysis of Bridge Hydraulics for Reaches 1-3*** (Task 5.1)

Purpose. The purpose of this task is to document the results of preliminary backwater analyses for the NRCS plan in Lower Silver Creek Reaches 1 through 3. More specifically, problems with hydraulic performance at existing bridges are pointed out so that Coyote Watershed Program staff may begin to reformulate the project plan. Based on preliminary analysis, it is clear that several bridges within Reach 3 require replacement. This memorandum is intended to provide technical backup to discussions held in an August 8, 2000 meeting with Watershed Program and District staff.

Changes to Analysis Since August 8 Meeting. A preliminary backwater profile was presented at the August 8 meeting showing potential hydraulic problems at the following bridge crossings:

1) McKee Road (primarily due to sediment accumulation)
2) Alum Rock Avenue
3) Sunset Street
4) Lausett Footbridge
5) San Antonio Street

Subsequent quality control review of the HEC-RAS model used to produce this profile reveals that the situation with existing bridges is worse than first thought due to the following model changes:

- pressure flow calculations are used in lieu of energy methods; and
- the condition without weir flow (i.e. headwalls wrapping around the bridges) is modeled.

New Hydraulic Analyses. Revised backwater profiles for Reaches 1-3 are attached to this memorandum. To examine bridge performance within the reaches, the following scenarios have been analyzed with the design one-percent discharge:

1) NRCS channel plan with existing bridges intact;

2) NRCS channel plan with existing bridge decks removed (raise bridge decks and reuse existing abutments);

3) NRCS channel plan with new clear span bridge decks at existing grade (i.e. clear spans across proposed channel while leaving road grade as-is); and

4) NRCS channel plan without regard to the bridges (i.e. the way the NRCS apparently analyzed Lower Silver Creek). This represents the condition of clear bridge spans with freeboard to the low chord.

Interstate 680 is located between Lower Silver Creek Reach 3 and Reach 4. We have measured the opening in the field, and based on preliminary calculations, this culvert should not present a hydraulic capacity problem as long as downstream deficiencies are corrected.

Interpretation of Results. These analyses (as summarized in the table below) tell us that upstream of McKee Road, the existing bridges cannot remain in their present configuration. Most of the problems appear to result from the existing bridge at Alum Rock Avenue, since it chokes the flow by operating as a sluice gate (inlet control) with high discharges (velocity is 18 fps). Pressurized flow conditions result in levee/floodwall heights of up to 18 feet above existing top of bank. The hydrostatic and dynamic forces associated with the construction of such massive headwalls to contain flood waters could destroy the bridges themselves. It is also unlikely that the public could accept such a design even if the Program felt it were feasible.

To provide adequate freeboard with minimal levee and/or floodwall heights using the NRCS channel plan, it will be necessary to provide clear spans of the new channel with raised bridge decks. Under these conditions, the design water surface is primarily carried below top of bank. Providing specific energy freeboard per SCVWD criteria requires maximum levee and/or floodwall heights of no more than about four feet. Modifications to the McKee Road bridge/culvert, other than sediment removal, have not been analyzed yet. (Once the culvert is cleaned out, proposed channel geometry and vegetation appear to control the upstream water surface.)

Table 1
Summary of Maximum Levee/Floodwall Requirements for Proposed NRCS Plan
Based on SCVWD Freeboard Criteria
(In Feet as Measured from Existing Top of Bank Grade)

Reach	Existing Bridges	Raised Bridges on Exist. Abutments	New Clear Spans at (E) Grade	New Clear Spans w/ Raised Deck
Coyote Creek to Wooster	0	N/A	N/A	N/A
Wooster to UPRR	0	N/A	N/A	N/A
UPRR to Hwy 101	0	N/A	N/A	N/A
Hwy 101 to McKee	3	N/A	N/A	N/A
McKee to Alum Rock	5	N/A	N/A	N/A
Alum Rock to Sunset	15	7	4	1
Sunset to Lausett	16	6	5	0
Lausett to San Antonio	18	5	6	0
San Antonio to I-680	16	5	7	4

Inlet Control at Alum Rock Bridge

Bridge has 25-foot wide rectangular opening with

Low Chord	95.8
Invert	- 85.3
Depth	10.5 feet

Discharge = 4,830 cfs

Q/B = 4830 / 25 = 193 cfs/ft

FHA Chart 8 (Headwater Depth for Box Culverts with Inlet Control)

HW/D =	2.1	(Index 2 for headwall)
HW = (2.1)(10.5) =	22.1 feet	
EG = 22.1 + 85.3 =	107.4	(HEC-RAS Output; EG = 107.6)

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LOWER SILVER CREEK HYDRAULIC ANALYSIS

TECHNICAL MEMORANDUM: **5**

DATE: August 22, 2000

SUBJECT: ***Further Analysis of Bridge Hydraulics for Reaches 1-3*** (Task 5.1)

Purpose. This memorandum presents the results of further bridge hydraulics analyses within Lower Silver Creek Reaches 1 through 3. In particular, the effects of replacing or modifying individual bridge crossings between McKee Road and Interstate 680 are examined.

Problem Bridges. Preliminary backwater analyses have indicated the potential for hydraulic difficulties at the following bridge crossings:

1) McKee Road
2) Alum Rock Avenue
3) Sunset Street
4) Lausett Avenue Footbridge
5) San Antonio Street

In essence the difficulties are caused by pressure flow conditions that were not taken into consideration by the NRCS in its preliminary channel design. Table 1 presents hydraulic results within Reach 3 for each bridge in its existing configuration, with NRCS proposed channel improvements.

As the table shows, undersized bridge openings at every bridge cause pressurized flow conditions. The worst problem is at Alum Rock Avenue, whose bridge causes nearly

eight feet of energy loss with the design discharge. Head losses at other bridges range from 1.4 feet to 3.3 feet.

As presented in Technical Memorandum No. 4, this situation does not allow a feasible implementation of the NRCS plan.

Table 1

NRCS Channel with Existing Bridges

(All Elevations are in Feet, NAVD '88)

Bridge	Soffit Elev.	Energy Grade		Top of Bank Elev.		Flow Condition
	.	D/S	U/S	D/S	U/S	
McKee	88.4	89.6	91.2	89	90	Pressure
Alum Rock	95.8	99.8	107.6	96	96	Pressure
Sunset	98.5	108	111.3	97.5	98	Pressure
Lausett	100.7	111.4	112.8	98	98	Pressure
San Antonio	101.9	112.9	115.3	101.5	102	Pressure

Possible Solutions. According to SCVWD freeboard criteria, existing bridges or culverts may be pressurized as long as they are structurally sound and capable of resisting the resultant lateral and uplift forces. Subject to structural analysis and possible retrofit, therefore, it is permissible to pressurize existing bridges. To minimize bridge and road replacement costs and possible impacts to the community, the backwater profile has been re-analyzed by replacing bridges one-by-one until a reasonable solution is achieved.

Calculations show that while the McKee Road Bridge is pressurized with about 1.6 feet of head loss, eliminating the pressurized condition does not drastically alter the one-percent water surface profile upstream, since channel control takes over. Therefore, if this structure can resist additional loading posed by freeboard headwalls, it is assumed to remain in place.

Alum Rock Avenue Bridge Replacement. Table 2 represents hydraulic conditions with the Alum Rock Bridge modified to span the entire proposed NRCS channel with two one-foot wide piers. The minimum soffit elevation to maintain one foot of freeboard over the energy grade line is 97.4, which is 1.6 feet higher than the existing soffit. To meet

SCVWD freeboard criteria for new bridges, the soffit elevation needs to be 98.0, which is 2.2 feet higher than existing. Large hydraulic losses are still experienced at Sunset Street, necessitating 7-foot high floodwalls between Sunset Street and San Antonio Street.

Table 2
NRCS Channel with Alum Rock Replacement
(All Elevations are in Feet, NAVD '88)

Bridge	Soffit Elev.	Energy Grade		Top of Bank Elev.		Flow Condition
		D/S	U/S	D/S	U/S	
McKee	88.4	89.6	91.2	89	90	Pressure
Alum Rock	98.0	95.9	96.4	96	96	Class A Low
Sunset	98.5	97.9	102.5	97.5	98	Inlet
Lausett	100.7	102.8	103.7	98	98	Pressure
San Antonio	101.9	103.9	105.2	101.5	102	Pressure

Sunset Street Culvert Replacement. Table 3 shows hydraulic conditions with the Alum Rock Avenue bridge replaced as described above and the Sunset Street triple box culvert replaced with a bridge that also spans the entire proposed NRCS channel using two one-foot wide piers. The minimum bridge soffit elevation to maintain one foot of freeboard over the energy grade line is 98.6, which is just 0.1 foot higher than the existing culvert soffit, so it may be possible to replace this structure with minimal changes to the roadway profile. To meet SCVWD freeboard criteria for new bridges, the soffit elevation needs to be 99.4, which is 0.9 foot higher than existing; again resulting in fairly minor potential changes to the roadway.

Once inlet control is relieved at Sunset Street, upstream hydraulic performance is greatly improved, and further bridge replacement is not warranted. The Lausett footbridge would have 2.3 feet of freeboard over the lowered energy grade line, meeting SCVWD freeboard requirements for new bridges (pending verification of the soffit elevation). At San Antonio Street, the bridge is no longer pressurized, and there appears to be sufficient clearance to remove the "floating" concrete channel lining (the bridge structure and channel lining are separate) and carry the proposed channel improvements through the bridge. This eliminates the need for channel transitions into and out of the existing bridge, improves the aesthetic appearance of the channel, and provides for fish passage.

Freeboard levees and/or floodwalls would be similar in height (or reduced in height) when compared to the NRCS plan. Upstream of San Antonio Street, the proposed channel configuration still governs the water surface profile.

Table 3

NRCS Channel with Alum Rock & Sunset Replacement

(All Elevations are in Feet, NAVD '88)

Bridge	**Soffit Elev.**	**Energy Grade**		**Top of Bank Elev.**		**Flow Condition**
		D/S	U/S	D/S	U/S	
McKee	88.4	89.6	91.2	89	90	Pressure
Alum Rock	98.0	95.9	96.4	96	96	Class A Low
Sunset	99.4	96.7	97.6	97.5	98	Class A Low
Lausett	100.7	98.4	98.4	98	98	Class A Low
San Antonio	101.9	99.4	99.8	101.5	102	Class A Low

APPENDIX D
HYDROLOGIC BACKUP

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Lower Silver Creek Watershed Model - Land Use Summary

Basin	Rural		Mixed		Rural/Estate Residential		Low Density Residential		Medium Density Residential		High Density Residential		Commerical		Industial		Public Quasi-Public		Park		Water		Urban Hillside		Total
	Area	Percent	Area	Percent	Area	Percent	Area	Percent	Area	Percent	Area	Percent	Area	Percent	Area	Percent	Area	Percent	Area	Percent	Area	Percent	Area	Percent	
SLT-N									0.25	39%			0.04	6%					0.27	43%	0.08	12%			0.63
SLT-P	0.25	22%							0.65	75%			0.01	1%			0.17	20%	0.02	2%			0.02	2%	1.11
SLT-Q1	1.37	100%																							1.37
SLT-Q2	1.79	100%																							1.79
SLT-Q3	0.25	45%					0.06	20%	0.15	50%				0%				0%		0%			0.09	28%	0.56
SLT-R1	0.35	32%			0.15	20%	0.11	15%	0.19	26%				0%				0%		0%			0.29	39%	1.09
SLT-R2							0.02	3%	0.51	60%			0.01	2%			0.10	12%					0.20	24%	0.84
SLT-R3							0.02	4%	0.53	85%			0.01	2%			0.05	7%	0.01	1%			0.01	1%	0.62
SLT-R4									0.22	74%			0.05	16%			0.02	6%	0.01	4%					0.29
SLT-S1									0.04	11%	0.03	9%	0.06	17%			0.20	52%	0.04	11%					0.38
SLT-S2									0.54	75%	0.03	5%	0.06	9%			0.06	8%	0.03	4%					0.72
SLT-T									0.46	58%	0.06	7%	0.13	17%			0.10	13%	0.03	4%					0.78
SLT-U1	0.75	87%			0.04	38%											0.01	7%					0.06	51%	0.87
SLT-U2	0.01	1%					0.02	1%	1.25	69%	0.02	1%	0.17	9%			0.12	7%	0.14	8%			0.08	4%	1.80
SLT-U3									0.24	36%	0.09	13%	0.03	5%	0.13	19%	0.13	19%	0.05	7%					0.67
SLT-V									0.33	59%	0.03	5%	0.11	20%			0.05	10%	0.03	6%					0.55
SLT-W1									0.79	58%	0.05	3%	0.24	18%	0.04	3%	0.23	17%	0.02	1%					1.36
SLT-W2									0.84	63%	0.02	1%	0.12	9%			0.22	17%	0.13	10%					1.32
SLT-W3			0.09	12%					0.49	64%			0.07	9%	0.02	2%	0.05	7%	0.05	7%					0.76
SLT-X									0.09	36%					0.14	59%			0.01	5%					0.24
TOTAL	26.9%		0.5%		1.1%		1.3%		42.5%		1.8%		6.2%		1.8%		8.4%		4.7%		0.4%		4.1%		17.8

Lower Silver Creek Watershed Model
Initial Times of Concentration

Basin	Area (sq mi)	Rural Area (sq mi)	Rural Lm (ft)	Rural n	Rural S (ft/ft)	Rural TCr (hr)	Impervious % Imp	Impervious Area (sq mi)	Impervious Ast (sq ft)	Wst (ft)	Lst (ft)	Li (ft)	Lcb (ft)	Street n	Street S (ft/ft)	Overland n	Overland S (ft/ft)	Overland Tci (hr)	Street TC(c,b) (hr)		Pervious Area (sq mi)	Pervious Lp (ft)	Overland n	Overland S (ft/ft)	Pervious TCp (hr)
N	0.63						62%	0.391	2338159	50	46763	91.43	300	0.02	0.005	0.05	0.005	0.000	0.109	0.17	0.239	71.4	0.5	0.005	0.252
P	1.11	0.25	3800	0.07	0.068	0.36	45%	0.500	5418879	50	108378	39.24	300	0.02	0.068	0.05	0.068	0.653	0.060	0.17	0.611	78.5	0.5	0.068	0.145
Q1	1.37	1.37	14500	0.07	0.306	0.47	80%	1.096	3825514	50	76510	174.68	300	0.02	0.306	0.05	0.306	0.636	0.042	0.17	0.274	49.9	0.5	0.306	0.082
Q2	1.79	1.79	8800	0.07	0.273	0.38	80%	1.432	5000779	50	100016	174.58	300	0.02	0.273	0.05	0.273	0.467	0.043	0.17	0.358	49.9	0.5	0.273	0.085
Q3	0.56	0.25	3700	0.07	0.166	0.29	62%	0.347	2372970	50	47459	76.98	300	0.02	0.166	0.05	0.166	0.696	0.049	0.17	0.213	62.5	0.5	0.166	0.106
R1	1.09	0.35	2700	0.07	0.164	0.25	62%	0.676	4477550	50	89551	80.19	300	0.02	0.164	0.05	0.164	0.445	0.049	0.17	0.414	64.5	0.5	0.164	0.108
R2	0.84						37%	0.311	4672157	50	93443	21.36	300	0.02	0.080	0.05	0.080	0.627	0.058	0.17	0.529	78.9	0.5	0.080	0.140
R3	0.62						38%	0.236	3467811	50	69356	22.35	300	0.02	0.031	0.05	0.031	0.803	0.072	0.17	0.384	77.3	0.5	0.031	0.173
R4	0.29						34%	0.099	1600635	50	32013	17.93	300	0.02	0.016	0.05	0.016	0.627	0.084	0.17	0.191	83.3	0.5	0.016	0.209
S1	0.38						21%	0.080	1975982	50	39520	3.15	300	0.02	0.006	0.05	0.006	1.327	0.108	0.17	0.300	105.9	0.5	0.006	0.302
S2	0.72						35%	0.252	3963803	50	79276	19.31	300	0.02	0.026	0.05	0.026	0.898	0.075	0.17	0.468	82.3	0.5	0.026	0.186
T	0.78						30%	0.234	4267721	50	85354	13.21	300	0.02	0.012	0.05	0.012	0.903	0.090	0.17	0.546	89.2	0.5	0.012	0.230
U1	0.87	0.75	4000	0.07	0.286	0.26	77%	0.670	2548689	50	50974	158.19	300	0.02	0.286	0.05	0.286	0.417	0.043	0.17	0.200	54.7	0.5	0.286	0.088
U2	1.80	0.01	2200	0.07	0.054	0.29	39%	0.702	9599326	50	191987	25.97	300	0.02	0.054	0.05	0.054	0.815	0.064	0.17	1.098	79.7	0.5	0.054	0.155
U3	0.67						27%	0.181	3573080	50	71462	10.29	300	0.02	0.009	0.05	0.009	0.854	0.096	0.17	0.489	95.4	0.5	0.009	0.255
V	0.55						31%	0.171	2965485	50	59310	15.07	300	0.02	0.026	0.05	0.026	0.905	0.076	0.17	0.380	89.2	0.5	0.026	0.194
W1	1.36						28%	0.381	7547517	50	150950	10.16	300	0.02	0.005	0.05	0.005	1.120	0.112	0.17	0.979	90.4	0.5	0.005	0.289
W2	1.32						36%	0.475	6999500	50	139990	22.32	300	0.02	0.004	0.05	0.004	1.159	0.116	0.17	0.845	84.1	0.5	0.004	0.289
W3	0.76						38%	0.289	4124492	50	82490	23.80	300	0.02	0.005	0.05	0.005	1.216	0.109	0.17	0.471	79.6	0.5	0.005	0.265
X	0.24						25%	0.060	1321092	50	26422	6.65	300	0.02	0.025	0.05	0.025	0.888	0.076	0.17	0.180	95.0	0.5	0.025	0.201

Lower Silver Creek Watershed Model
Basin Travel Times

Basin	Area (sq mi)	Slope ft/ft	Length ft	"n"	Time hrs
N	0.63	0.005		0.08	0.000
P	1.11	0.057	11000	0.08	0.653
Q1	1.37	0.125	15400	0.08	0.636
Q2	1.79	0.145	8600	0.08	0.467
Q3	0.56	0.052	12000	0.08	0.696
R1	1.09	0.063	5100	0.08	0.445
R2	0.84	0.030	7300	0.08	0.627
R3	0.62	0.025	11300	0.08	0.803
R4	0.29	0.014	5000	0.08	0.627
S1	0.38	0.003	10800	0.08	1.327
S2	0.72	0.008	8100	0.08	0.898
T	0.78	0.012	10200	0.08	0.903
U1	0.87	0.188	7700	0.08	0.417
U2	1.80	0.036	14000	0.08	0.815
U3	0.67	0.007	7000	0.08	0.854
V	0.55	0.007	7600	0.08	0.905
W1	1.36	0.0032	8200	0.08	1.120
W2	1.32	0.0029	8400	0.08	1.159
W3	0.76	0.0029	9300	0.08	1.216
X	0.24	0.003	4600	0.08	0.888

Lower Silver Creek Watershed Model
Times of Concentration and Storage Coefficients

Basin	Area (sq mi)	Rural TCr (hr)	Impervious TC_{imp} (hr)	Pervious TC_{perv} (hr)	Impervious R/(Tc+R)	Pervious R/(Tc+R)	Rural R (hr)	Impervious R (hr)	Pervious R (hr)
N									
P	1.11	0.65	0.823	0.969	0.4	0.75	1.96	0.55	2.91
Q1	1.37	0.64	0.806	0.889	0.4	0.75	1.91	0.54	2.67
Q2	1.79	0.47	0.637	0.722	0.4	0.75	1.40	0.42	2.17
Q3	0.56	0.70	0.866	0.971	0.4	0.75	2.09	0.58	2.91
R1	1.09	0.44	0.615	0.722	0.4	0.75	1.33	0.41	2.17
R2	0.84		0.797	0.937	0.4	0.75		0.53	2.81
R3	0.62		0.973	1.146	0.4	0.75		0.65	3.44
R4	0.29		0.797	1.006	0.4	0.75		0.53	3.02
S1	0.38		1.497	1.798	0.4	0.75		1.00	5.40
S2	0.72		1.068	1.253	0.4	0.75		0.71	3.76
T	0.78		1.073	1.304	0.4	0.75		0.72	3.91
U1	0.87	0.42	0.587	0.675	0.4	0.75	1.25	0.39	2.02
U2	1.80	0.82	0.985	1.140	0.4	0.75	2.45	0.66	3.42
U3	0.67		1.024	1.278	0.4	0.75		0.68	3.83
V	0.55		1.075	1.269	0.4	0.75		0.72	3.81
W1	1.36		1.290	1.579	0.4	0.75		0.86	4.74
W2	1.32		1.329	1.618	0.4	0.75		0.89	4.85
W3	0.76		1.386	1.651	0.4	0.75		0.92	4.95
X	0.24		1.058	1.260	0.4	0.75		0.71	3.78

SILVER CREEK
HYDROLOGIC SOIL GROUPS

		RURAL								URBAN						AMC II						
Basin	Area	B	C	D	B	C	D	Rural	Ia	B		C		D		B	C	D	Pervioius	Ia	Imperviious	Ia
		%	%	%	CN	CN	CN	CN	(in)	area	%	area	%	area	%	CN	CN	CN	CN	(in)	CN	(in)
SLT-N	0.63											0.19	30%	0.44	70%		23.4	59.1	83	0.42	98	0.04
SLT-P	1.11			100%			86	86	0.63			0.29	26%	0.82	74%		20.6	62.1	83	0.42	98	0.04
SLT-Q1	1.37		49%	51%		37	44	81	0.54			0.68	49%	0.70	51%		38.9	42.7	82	0.45	98	0.04
SLT-Q2	1.79		33%	67%		25	58	83	0.57			0.60	33%	1.19	67%		26.4	55.9	82	0.43	98	0.04
SLT-Q3	0.56			100%			86	86	0.63			0.02	3%	0.54	97%		2.2	81.7	84	0.38	98	0.04
SLT-R1	1.09			100%			86	86	0.63					1.09	100%			84.0	84	0.38	98	0.04
SLT-R2	0.84													0.84	100%			84.0	84	0.38	98	0.04
SLT-R3	0.62											0.01	1%	0.62	99%		0.9	83.0	84	0.38	98	0.04
SLT-R4	0.29											0.12	40%	0.18	60%		31.4	50.6	82	0.44	98	0.04
SLT-S1	1.22											0.75	61%	0.47	39%		48.3	32.6	81	0.47	98	0.04
SLT-S2	0.72											0.57	79%	0.15	21%		62.5	17.6	80	0.50	98	0.04
SLT-T	0.78									0.14	18%	0.59	76%	0.05	6%	12.5	60.0	5.0	77	0.58	98	0.04
SLT-U1	0.87		42%	58%		32	50	82	0.55			0.41	47%	0.46	53%	0.0	37.2	44.5	82	0.45	98	0.04
SLT-U2	1.80		100%			76		76	0.44	1.33	74%	0.23	13%	0.24	14%	50.9	10.0	11.4	72	0.73	98	0.04
SLT-U3	0.67									0.67	100%					69.0			69	0.83	98	0.04
SLT-V	0.55									0.32	58%	0.11	21%	0.11	21%	40.2	16.4	17.6	74	0.67	98	0.04
SLT-W1	1.36									0.48	35%	0.04	3%	0.84	62%	24.3	2.3	51.9	79	0.54	98	0.04
SLT-W2	1.32									0.50	38%			0.82	62%	26.3		51.9	78	0.55	98	0.04
SLT-W3	0.76									0.46	60%			0.31	40%	41.2		33.8	75	0.65	98	0.04
SLT-X	0.16									0.16	100%					69.0			69	0.83	98	0.04
TTL	18.53									4.06	22%	4.59	25%	9.88	53%				79	0.52	98	0.04

LOWER SILVER CREEK WATERSHED MODEL
CURVE NUMBER ADJUSTMENT FOR ANTECEDENT MOISTURE

CN (AMCII)	CN (AMCI)	CN (AMCIII)	CN (AMC2.5)	CN (AMC2.75)
65	45	83	74	79
66	46	84	75	79
67	47	85	76	80
68	49	85	77	81
69	50	86	78	82
70	51	87	79	83
71	52	88	79	84
72	53	89	80	84
73	55	89	81	85
74	56	90	82	86
75	57	91	83	87
76	58	92	84	88
77	59	92	85	88
78	61	93	85	89
79	62	93	86	90
80	63	94	87	91
81	64	95	88	91
82	66	95	89	92
83	67	96	89	93
84	69	96	90	93
85	70	97	91	94
86	72	97	92	94
87	73	97	92	95
88	75	98	93	95
89	76	98	93	96
90	78	98	94	96
91	80	98	95	96
92	82	98	95	97
93	83	99	96	97
94	85	99	96	98
95	87	99	97	98
96	90	99	98	98
97	92	99	98	99
98	95	100	99	99
99	97	100	99	100
100	100	100	100	100

Generalized Unitized Urban Storage-Discharge Relationships

A>400ac (0.625 sq mi) w/o levees on hillsides [A]														
SV	0	2.5	7.5	10	12.5	20	30	80	130	180				
SQ	0	28	70	80	85	125	155	360	560	755				
A>400ac w/o levees [B]														
SV	0	2.5	7.5	10	12.5	20	30	80	130	180				
SQ	0	28	70	80	85	125	155	155	155	155				
A>400ac w/ levees [C]														
SV	0	2.5	7.5	10	12.5	20	30	80	130	180				
SQ	0	28	70	80	85	90	92	92	92	92				
A<400ac w/o levees on hillsides [D]														
SV	0	2.5	7.5	10	12.5	20	30	80	130	180				
SQ	0	46	150	180	205	240	280	465	685	850				
A<400ac w/o levees [E]														
SV	0	2.5	7.5	10	12.5	20	30	80	130	180				
SQ	0	46	150	180	205	240	280	280	280	280				
A<400ac w/ levees [F]														
SV	0	2.5	7.5	10	12.5	20	30	80	130	180				
SQ	0	46	150	180	205	215	220	220	220	220				

Storm Drain Routing In Lower Silver Creek Watershed

Basin	Tributary	Urban (sq. mi)	Condition											
N	N	0.63	Not Used	SV										
				SQ										
P	P	0.86	C	SV	0.0	2.2	6.5	8.6	10.8	17.2	25.8	68.8	111.8	154.8
				SQ	0.0	24.1	60.2	68.8	73.1	77.4	79.1	79.1	79.1	79.1
Q1	Q1	1.37	Rural	SV										
				SQ										
Q2	Q2	1.79	Rural	SV										
				SQ										
Q3	Q3	0.63	B	SV	0.0	1.6	4.7	6.3	7.9	12.6	18.9	50.4	81.9	113.4
				SQ	0.0	17.6	44.1	50.4	53.6	78.8	97.7	97.7	97.7	97.7
	R1	0.74	A	SV	0.0	1.9	5.6	7.4	9.3	14.8	22.2	59.2	96.2	133.2
				SQ	0.0	20.7	51.8	59.2	62.9	92.5	114.7	266.4	414.4	558.7
	R2	0.84	B	SV	0.0	2.1	6.3	8.4	10.5	16.8	25.2	67.2	109.2	151.2
				SQ	0.0	23.5	58.8	67.2	71.4	105.0	130.2	130.2	130.2	130.2
	R3	0.62	E	SV	0.0	1.6	4.7	6.2	7.8	12.4	18.6	49.6	80.6	111.6
				SQ	0.0	28.5	93.0	111.6	127.1	148.8	173.6	173.6	173.6	173.6
	R4	0.29	F	SV	0.0	0.7	2.2	2.9	3.6	5.8	8.7	23.2	37.7	52.2
				SQ	0.0	13.3	43.5	52.2	59.5	62.4	63.8	63.8	63.8	63.8
	S1	0.38	F	SV	0.0	1.0	2.9	3.8	4.8	7.6	11.4	30.4	49.4	68.4
				SQ	0.0	17.5	57.0	68.4	77.9	81.7	83.6	83.6	83.6	83.6
	S2	0.72	C	SV	0.0	1.8	5.4	7.2	9.0	14.4	21.6	57.6	93.6	129.6
				SQ	0.0	20.2	50.4	57.6	61.2	64.8	66.2	66.2	66.2	66.2
	T	0.78	C	SV	0.0	2.0	5.9	7.8	9.8	15.6	23.4	62.4	101.4	140.4
				SQ	0.0	21.8	54.6	62.4	66.3	70.2	71.8	71.8	71.8	71.8
	U1	0.12	D	SV	0.0	0.3	0.9	1.2	1.5	2.4	3.6	9.6	15.6	21.6
				SQ	0.0	5.5	18.0	21.6	24.6	28.8	33.6	55.8	82.2	102.0
	U2	1.8	B	SV	0.0	4.5	13.5	18.0	22.5	36.0	54.0	144.0	234.0	324.0
				SQ	0.0	50.4	126.0	144.0	153.0	225.0	279.0	279.0	279.0	279.0
	U3	0.67	B	SV	0.0	1.7	5.0	6.7	8.4	13.4	20.1	53.6	87.1	120.6
				SQ	0.0	18.8	46.9	53.6	57.0	83.8	103.9	103.9	103.9	103.9
	V	0.55	F	SV	0.0	1.4	4.1	5.5	6.9	11.0	16.5	44.0	71.5	99.0
				SQ	0.0	25.3	82.5	99.0	112.8	118.3	121.0	121.0	121.0	121.0
	W1	1.36	B	SV	0.0	3.4	10.2	13.6	17.0	27.2	40.8	108.8	176.8	244.8
				SQ	0.0	38.1	95.2	108.8	115.6	170.0	210.8	210.8	210.8	210.8
	W2	1.32	B	SV	0.0	3.3	9.9	13.2	16.5	26.4	39.6	105.6	171.6	237.6
				SQ	0.0	37.0	92.4	105.6	112.2	165.0	204.6	204.6	204.6	204.6
	W1 - W3	3.44	C	SV	0.0	8.6	25.8	34.4	43.0	68.8	103.2	275.2	447.2	619.2
				SQ	0.0	96.3	240.8	275.2	292.4	309.6	316.5	316.5	316.5	316.5
	X	0.24	F	SV	0.0	0.6	1.8	2.4	3.0	4.8	7.2	19.2	31.2	43.2
				SQ	0.0	11.0	36.0	43.2	49.2	51.6	52.8	52.8	52.8	52.8

Lower Silver Creek Watershed Model
INTRA-BASIN ROUTING

Basin	Nodes	Side Slope	Bottom Width	Length	Slope	HEC-2 "n"	Shape	Material
N		2	95	8000	0.001	0.04	TRAP	NATURAL
P		2.2	20	4300	0.001	0.04	TRAP	NATURAL
Q3		0.8	3	9500	0.049	0.04	TRAP	NATURAL
Q3		1	4	2500	0.018	0.04	TRAP	NATURAL
R2				500	0.009	0.013	PIPE	54" RCP
R2				1500	0.009	0.013	PIPE	60" RCP
R2		1	3	1000	0.009	0.04	TRAP	
R2				1200	0.009	0.013	PIPE	72" RCP
R2				1000	0.009	0.013	PIPE	84" RCP
R2		1	7	1500	0.009	0.04	TRAP	
S1		2.3	10	1300	0.004	0.04	TRAP	
S1		1	3	1200	0.004	0.04	TRAP	
S1		1.5	6	1500	0.004	0.04	TRAP	
S2		1.5	9	2200	0.003	0.04	TRAP	
S2		0.75	19.5	1400	0.003	0.04	TRAP	
U2		0.5	1	3000	0.042	0.04	TRAP	NATURAL
U2				1500	0.044	0.013	BOX	3, X 3.5' RCB
U2				750	0.012	0.013	PIPE	60" RCP
U2				7000	0.012	0.013	PIPE	66" RCP
U2				1000	0.012	0.013	PIPE	72" RCP
U3				1600	0.008	0.013	PIPE	72" RCP
U3		1	7	500	0.008	0.04	TRAP	NATURAL
U3				3000	0.008	0.013	PIPE	78" RCP
V		1	20	800	0.006	0.04	TRAP	
V		1	19.5	4200	0.006	0.04	TRAP	
X				2000	0.001	0.013	PIPE	78" RCP
X		2	22	2000	0.001	0.04	TRAP	NATURAL

STORAGE AVAILABLE AT LAKE CUNNINGHAM PARK

	Elevation (NGVD)	Elevation (NAVD)	Area (ft^2)	Volume (ft^3)	Volume (ac-ft)
Meadow	118.6	121.5	-	0	0
	119.1	122	202,324	50,581	1
	120.1	123	608,340	405,332	10
	121.1	124	1,017,080	812,710	29
	122.1	125	1,329,119	1,173,100	56
	123.1	126	1,459,976	1,394,548	88
Lake	120.3	123.2	2,163,806	0	0
	121.1	124	2,238,276	1,760,833	40
	122.1	125	2,365,805	2,302,041	93
	123.1	126	2,455,650	2,410,728	149
Park	123.1	126	3,915,626	-	237
	124.1	127	4,104,485	4,010,056	329
	125.1	128	4,279,220	4,191,853	425
	126.1	129	5,499,668	4,889,444	537
	127.1	130	5,825,701	5,662,685	667
	128.1	131	6,086,601	5,956,151	804
	129.1	132	6,292,605	6,189,603	946
	130.1	133	6,599,889	6,446,247	1094

LAKE CUNNINGHAM FLOOD CONTROL OPERATION

Creek Weir Length =	900	feet	**Lake Weir Length**	1000	feet	**Meadow**	6	Siphons		**Lake**	3	Siphons			
Weir Elevation =	129.5	NAVD	Weir Elevation =	126	NAVD	**Drain**	36	inch diameter		**Drain**	36	inch diameter			
Coef. Of Discharge =	2.6		Coef. Of Discharge =	2.6			0.8	Discharge Coeff			0.8	Discharge Coeff			

HEC-1 Ord	Time After End of DR	Time	Combined Inflow	Flow thru Control	WSEL at Weir	Spill to Meadow	Volume to Meadow	Volume in Meadow	WSEL in Meadow	h_d/H_e	C_s	Spill to Lake	Volume to Lake	Volume in Lake	WSEL in Lake
	(hours)	(hours)	(cfs)	(cfs)	(NAVD)	(cfs)	(ac-ft)	(ac-ft)	(NAVD)			(cfs)	(ac-ft)	(ac-ft)	(NAVD)
1		0	0	0	121.20				121.5						123.2
2		0.17	0	0	121.20				121.5						123.2
3		0.33	0	0	121.20				121.5						123.2
4		0.50	1	1	121.21				121.5						123.2
5		0.67	1	1	121.21				121.5						123.2
6		0.83	2	2	121.22				121.5						123.2
7		1.00	5	5	121.29				121.5						123.2
8		1.17	10	10	121.62				121.5						123.2
9		1.33	19	19	121.73				121.5						123.2
10		1.50	32	32	121.94				121.5						123.2
11		1.67	50	50	122.04				121.5						123.2
12		1.83	74	74	122.18				121.5						123.2
13		2.00	101	101	122.34				121.5						123.2
14		2.17	130	130	122.51				121.5						123.2
15		2.33	158	158	122.67				121.5						123.2
16		2.50	186	186	122.83				121.5						123.2
17		2.67	211	211	122.97				121.5						123.2
18		2.83	234	234	123.11				121.5						123.2
19		3.00	254	254	123.22				121.5						123.2
20		3.17	273	273	123.33				121.5						123.2
21		3.33	291	291	123.39				121.5						123.2
22		3.50	312	312	123.46				121.5						123.2
23		3.67	335	335	123.53				121.5						123.2
24		3.83	361	361	123.62				121.5						123.2
25		4.00	392	392	123.72				121.5						123.2
26		4.17	427	427	123.83				121.5						123.2
27		4.33	466	466	123.96				121.5						123.2
28		4.50	511	511	124.11				121.5						123.2
29		4.67	562	562	124.27				121.5						123.2
30		4.83	620	620	124.46				121.5						123.2
31		5.00	684	684	124.63				121.5						123.2
32		5.17	754	754	124.81				121.5						123.2
33		5.33	825	825	125.00				121.5						123.2
34		5.50	893	893	125.18				121.5						123.2
35		5.67	954	954	125.34				121.5						123.2
36		5.83	1007	1007	125.48				121.5						123.2
37		6.00	1055	1055	125.60				121.5						123.2
38		6.17	1097	1097	125.72				121.5						123.2
39		6.33	1136	1136	125.82				121.5						123.2
40		6.50	1171	1171	125.91				121.5						123.2
41		6.67	1201	1201	125.98				121.5						123.2
42		6.83	1228	1228	126.05				121.5						123.2
43		7.00	1252	1252	126.11				121.5						123.2
44		7.17	1273	1273	126.16				121.5						123.2
45		7.33	1297	1297	126.22				121.5						123.2
46		7.50	1324	1324	126.29				121.5						123.2
47		7.67	1355	1355	126.37				121.5						123.2
48		7.83	1390	1390	126.45				121.5						123.2
49		8.00	1427	1427	126.54				121.5						123.2
50		8.17	1466	1466	126.64				121.5						123.2
51		8.33	1505	1505	126.73				121.5						123.2
52		8.50	1544	1544	126.83				121.5						123.2
53		8.67	1582	1582	126.92				121.5						123.2
54		8.83	1617	1617	127.00				121.5						123.2
55		9.00	1651	1651	127.08				121.5						123.2
56		9.17	1681	1681	127.15				121.5						123.2
57		9.33	1705	1705	127.21				121.5						123.2
58		9.50	1723	1723	127.25				121.5						123.2
59		9.67	1738	1738	127.29				121.5						123.2
60		9.83	1751	1751	127.32				121.5						123.2
61		10.00	1762	1762	127.35				121.5						123.2
62		10.17	1773	1773	127.37				121.5						123.2
63		10.33	1783	1783	127.40				121.5						123.2
64		10.50	1793	1793	127.42				121.5						123.2
65		10.67	1803	1803	127.45				121.5						123.2
66		10.83	1813	1813	127.47				121.5						123.2
67		11.00	1821	1821	127.49				121.5						123.2
68		11.17	1826	1826	127.51				121.5						123.2
69		11.33	1830	1830	127.52				121.5						123.2
70		11.50	1836	1836	127.53				121.5						123.2
71		11.67	1844	1844	127.55				121.5						123.2
72		11.83	1856	1856	127.58				121.5						123.2
73		12.00	1871	1871	127.61				121.5						123.2
74		12.17	1888	1888	127.65				121.5						123.2
75		12.33	1907	1907	127.70				121.5						123.2
76		12.50	1925	1925	127.74				121.5						123.2
77		12.67	1940	1940	127.78				121.5						123.2
78		12.83	1953	1953	127.81				121.5						123.2
79		13.00	1969	1969	127.85				121.5						123.2
80		13.17	1992	1992	127.90				121.5						123.2
81		13.33	2027	2027	127.98				121.5						123.2
82		13.50	2075	2075	128.10				121.5						123.2

LAKE CUNNINGHAM FLOOD CONTROL OPERATION

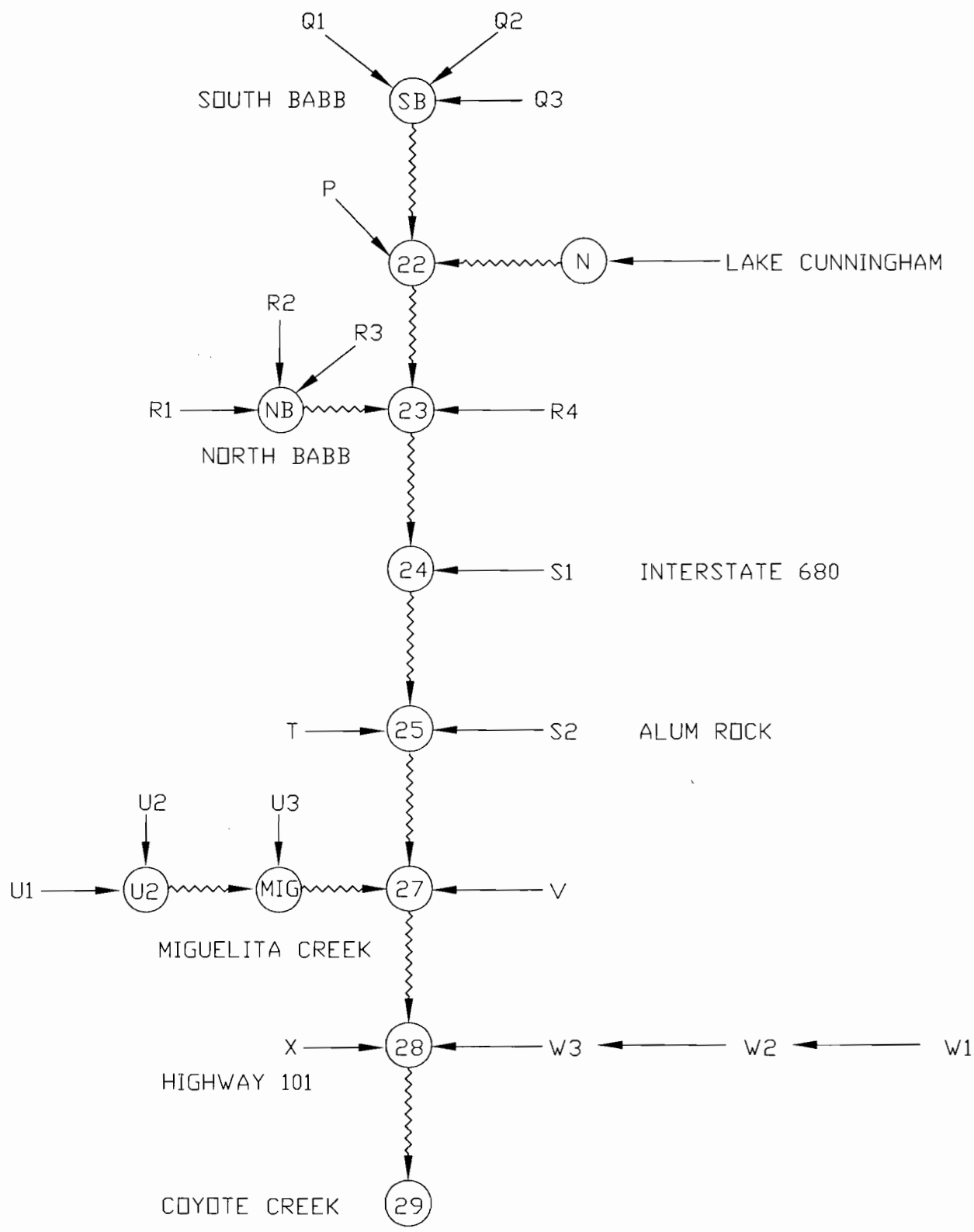
Creek Weir Length =		900	feet	**Lake Weir Length**		1000	feet	**Meadow**	6	Siphons		**Lake**	3	Siphons			
Weir Elevation =		129.5	NAVD	Weir Elevation =		126	NAVD	**Drain**	36	inch diameter		**Drain**	36	inch diameter			
Coef. Of Discharge =		2.6		Coef. Of Discharge =		2.6			0.8	Discharge Coeff			0.8	Discharge Coeff			
HEC-1 Ord	Time After End of DR	Time	Combined Inflow	Flow thru Control	WSEL at Weir	Spill to Meadow	Volume to Meadow	Volume in Meadow	WSEL in Meadow	h_d/H_e	C_s	Spill to Lake	Volume to Lake	Volume in Lake	WSEL in Lake		
	(hours)	(hours)	(cfs)	(cfs)	(NAVD)	(cfs)	(ac-ft)	(ac-ft)	(NAVD)			(cfs)	(ac-ft)	(ac-ft)	(NAVD)		
83		13.67	2135	2135	128.24				121.5						123.2		
84		13.83	2209	2209	128.42				121.5						123.2		
85		14.00	2299	2299	128.64				121.5						123.2		
86		14.17	2399	2399	128.88				121.5						123.2		
87		14.33	2494	2494	129.12				121.5						123.2		
88		14.50	2567	2567	129.30				121.5						123.2		
89		14.67	2605	2605	129.41	0	0	0	121.50						123.2		
90		14.83	2615	2590	129.55	25	0	0	121.65						123.2		
91		15.00	2616	2590	129.55	26	0	1	121.81						123.2		
92		15.17	2627	2590	129.56	37	1	1	122.01						123.2		
93		15.33	2660	2610	129.58	50	1	2	122.08						123.2		
94		15.50	2719	2620	129.62	99	1	3	122.23						123.2		
95		15.67	2799	2630	129.67	169	2	6	122.48						123.2		
96		15.83	2896	2650	129.72	246	3	9	122.84						123.2		
97		16.00	3005	2680	129.77	325	4	13	123.16						123.2		
98		16.17	3120	2710	129.81	410	6	19	123.46						123.2		
99		16.33	3233	2740	129.85	493	7	26	123.83						123.2		
100		16.50	3329	2745	129.90	584	8	34	124.18						123.2		
101		16.67	3402	2752	129.93	650	9	43	124.51						123.2		
102		16.83	3454	2757	129.95	697	10	53	124.87						123.2		
103		17.00	3501	2759	129.97	742	10	63	125.21						123.2		
104		17.17	3564	2760	129.99	804	11	74	125.57						123.2		
105		17.33	3664	2759	130.03	904	12	86	125.97					0	123.20		
106		17.50	3812	2741	130.09	1071	15	96	126.26	---	2.6	337	5	5	123.29		
107		17.67	4013	2732	130.17	1281	18	103	126.45	---	2.6	779	11	15	123.50		
108		17.83	4254	2721	130.25	1533	21	107	126.58	---	2.6	1150	16	31	123.82		
109		18.00	4514	2714	130.34	1800	25	110	126.68	---	2.6	1461	20	51	124.21		
110		18.17	4761	2690	130.42	2071	29	113	126.76	---	2.6	1714	24	75	124.65		
111		18.33	4952	2685	130.48	2267	31	115	126.82	---	2.6	1918	26	101	125.15		
112		18.50	5053	2698	130.50	2355	32	116	126.86	---	2.6	2066	28	130	125.66		
113		18.67	5059	2720	130.50	2339	32	118	126.89	0.78	2.6	2184	30	160	126.20		
114		18.83	4988	2745	130.47	2243	31	119	126.95	0.25	2.3	2144	30	189	126.71		
115		19.00	4871	2772	130.43	2099	29	127	127.17	0.07	1.2	1553	21	211	127.08		
116		19.17	4735	2786	130.39	1949	27	137	127.44	0.05	0.7	1262	17	228	127.37		
117		19.33	4591	2796	130.34	1795	25	146	127.67	0.02	0.5	1170	16	244	127.64		
118		19.50	4447	2807	130.29	1640	23	146	127.68	0.00	0.1	175	2	247	127.68		
119		19.67	4312	2807	130.25	1505	21	414	127.90						127.90		
120		19.83	4188	2803	130.21	1385	19	433	128.09						128.09		
121		20.00	4074	2796	130.17	1279	18	451	128.24						128.24		
122		20.17	3967	2791	130.13	1176	16	467	128.39						128.39		
123		20.33	3863	2786	130.10	1077	15	482	128.52						128.52		
124		20.50	3760	2780	130.06	980	13	495	128.64						128.64		
125		20.67	3656	2771	130.02	885	12	507	128.75						128.75		
126		20.83	3552	2766	129.98	786	11	518	128.87						128.87		
127		21.00	3454	2759	129.95	695	10	528	128.94						128.94		
128		21.17	3362	2753	129.91	609	8	536	129.00						129.00		
129		21.33	3275	2745	129.87	530	7	543	129.06						129.06		
130		21.50	3192	2730	129.84	462	6	550	129.11						129.11		
131		21.67	3117	2710	129.81	407	6	555	129.15						129.15		
132		21.83	3050	2697	129.78	353	5	560	129.19						129.19		
133		22.00	2997	2685	129.76	312	4	565	129.22						129.22		
134		22.17	2957	2675	129.74	282	4	569	129.25						129.25		
135		22.33	2928	2670	129.73	258	4	572	129.27						129.27		
136		22.50	2903	2665	129.72	238	3	575	129.30						129.30		
137		22.67	2878	2658	129.71	220	3	578	129.32						129.32		
138		22.83	2852	2652	129.69	200	3	581	129.34						129.34		
139		23.00	2824	2645	129.68	179	2	584	129.36						129.36		
140		23.17	2796	2638	129.67	158	2	586	129.38						129.38		
141		23.33	2765	2632	129.65	133	2	588	129.39						129.39		
142		23.50	2732	2626	129.63	110	2	589	129.40						129.40		
143		23.67	2698	2612	129.61	91	1	590	129.41						129.41		
144		23.83	2665	2605	129.60	71	1	591	129.42						129.42		
145		24.00	2636	2636	129.57	46	1	592	129.42						129.42		
146		24.17	2607	2607	129.55	27	0	592	129.43						129.43		
147		24.33	2564	2557	129.52	7	0	592	129.43						129.43		
148		24.50	2493	2578	129.33	-85	-1	591	129.42						129.42		
149		24.67	2384	2514	129.19	-130	-2	589	129.41						129.41		
150		24.83	2244	2417	129.00	-173	-2	587	129.39						129.39		
151		25.00	2087	2314	128.69	-227	-3	584	129.36						129.36		
152		25.17	1928	2190	128.44	-262	-4	580	129.34						129.34		
153		25.33	1778	2071	128.18	-293	-4	576	129.31						129.31		
154		25.50	1644	1971	127.86	-327	-5	572	129.27						129.27		
155		25.67	1524	1873	127.63	-349	-5	567	129.24						129.24		
156		25.83	1417	1784	127.42	-367	-5	562	129.20						129.20		
157		26.00	1317	1702	127.20	-385	-5	557	129.16						129.16		
158		26.17	1222	1621	127.01	-399	-5	551	129.12						129.12		
159		26.33	1132	1544	126.83	-412	-6	545	129.07						129.07		
160		26.50	1044	1469	126.64	-425	-6	540	129.03						129.03		
161		26.67	959	1395	126.47	-436	-6	534	128.98						128.98		
162		26.83	881	1327	126.30	-446	-6	527	128.93						128.93		
163		27.00	810	1264	126.15	-454	-6	521	128.87						128.87		
164		27.17	746	1207	126.00	-461	-6	515	128.81						128.81		

LAKE CUNNINGHAM FLOOD CONTROL OPERATION

Creek Weir Length =		900	feet	**Lake Weir Length**		1000	feet	**Meadow**	6	Siphons		**Lake**	3	Siphons			
Weir Elevation =		129.5	NAVD	Weir Elevation =		126	NAVD	**Drain**	36	inch diameter		**Drain**	36	inch diameter			
Coef. Of Discharge =		2.6		Coef. Of Discharge =		2.6			0.8	Discharge Coeff			0.8	Discharge Coeff			
HEC-1 Ord	Time After End of DR (hours)	Time (hours)	Combined Inflow (cfs)	Flow thru Control (cfs)	WSEL at Weir (NAVD)	Spill to Meadow (cfs)	Volume to Meadow (ac-ft)	Volume in Meadow (ac-ft)	WSEL in Meadow (NAVD)	h_d/H_e	C_s	Spill to Lake (cfs)	Volume to Lake (ac-ft)	Volume in Lake (ac-ft)	WSEL in Lake (NAVD)		
165		27.33	687	1155	125.86	-468	-6	508	128.76						128.76		
166		27.50	632	1105	125.74	-473	-7	502	128.70						128.70		
167		27.67	580	1057	125.63	-477	-7	495	128.64						128.64		
168		27.83	528	1011	125.50	-483	-7	489	128.58						128.58		
169		28.00	477	963	125.39	-486	-7	482	128.52						128.52		
170		28.17	429	920	125.27	-491	-7	475	128.46						128.46		
171		28.33	384	879	125.16	-495	-7	468	128.40						128.40		
172		28.50	342	840	125.05	-498	-7	462	128.34						128.34		
173		28.67	304	804	124.97	-500	-7	455	128.28						128.28		
174		28.83	271	773	124.88	-502	-7	448	128.22						128.22		
175		29.00	240	743	124.80	-503	-7	441	128.15						128.15		
176		29.17	212	716	124.73	-504	-7	434	128.09						128.09		
177		29.33	187	691	124.66	-504	-7	427	128.03						128.03		
178		29.50	163	668	124.59	-505	-7	420	127.96						127.96		
179		29.67	143	648	124.53	-505	-7	413	127.89						127.89		
180		29.83	124	627	124.48	-503	-7	406	127.82						127.82		
181		30.00	108	609	124.43	-501	-7	399	127.75						127.75		
182		30.17	95	595	124.38	-500	-7	392	127.68						127.68		
183		30.33	82	579	124.34	-497	-7	385	127.61						127.61		
184		30.50	72	567	124.30	-495	-7	379	127.53						127.53		
185		30.67	62	554	124.27	-492	-7	372	127.46						127.46		
186		30.83	54	544	124.23	-490	-7	365	127.39						127.39		
187		31.00	47	534	124.20	-487	-7	358	127.32						127.32		
188		31.17	41	524	124.18	-483	-7	352	127.25						127.25		
189		31.33	35	515	124.15	-480	-7	345	127.19						127.19		
190		31.50	31	508	124.12	-477	-7	339	127.12						127.12		
191		31.67	27	500	124.10	-473	-7	332	127.05						127.05		
192		31.83	23	492	124.08	-469	-6	326	126.98						126.98		
193		32.00	20	486	124.05	-466	-6	319	126.91						126.91		
194		32.17	17	478	124.04	-461	-6	313	126.84						126.84		
195		32.33	15	472	124.02	-457	-6	307	126.77						126.77		
196		32.50	13	466	124.00	-453	-6	300	126.70						126.70		
	0	32.67	0	452	123.95	-452	-6	294	126.64						126.64		
	0.17	32.83		447	123.94	-447	-6	288	126.57						126.57		
	0.33	33.00		443	123.92	-443	-6	282	126.50						126.50		
	0.50	33.17		439	123.91	-439	-6	276	126.44						126.44		
	0.67	33.33		434	123.89	-434	-6	270	126.37						126.37		
	0.83	33.50		429	123.88	-430	-6	264	126.31						126.31		
	1.00	33.67		425	123.87	-425	-6	258	126.24						126.24		
	1.17	33.83		421	123.85	-421	-6	252	126.18						126.18		
	1.33	34.00		417	123.84	-417	-6	246	126.12						126.12		
	1.50	34.17		412	123.82	-412	-6	241	126.05						126.05		
	1.63	34.30		408	123.81	-408	-4	236	126.00					149	126.00		
	1.67	34.33		405	123.80	-405	-1	86	125.96			0	0	149	126.00		
	1.83	34.50		402	123.79	-402	-6	81	125.80			-26	0	148	125.99		
	2.00	34.67		390	123.75	-390	-5	76	125.65			-60	-1	147	125.98		
	2.17	34.83		379	123.72	-379	-5	72	125.52			-78	-1	146	125.96		
	2.33	35.00		369	123.68	-369	-5	68	125.40			-90	-1	145	125.94		
	2.50	35.17		359	123.65	-360	-5	65	125.28			-100	-1	144	125.91		
	2.67	35.33		351	123.62	-351	-5	62	125.18			-108	-1	142	125.89		
	2.83	35.50		343	123.59	-343	-5	58	125.08			-115	-2	141	125.86		
	3.00	35.67		335	123.56	-335	-5	55	124.98			-120	-2	139	125.83		
	3.17	35.83		327	123.53	-327	-5	53	124.87			-125	-2	137	125.80		
	3.33	36.00		319	123.50	-319	-4	50	124.78			-131	-2	135	125.76		
	3.50	36.17		311	123.47	-311	-4	48	124.69			-135	-2	134	125.73		
	3.67	36.33		304	123.44	-304	-4	45	124.60			-139	-2	132	125.69		
	3.83	36.50		297	123.42	-297	-4	43	124.52			-142	-2	130	125.66		
	4.00	36.67		290	123.39	-290	-4	41	124.45			-145	-2	128	125.62		
	4.17	36.83		283	123.37	-283	-4	39	124.38			-147	-2	126	125.59		
	4.33	37.00		277	123.35	-277	-4	38	124.32			-149	-2	124	125.55		
	4.50	37.17		271	123.32	-271	-4	36	124.26			-151	-2	122	125.51		
	4.67	37.33		266	123.30	-266	-4	34	124.20			-153	-2	119	125.47		
	4.83	37.50		261	123.28	-260	-4	33	124.14			-154	-2	117	125.44		
	5.00	37.67		256	123.26	-256	-4	32	124.09			-155	-2	115	125.40		
	5.17	37.83		251	123.24	-251	-3	30	124.04			-156	-2	113	125.36		
	5.33	38.00		246	123.22	-246	-3	29	123.99			-156	-2	111	125.32		
	5.50	38.17		242	123.20	-242	-3	28	123.93			-157	-2	109	125.28		
	5.67	38.33		236	123.18	-236	-3	27	123.87			-158	-2	107	125.24		
	5.83	38.50		230	123.16	-230	-3	26	123.82			-159	-2	104	125.20		
	6.00	38.67		225	123.14	-225	-3	25	123.77			-160	-2	102	125.16		
	6.17	38.83		221	123.12	-221	-3	24	123.73			-160	-2	100	125.12		
	6.33	39.00		216	123.10	-216	-3	23	123.69			-161	-2	98	125.08		
	6.50	39.17		212	123.08	-212	-3	23	123.65			-161	-2	96	125.04		
	6.67	39.33		208	123.06	-208	-3	22	123.61			-161	-2	93	125.00		
	6.83	39.50		205	123.05	-205	-3	21	123.58			-160	-2	91	124.96		
	7.00	39.67		201	123.03	-201	-3	21	123.55			-160	-2	89	124.92		
	7.17	39.83		198	123.02	-198	-3	20	123.52			-159	-2	87	124.88		
	7.33	40.00		195	123.01	-195	-3	20	123.49			-158	-2	85	124.84		
	7.50	40.17		193	122.99	-193	-3	19	123.47			-158	-2	82	124.79		
	7.67	40.33		190	122.98	-190	-3	19	123.44			-157	-2	80	124.75		
	7.83	40.50		188	122.97	-188	-3	18	123.42			-156	-2	78	124.71		
	8.00	40.67		185	122.96	-185	-3	18	123.40			-155	-2	76	124.67		

LAKE CUNNINGHAM FLOOD CONTROL OPERATION

Creek Weir Length =		900	feet	**Lake Weir Length**		1000	feet	**Meadow**	6	Siphons		**Lake**	3	Siphons		
Weir Elevation =		129.5	NAVD	Weir Elevation =		126	NAVD	**Drain**	36	inch diameter		**Drain**	36	inch diameter		
Coef. Of Discharge =		2.6		Coef. Of Discharge =		2.6			0.8	Discharge Coeff			0.8	Discharge Coeff		
HEC-1 Ord	Time After End of DR	Time	Combined Inflow	Flow thru Control	WSEL at Weir	Spill to Meadow	Volume to Meadow	Volume in Meadow	WSEL in Meadow	h_d/H_e	C_s	Spill to Lake	Volume to Lake	Volume in Lake	WSEL in Lake
	(hours)	(hours)	(cfs)	(cfs)	(NAVD)	(cfs)	(ac-ft)	(ac-ft)	(NAVD)			(cfs)	(ac-ft)	(ac-ft)	(NAVD)
	8.17	40.83		183	122.95	-183	-3	18	123.38			-154	-2	74	124.63
	8.33	41.00		181	122.94	-181	-2	17	123.36			-153	-2	72	124.59
	8.50	41.17		178	122.93	-178	-2	17	123.34			-151	-2	70	124.55
	8.67	41.33		176	122.92	-176	-2	16	123.32			-150	-2	68	124.51
	8.83	41.50		174	122.91	-174	-2	16	123.30			-149	-2	66	124.48
	9.00	41.67		172	122.90	-172	-2	16	123.28			-148	-2	64	124.44
	9.17	41.83		170	122.89	-170	-2	15	123.26			-146	-2	61	124.40
	9.33	42.00		169	122.88	-169	-2	15	123.24			-145	-2	59	124.36
	9.50	42.17		167	122.87	-167	-2	15	123.23			-144	-2	58	124.32
	9.67	42.33		165	122.86	-165	-2	14	123.21			-142	-2	56	124.29
	9.83	42.50		163	122.85	-163	-2	14	123.20			-141	-2	54	124.25
	10.00	42.67		161	122.84	-161	-2	14	123.18			-140	-2	52	124.21
	10.17	42.83		160	122.84	-160	-2	14	123.16			-138	-2	50	124.18
	10.33	43.00		158	122.83	-158	-2	13	123.15			-137	-2	48	124.14
	10.50	43.17		156	122.82	-156	-2	13	123.13			-136	-2	46	124.11
	10.67	43.33		155	122.81	-154	-2	13	123.12			-134	-2	44	124.07
	10.83	43.50		153	122.80	-153	-2	12	123.10			-133	-2	42	124.04
	11.00	43.67		151	122.79	-151	-2	12	123.09			-131	-2	41	124.00
	11.17	43.83		150	122.79	-150	-2	12	123.07			-130	-2	39	123.97
	11.33	44.00		148	122.78	-148	-2	12	123.06			-129	-2	37	123.93
	11.50	44.17		147	122.77	-147	-2	11	123.05			-127	-2	35	123.90
	11.67	44.33		145	122.76	-145	-2	11	123.03			-126	-2	33	123.86
	11.83	44.50		144	122.75	-144	-2	11	123.02			-124	-2	32	123.83
	12.00	44.67		142	122.74	-142	-2	11	123.00			-123	-2	30	123.80
	12.17	44.83		141	122.73	-141	-2	10	122.99			-121	-2	28	123.76
	12.33	45.00		139	122.73	-139	-2	10	122.97			-120	-2	27	123.73
	12.50	45.17		138	122.72	-138	-2	10	122.96			-118	-2	25	123.70
	12.67	45.33		136	122.71	-136	-2	9	122.89			-117	-2	24	123.67
	12.83	45.50		129	122.67	-129	-2	9	122.88			-120	-2	22	123.63
	13.00	45.67		127	122.66	-127	-2	9	122.86			-118	-2	20	123.60
	13.17	45.83		126	122.65	-126	-2	9	122.85			-117	-2	19	123.57
	13.33	46.00		124	122.64	-124	-2	9	122.84			-115	-2	17	123.54
	13.50	46.17		123	122.63	-123	-2	9	122.82			-114	-2	15	123.51
	13.67	46.33		122	122.62	-122	-2	9	122.81			-112	-2	14	123.48
	13.83	46.50		120	122.62	-120	-2	9	122.80			-111	-2	12	123.45
	14.00	46.67		119	122.61	-119	-2	8	122.78			-110	-2	11	123.42
	14.17	46.83		117	122.60	-117	-2	8	122.77			-108	-1	9	123.39
	14.33	47.00		116	122.59	-116	-2	8	122.76			-107	-1	8	123.36
	14.50	47.17		114	122.58	-114	-2	8	122.74			-105	-1	6	123.33
	14.67	47.33		113	122.57	-113	-2	8	122.73			-104	-1	5	123.30
	14.83	47.50		111	122.56	-111	-2	8	122.72			-103	-1	4	123.27
	15.00	47.67		110	122.56	-110	-2	8	122.71			-101	-1	2	123.24
	15.17	47.83		108	122.55	-108	-1	8	122.69			-100	-1	1	123.22
	15.33	48.00		107	122.54	-107	-1	8	122.68			-98	-1	-1	123.19
	15.50	48.17		105	122.53	-105	-1	7	122.58			-40	-1	-1	123.18
	15.67	48.33		94	122.47	-94	-1	5	122.45						123.20
	15.83	48.50		77	122.37	-77	-1	4	122.33						123.20
	16.00	48.67		62	122.28	-62	-1	3	122.24						123.20
	16.17	48.83		49	122.21	-49	-1	3	122.17						123.20
	16.33	49.00		39	122.15	-39	-1	2	122.11						123.20
	16.50	49.17		30	122.10	-30	0	2	122.06						123.20
	16.67	49.33		24	122.06	-24	0	1	122.03						123.20
	16.83	49.50		18	122.02	-18	0	1	122.00						123.20
	17.00	49.67		20	122.04	-20	0	1	121.89						123.20
	17.17	49.83		20	122.04	-20	0	1	121.77						123.20
	17.33	50.00		20	122.04	-20	0	0	121.66						123.20
	17.50	50.17		20	122.04	-20	0	0	121.54						123.20
	17.67	50.33		20	122.04	-20	0	0	121.50						123.20
	17.83	50.50		20	122.04	-20	0	0	121.50						123.20
	18.00	50.67		20	122.04	-20	0	-1	121.50						123.20



WATERSHED MODEL SCHEMATIC

FILE NAME: SCVWA\08 - LOWER SILVER CR\REPORT\HYDROLOGY\SCHEMATIC.DWG

Schaaf & Wheeler

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*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
            SEPTEMBER 1990             *
             VERSION 4.0               *
*                                      *
*  RUN DATE  06/14/2001  TIME  18:43:21 *
*                                      *
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*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
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X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   LOWER SILVER-THOMPSON CREEK FLOOD HYDROGRAPHS, AUGUST 2000
  2           ID   100YEAR FLOOD PEAKS rainfall 4.2 moisture 2.75,r0.75
  3           ID   URBAN AREA FULLY DEVELOPED BASED ON SAN JOSE 2020 GENERAL PLAN
  4           ID   PREPARED BY SCHAAF & WHEELER TO EXAMINE LAKE CUNNINGHAM STORAGE
              *DIAGRAM
  5           IT      10       0       0     196
  6           IO       5       0
              *  Lake Cunningham Outflow Hydrograph w/ Modified Operation

  7           KK    LAKE  LAKE CUNNINGHAM OUTPUT
  8           BA   26.28
              *
  9           IN      10
              *
 10           QI       0       0       0       1       1       2       5      10      19      32
 11           QI      50      74     101     130     158     186     211     234     254     273
 12           QI     291     312     335     361     392     427     466     511     562     620
 13           QI     684     754     825     893     954    1007    1055    1097    1136    1171
 14           QI    1201    1228    1252    1273    1297    1324    1355    1390    1427    1466
 15           QI    1505    1544    1582    1617    1651    1681    1705    1723    1738    1751
 16           QI    1762    1773    1783    1793    1803    1813    1821    1826    1830    1836
 17           QI    1844    1856    1871    1888    1907    1925    1940    1953    1969    1992
 18           QI    2027    2075    2135    2209    2299    2399    2494    2567    2605    2590
 19           QI    2590    2590    2610    2620    2630    2650    2680    2710    2740    2745
 20           QI    2752    2757    2759    2760    2759    2741    2732    2721    2714    2690
 21           QI    2685    2698    2720    2745    2772    2786    2796    2807    2807    2803
 22           QI    2796    2791    2786    2780    2771    2766    2759    2753    2745    2730
 23           QI    2710    2697    2685    2675    2670    2665    2658    2652    2645    2638
 24           QI    2632    2626    2612    2605    2636    2607    2557    2578    2514    2417
 25           QI    2314    2190    2071    1971    1873    1784    1702    1621    1544    1469
 26           QI    1395    1327    1264    1207    1155    1105    1057    1011     963     920
 27           QI     879     840     804     773     743     716     691     668     648     627
 28           QI     609     595     579     567     554     544     534     524     515     508
 29           QI     500     492     486     478     472     466     452     447     443     439
 30           QI     434     429     425     421     417     412     408     405     402     390
 31           QI     379     369     359     351     343     335     327     319     311     304
 32           QI     297     290     283     277     271     266     261     256     251     246
 33           QI     242     236     230     225     221     216     212     208     205     201
 34           QI     198     195     193     190     188     185     183     181     178     176
 35           QI     174     172     170     169     167     165     163     161     160     158
 36           QI     156     155     153     151     150     148     147     145     144     142
 37           QI     141     139     138     136     129     127     126     124     123     122
 38           QI     120     119     117     116     114     113     111     110     108     107
 39           QI     105      94      77      62      49      39      30      24      18      20
 40           QI      20      20      20      20      20
              *

 41           KK    PT22
 42           KM     ROUTE LAKE OUTFLOW FROM CUNNINGHAM TO S. BABB
 43           RL    .000    .000
 44           RD    4300    .002    .045            TRAP      80    0.75
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  45          KK    PRUR
  46          KM     HYDROGRAPH FOR RURAL PORTION OF AREA P
  47          BA    0.25     .00     .00
  48          PB     4.2
  49          IN      15
  50          PI    .400   .3500   .3500   .4700   .5300   .6000   .6000   .6200   .5300   .5900
  51          PI    .510   .5600   .7400   .7500   .8000   .8500  1.0400   .9400  1.1200  1.1300
  52          PI   0.920   .8000   .9000   .8800   .8400   .7600   .8200   .7200  1.0300   .8200
  53          PI   0.960  0.9500   .9500   .9400   .9300   .9400   .7200   .9200   .9100   .7400
  54          PI   0.930  0.8200   .8600   .6800   .9400   .8500   .8900   .9200   .9100   .7800
  55          PI    .940  1.1300  1.2300  1.2800  1.5000  1.7000   .8300   .9200  1.0500  1.4300
  56          PI   1.560  1.5600  1.6900  1.9300  1.6200  1.1700  1.7400  2.0600  2.6000  3.1800
  57          PI   3.330  3.2800  1.4400  1.1100  1.0900  1.0600  1.0700  1.1000  1.1700   .8900
  58          PI    .930   .8900   .8200  1.0600   .5200  1.0400   .8500  1.0600   .8600   .8600
  59          PI    .880   .8500   .7200   .7900   .9400   .8400   .0000   .0000   .0000   .0000
  60          LS              94
  61          UC    .650    1.96
              *

  62          KK    PPER
  63          KM     HYDROGRAPH FOR PERVIOUS PORTION OF AREA P
  64          BA    .560     .00     .00
  65          LS              93
  66          UC    .969    2.91
              *

  67          KK    PIMP
  68          KM     HYDROGRAPH FOR IMPERVIOUS PORTION OF AREA P
  69          BA    .300     .00     .00
  70          LS              99
  71          UC    .823    0.55
              *

  72          KK  URBANP
  73          HC       2
              *

  74          KK   PSTOR
  75          KM     ROUTE THRU STORM DRAIN SYSTEM P
  76          RL      0.     .00
  77          RS       1    STOR      0.     .00
  78          SV       0     2.2     6.5     8.6    10.8    17.2    25.8   154.8
  79          SQ       0    24.1    60.2    68.8    76.1    77.4    79.1    79.1
              *

  80          KK    PT22
  81          KM     LOWER SILVER CREEK ABOVE S. BABB CONFLUENCE
  82          HC       3
              *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  83          KK   Q1RUR
  84          KM     HYDROGRAPH FOR RURAL PORTION OF AREA Q1
  85          BA    1.37     .00     .00
  86          LS              91
  87          UC    .640    1.91
              *

  88          KK   Q2RUR
  89          KM     HYDROGRAPH FOR RURAL PORTION OF AREA Q2
  90          BA    1.79     .00     .00
  91          LS              93
  92          UC    .470    1.40
              *

  93          KK   Q1&Q2
  94          HC       2
              *

  95          KK    CLAY
  96          KM     ROUTE S. BABB CREEK TO CLAYTON ROAD
  97          RL     .00     .00
  98          RD    7000   0.035    0.04            TRAP       3     0.8
              *

  99          KK   SBABB
 100          KM     ROUTE S. BABB CREEK TO SILVER CREEK CONFLUENCE
 101          RL     .00     .00
 102          RD    5000   0.015   0.018            TRAP       4     1.0
              *

 103          KK   Q3RUR
 104          KM     HYDROGRAPH FOR RURAL PORTION OF AREA Q3
 105          BA    0.25     .00     .00
 106          LS              94
 107          UC    .700    2.09
              *

 108          KK   Q3PER
 109          KM     HYDROGRAPH FOR PERVIOUS PORTION OF AREA Q3
 110          BA    .240     .00     .00
 111          LS              93
 112          UC    .971    2.91
              *

 113          KK   Q3IMP
 114          KM     HYDROGRAPH FOR IMPERVIOUS PORTION OF AREA Q3
 115          BA    .390     .00     .00
 116          LS              99
 117          UC    .866    0.58
              *
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 118          KK  URBNQ3
 119          HC       2
              *

 120          KK  Q3STOR
 121          KM     ROUTE THRU STORM DRAIN SYSTEM Q3
 122          RL      0.     .00
 123          RS       1    STOR      0.     .00
 124          SV       0     1.6     4.7     6.3     7.9    12.6    18.9   113.4
 125          SQ       0    17.6    44.1    50.4    53.6    78.8    97.7    97.7
              *

 126          KK   ALLQ3
 127          HC       2
              *

 128          KK   SBABB
 129          KM     INFLOW FROM SOUTH BABB CREEK
 130          HC       2
              *

 131          KK    PT22
 132          KM    SOUTH BABB /LOWER SILVER CONFLUENCE
 133          HC       2
              *

 134          KK    PT23
 135          KM     ROUTE HYDROGRAPH IN SILVER CREEK FROM POINT 22 TO POINT 23
 136          RL     .00     .00
 137          RD    3110   0.002   0.045            TRAP      40    0.75
              *

 138          KK   R1RUR
 139          KM     HYDROGRAPH FOR RURAL PORTION OF AREA R1
 140          BA    0.35     .00     .00
 141          LS              94
 142          UC    .440    1.33
              *

 143          KK   R1PER
 144          KM     HYDROGRAPH FOR PERVIOUS PORTION OF AREA R1
 145          BA    .340     .00     .00
 146          LS              93
 147          UC    .722    2.17
              *

 148          KK   R1IMP
 149          KM     HYDROGRAPH FOR IMPERVIOUS PORTION OF AREA R1
 150          BA    .400     .00     .00
 151          LS              99
 152          UC    .615    0.41
              *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 153          KK  URBNR1
 154          HC       2
              *

 155          KK  R1STOR
 156          KM     ROUTE THRU STORM DRAIN SYSTEM R1
 157          RL      0.     .00
 158          RS       1    STOR      0.     .00
 159          SV       0     1.9     5.6     7.4     9.3    14.8    22.2    59.2    96.2   133.2
 160          SQ       0    20.7    51.8    59.2    62.9    92.5   114.7   266.4   414.4   558.7
              *

 161          KK      R1
 162          HC       2
              *

 163          KK   WHITE
 164          KM     ROUTE HYDROGRAPH IN PIPE FROM POINT R1 TO WHITE ROAD
 165          RL     .00     .00
 166          RD    5300   0.013    .013            CIRC     6.0
              *

 167          KK   NBABB
 168          KM    ROUTE FROM WHITE ROAD TO N BABB CONFLUENCE
 169          RL     .00     .00
 170          RD    1500   0.013    .015            TRAP     4.0     1.0
              *

 171          KK   R2PER
 172          KM     HYDROGRAPH FOR PERVIOUS PORTION OF AREA R2
 173          BA    .530     .00     .00
 174          LS              93
 175          UC    .937    2.81
              *

 176          KK   R2IMP
 177          KM     HYDROGRAPH FOR IMPERVIOUS PORTION OF AREA R2
 178          BA    .310     .00     .00
 179          LS              99
 180          UC    .797    0.53
              *

 181          KK  URBNR2
 182          HC       2
              *

 183          KK  R2STOR
 184          KM     ROUTE THRU STORM DRAIN SYSTEM R2
 185          RL      0.     .00
 186          RS       1    STOR      0.     .00
 187          SV       0     2.1     6.3     8.4    10.5    16.8    25.2   151.2
 188          SQ       0    23.5    58.8    67.2    71.4   105.0   130.2   130.2
              *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 189          KK   R3PER
 190          KM     HYDROGRAPH FOR PERVIOUS PORTION OF AREA R3
 191          BA    .380     .00     .00
 192          LS              93
 193          UC   1.146    3.44
              *

 194          KK   R3IMP
 195          KM     HYDROGRAPH FOR IMPERVIOUS PORTION OF AREA R3
 196          BA    .240     .00     .00
 197          LS              99
 198          UC    .973    0.65
              *

 199          KK  URBNR3
 200          HC       2
              *

 201          KK  R3STOR
 202          KM     ROUTE THRU STORM DRAIN SYSTEM R3
 203          RL      0.     .00
 204          RS       1    STOR      0.     .00
 205          SV       0     1.6     4.7     6.2     7.8    12.4    18.6   111.6
 206          SQ       0    28.5    93.0    14.6   127.1   148.8   173.6   173.6
              *

 207          KK   NBABB
 208          KM    NORTH BABB CREEK INFLOW
 209          HC       3
              *

 210          KK   R4PER
 211          KM     HYDROGRAPH FOR PERVIOUS PORTION OF AREA R4
 212          BA    .190     .00     .00
 213          LS              92
 214          UC   1.006    3.02
              *

 215          KK   R4IMP
 216          KM     HYDROGRAPH FOR IMPERVIOUS PORTION OF AREA R4
 217          BA    .100     .00     .00
 218          LS              99
 219          UC    .797    0.53
              *

 220          KK  URBNR4
 221          HC       2
              *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 222          KK  R4STOR
 223          KM     ROUTE THRU STORM DRAIN SYSTEM R4.
 224          RL      0.     .00
 225          RS       1    STOR      0.     .00
 226          SV       0     0.7     2.2     2.9     3.6     5.8     8.7    52.2
 227          SQ       0    13.3    43.5    52.2    59.5    62.4    63.8    63.8
              *

 228          KK    PT23
 229          KM    NORTH BABB CREEK / SILVER CREEK CONFLUENCE
 230          HC       3
              *

 231          KK      4B
 232          KM     ROUTE HYDROGRAPH FROM POINT 23 TO REACH 4B (THRU S1)
 233          RL     .00     .00
 234          RD    1450  0.0032   0.045            TRAP      38    0.75
              *

 235          KK    PT24
 236          KM     ROUTE HYDROGRAPH FROM REACH 4B TO I680 (THRU S1)
 237          RL     .00     .00
 238          RD    2500   0.003   0.045            TRAP      62    0.75
              *

 239          KK   S1PER
 240          KM     HYDROGRAPH FOR PERVIOUS PORTION OF AREA S1
 241          BA    .300     .00     .00
 242          LS              91
 243          UC   1.798    5.40
              *

 244          KK   S1IMP
 245          KM     HYDROGRAPH FOR IMPERVIOUS PORTION OF AREA S1
 246          BA    .080     .00     .00
 247          LS              99
 248          UC   1.497    1.00
              *

 249          KK  URBNS1
 250          HC       2
              *

 251          KK  S1STOR
 252          KM     ROUTE THRU STORM DRAIN SYSTEM S1.
 253          RL      0.     .00
 254          RS       1    STOR      0.     .00
 255          SV       0     1.0     2.9     3.8     4.8     7.6    11.4    68.4
 256          SQ       0    17.5    57.0    68.4    77.9    81.7    83.6    83.6
              *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 257          KK    PT24
 258          KM    HWY 680
 259          HC       2
              *

 260          KK      3F
 261          KM     ROUTE HYDROGRAPH FROM POINT 24 THRU REACH 3F
 262          RL     .00     .00
 263          RD    1000  0.0028   0.045            TRAP     120     2.0
              *

 264          KK      3E
 265          KM     ROUTE HYDROGRAPH THRU REACH 3E
 266          RL     .00     .00
 267          RD    1150  0.0028   0.045            TRAP      75     2.0
              *

 268          KK    PT25
 269          KM     ROUTE HYDROGRAPH THRU REACH 3D AND 3C TO ALUM ROCK
 270          RL     .00     .00
 271          RD    1400    .004     .04            TRAP      50     0.1
              *

 272          KK   S2PER
 273          KM     HYDROGRAPH FOR PERVIOUS PORTION OF AREA S2
 274          BA    .470     .00     .00
 275          LS              91
 276          UC   1.253    3.76
              *

 277          KK   S2IMP
 278          KM     HYDROGRAPH FOR IMPERVIOUS PORTION OF AREA S2
 279          BA    .250     .00     .00
 280          LS              99
 281          UC   1.068    0.71
              *

 282          KK  URBNS2
 283          HC       2
              *

 284          KK  S2STOR
 285          KM     ROUTE THRU STORM DRAIN SYSTEM S2
 286          RL      0.     .00
 287          RS       1    STOR      0.     .00
 288          SV       0     1.8     5.4     7.2     9.0    14.4    21.6   129.6
 289          SQ       0    20.2    50.4    57.6    61.2    64.8    66.2    66.2
              *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 290          KK    TPER
 291          KM     HYDROGRAPH FOR PERVIOUS PORTION OF AREA T
 292          BA    .550     .00     .00
 293          LS              88
 294          UC   1.304    3.91
              *

 295          KK    TIMP
              *
 296          KM     HYDROGRAPH FOR IMPERVIOUS PORTION OF AREA T
 297          BA    .240     .00     .00
 298          LS              99
 299          UC   1.073    0.72
              *

 300          KK  URBANT
 301          HC       2
              *

 302          KK   TSTOR
 303          KM     ROUTE THRU STORM DRAIN SYSTEM T
 304          RL      0.     .00
 305          RS       1    STOR      0.     .00
 306          SV       0     2.0     5.9     7.8     9.8    15.6    23.4   140.4
 307          SQ       0    21.8    54.6    62.4    66.3    70.2    71.8    71.8
              *

 308          KK    PT25
 309          KM    ALUM ROCK AVE
 310          HC       3
              *

 311          KK      3B
 312          KM     ROUTE HYDROGRAPH FROM POINT 25 THRU REACH 3B
 313          RL     .00     .00
 314          RD    2200  0.0015   0.018            TRAP      58     0.0
              *

 315          KK      3A
 316          KM     ROUTE HYDROGRAPH THRU REACH 3A TO MCKEE
 317          RL     .00     .00
 318          RD    1300  0.0015   0.045            TRAP      75     2.0
              *

 319          KK    PT27
 320          KM     ROUTE HYDROGRAPH THRU REACH 2 TO POINT 27 (MIGUELITA CREEK)
 321          RL     .00     .00
 322          RD    1450    .001    .018            TRAP      45     0.0
              *
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 323          KK   U1RUR
 324          KM     HYDROGRAPH FOR RURAL PORTION OF AREA U1
 325          BA    0.75     .00     .00
 326          LS              92
 327          UC    .420    1.25
              *

 328          KK   U1PER
 329          KM     HYDROGRAPH FOR PERVIOUS PORTION OF AREA U1
 330          BA    .050     .00     .00
 331          LS              92
 332          UC    .675    2.02
              *

 333          KK   U1IMP
 334          KM     HYDROGRAPH FOR IMPERVIOUS PORTION OF AREA U1
 335          BA    .070     .00     .00
 336          LS              99
 337          UC    .587    0.39
              *

 338          KK  URBNU1
 339          HC       2
              *

 340          KK  U1STOR
 341          KM     ROUTE THRU STORM DRAIN SYSTEM U1
 342          RL      0.     .00
 343          RS       1    STOR      0.     .00
 344          SV       0     0.3     0.9     1.2     1.5     2.4     3.6     9.6    15.6    21.6
 345          SQ       0     5.5    18.0    21.6    24.6    28.8    33.6    55.8    82.2   162.0
              *

 346          KK      U1
 347          HC       2
              *

 348          KK   MCKEE
 349          KM     ROUTE U1 HYDROGRAPH TO MCKEE ROAD (THRU U2)
 350          RL     .00     .00
 351          RD    3500   0.042    0.04            TRAP       1     0.5
              *

 352          KK    SHOP
 353          KM     ROUTE HYDROGRAPH IN MCKEE ROAD TO SHOPPING CENTER
 354          RL     .00     .00
 355          RD    2000   0.044    .013            TRAP     3.5     0.0
              *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 356          KK     CAP
 357          KM     ROUTE HYDROGRAPH TO CAPITOL EXPRESSWAY
 358          RL     .00     .00
 359          RD    6000   0.012    .013            CIRC      5.
              *

 360          KK    I680
 361          KM     ROUTE HYDROGRAPH TO I680
 362          RL     .00     .00
 363          RD    2000   0.012    .013            CIRC      6.
              *

 364          KK   U2RUR
 365          KM     HYDROGRAPH FOR RURAL PORTION OF AREA U2
 366          BA    0.01     .00     .00
 367          LS              88
 368          UC    .820    2.45
              *

 369          KK   U2PER
 370          KM     HYDROGRAPH FOR PERVIOUS PORTION OF AREA U2
 371          BA    1.11     .00
 372          LS              85
 373          UC   1.140    3.42
              *

 374          KK   U2IMP
 375          KM     HYDROGRAPH FOR IMPERVIOUS PORTION OF AREA U2
 376          BA    .690     .00     .00
 377          LS              99
 378          UC    .985    0.66
              *

 379          KK  URBNU2
 380          HC       2
              *

 381          KK  U2STOR
 382          KM     ROUTE THRU STORM DRAIN SYSTEM U2
 383          RL      0.     .00
 384          RS       1    STOR      0.     .00
 385          SV       0     4.5    13.5    18.0    22.5    36.0    54.0   324.0
 386          SQ       0    50.4   126.0   144.0   153.0   225.0   279.0   279.0
              *

 387          KK   ALLU2
 388          HC       2
              *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 389          KK    I680
 390          HC       2
              *

 391          KK     MIG
 392          KM     ROUTE HYDROGRAPH FROM I680 TO MIGUELITA CONFLUENCE (THRU U3)
 393          RL     .00     .00
 394          RD    6000   0.008    .013            CIRC     6.5
              *

 395          KK   U3PER
 396          KM     HYDROGRAPH FOR PERVIOUS PORTION OF AREA U3
 397          BA    0.49     .00
 398          LS              82
 399          UC   1.278    3.83
              *

 400          KK   U3IMP
 401          KM     HYDROGRAPH FOR IMPERVIOUS PORTION OF AREA U3
 402          BA    .180     .00     .00
 403          LS              99
 404          UC   1.024    0.68
              *

 405          KK  URBNU3
 406          HC       2
              *

 407          KK  U3STOR
 408          KM     ROUTE THRU STORM DRAIN SYSTEM U3
 409          RL      0.     .00
 410          RS       1    STOR      0.     .00
 411          SV       0     1.7     5.0     6.7     8.4    13.4    20.1   120.6
 412          SQ       0    18.8    46.9    53.6    57.0    83.8   103.9   103.9
              *

 413          KK     MIG
 414          KM     INFLOW FROM MIGUELITA CREEK
 415          HC       2
              *

 416          KK    VPER
 417          KM     HYDROGRAPH FOR PERVIOUS PORTION OF AREA V
 418          BA    .380     .00     .00
 419          LS              86
 420          UC   1.269    3.81
              *

 421          KK    VIMP
 422          KM     HYDROGRAPH FOR IMPERVIOUS PORTION OF AREA V
 423          BA    .170     .00     .00
 424          LS              99
 425          UC   1.075     .72
              *
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 426          KK   URBNV
 427          HC       2
              *

 428          KK   VSTOR
 429          KM     ROUTE THRU STORM DRAIN SYSTEM V
 430          RL      0.     .00
 431          RS       1    STOR      0.     .00
 432          SV       0     1.4     4.1     5.5     6.9    11.0    16.5    99.0
 433          SQ       0    25.3    82.5    99.0   112.8   118.3   121.0   121.0
              *

 434          KK    PT27
 435          KM    LOWER SILVER CREEK DOWNSTREAM MIGUELITA
 436          HC       3
              *

 437          KK    PT28
 438          KM    ROUTE LOWER SILVER CREEK FROM MIGUELITA TO HWY 101
 439          RL     .00     .00
 440          RD    1900    .001    .045           TRAP     100    2.00
              *

 441          KK   W1PER
 442          KM     HYDROGRAPH FOR PERVIOUS PORTION OF AREA W1
 443          BA    .990     .00     .00
 444          LS              90
 445          UC   1.579    4.74
              *

 446          KK   W1IMP
 447          KM     HYDROGRAPH FOR IMPERVIOUS PORTION OF AREA W1
 448          BA    .380     .00     .00
 449          LS              99
 450          UC   1.290    0.86
              *

 451          KK  URBNW1
 452          HC       2
              *

 453          KK      W1
 454          KM     ROUTE THRU STORM DRAIN SYSTEM W1.
 455          RL      0.     .00
 456          RS       1    STOR      0.     .00
 457          SV       0     3.4    10.2    13.6    17.0    27.2    40.8   244.8
 458          SQ       0    38.1    95.2   108.8   115.6   170.0   210.8   210.8
              *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 459          KK    RTW1
 460          KM     ROUTE HYDROGRAPH OVERLAND AT 1FPS FROM POINT W1 TO POINT W2 (THRU W2)
 461          RL     .00     .00
 462          RM      10    1.83     0.3
              *

 463          KK   W2PER
 464          KM     HYDROGRAPH FOR PERVIOUS PORTION OF AREA W2
 465          BA    .850     .00     .00
 466          LS              89
 467          UC   1.618    4.85
              *

 468          KK   W2IMP
 469          KM     HYDROGRAPH FOR IMPERVIOUS PORTION OF AREA W2
 470          BA    .470     .00     .00
 471          LS              99
 472          UC   1.329    0.89
              *

 473          KK  URBNW2
 474          HC       2
              *

 475          KK  W2STOR
 476          KM     ROUTE THRU STORM DRAIN SYSTEM W2.
 477          RL      0.     .00
 478          RS       1    STOR      0.     .00
 479          SV       0     3.3     9.9    13.2    16.5    26.4    39.6   237.6
 480          SQ       0    37.0    92.4   105.6   112.2   165.0   204.6   204.6
              *

 481          KK    I680
 482          HC       2
              *

 483          KK    PT28
 484          KM    ROUTE OVERLAND AT 1 FPS THRU W3 TO LOWER SILVER
 485          RL     .00     .00
 486          RM      10    1.81     0.3
              *

 487          KK   W3PER
 488          KM     HYDROGRAPH FOR PERVIOUS PORTION OF AREA W3
 489          BA    0.47     .00
 490          LS              87
 491          UC   1.651   4.950
              *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 492          KK   W3IMP
 493          KM     HYDROGRAPH FOR IMPERVIOUS PORTION OF AREA W3
 494          BA    .290     .00     .00
 495          LS              99
 496          UC   1.386     .92
              *

 497          KK  URBNW3
 498          HC       3
              *

 499          KK  W3STOR
 500          KM     ROUTE THRU STORM DRAIN SYSTEM W3
 501          RL      0.     .00
 502          RS       1    STOR      0.     .00
 503          SV       0     8.6    25.8    34.4    43.0    68.8   103.2   619.2
 504          SQ       0    96.3   240.8   275.2   292.4   309.6   316.5   316.5
              *

 505          KK    XPER
 506          KM     HYDROGRAPH FOR PERVIOUS PORTION OF AREA X
 507          BA    0.18     .00
 508          LS              82
 509          UC   1.260    3.78
              *

 510          KK    XIMP
 511          KM     HYDROGRAPH FOR IMPERVIOUS PORTION OF AREA X
 512          BA    .060     .00     .00
 513          LS              99
 514          UC   1.058     .71
              *

 515          KK   URBNX
 516          HC       2
              *

 517          KK   XSTOR
 518          KM     ROUTE THRU STORM DRAIN SYSTEM X
 519          RL      0.     .00
 520          RS       1    STOR      0.     .00
 521          SV       0     0.6     1.8     2.4     3.0     4.8     7.2    43.2
 522          SQ       0    11.0    36.0    43.2    49.2    51.6    52.8    52.8
              *

 523          KK    PT28
 524          KM    HIGHWAY 101
 525          HC       3
              *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 526          KK   WOOST
 527          KM     ROUTE HYDROGRAPH FROM POINT 28 TO WOOSTER AVENUE
 528          RL     .00     .00
 529          RD     900   0.003    .045           TRAP      80     1.0
              *

 530          KK    PT29
 531          KM     ROUTE HYDROGRAPH FROM WOOSTER TO POINT 29 (COYOTE CREEK)
 532          RL     .00     .00
 533          RD    1100   0.003    .045           TRAP     100     2.0
              *
 534          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
'INE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   7        LAKE
               V
               V
  41        PT22
               .
               .
  45           .        PRUR
               .           .
               .           .
  62           .           .        PPER
               .           .           .
               .           .           .
  67           .           .           .        PIMP
               .           .           .           .
               .           .           .           .
  72           .           .      URBANP............
               .           .           V
               .           .           V
  74           .           .       PSTOR
               .           .           .
               .           .           .
  80        PT22........................
               .
               .
  83           .        Q1RUR
               .           .
               .           .
  88           .           .       Q2RUR
               .           .           .
               .           .           .
  93           .        Q1&Q2............
               .           V
               .           V
  95           .         CLAY
               .           V
               .           V
  99           .        SBABB
               .           .
               .           .
 103           .           .       Q3RUR
               .           .           .
               .           .           .
 108           .           .           .       Q3PER
               .           .           .           .
               .           .           .           .
 113           .           .           .           .       Q3IMP
               .           .           .           .           .
               .           .           .           .           .
  18           .           .           .     URBNQ3............
               .           .           .           V
               .           .           .           V
 120           .           .           .     Q3STOR
               .           .           .           .
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```
            .          .          .          .
126         .          .      ALLQ3............
            .          .          .
            .          .          .
 28         .      SBABB............
            .          .
            .          .
131      PT22............
            V
            V
134      PT23
            .
            .
138         .      R1RUR
            .          .
            .          .
143         .          .      R1PER
            .          .          .
            .          .          .
148         .          .          .      R1IMP
            .          .          .          .
            .          .          .          .
153         .          .     URBNR1............
            .          .          V
            .          .          V
155         .          .     R1STOR
            .          .          .
            .          .          .
161         .         R1............
            .          V
            .          V
163         .      WHITE
            .          V
            .          V
167         .      NBABB
            .          .
            .          .
171         .          .      R2PER
            .          .          .
            .          .          .
176         .          .          .      R2IMP
            .          .          .          .
            .          .          .          .
181         .          .     URBNR2............
            .          .          V
            .          .          V
183         .          .     R2STOR
            .          .          .
            .          .          .
189         .          .          .      R3PER
            .          .          .          .
            .          .          .          .
194         .          .          .          .      R3IMP
            .          .          .          .          .
            .          .          .          .          .
 99         .          .          .     URBNR3............
            .          .          .          V
            .          .          .          V
201         .          .          .     R3STOR
            .          .          .          .
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```
            .          .          .          .
207         .      NBABB.......................
            .          .
            .          .
 10         .          .      R4PER
            .          .          .
            .          .          .
215         .          .          .      R4IMP
            .          .          .          .
            .          .          .          .
220         .          .     URBNR4............
            .          .          V
            .          .          V
222         .          .     R4STOR
            .          .          .
            .          .          .
228       PT23........................
            V
            V
231        4B
            V
            V
235       PT24
            .
            .
239         .      S1PER
            .          .
            .          .
244         .          .      S1IMP
            .          .          .
            .          .          .
249         .      URBNS1............
            .          V
            .          V
251         .      S1STOR
            .          .
            .          .
257       PT24............
            V
            V
260        3F
            V
            V
264        3E
            V
            V
268       PT25
            .
            .
272         .       S2PER
            .          .
            .          .
277         .          .      S2IMP
            .          .          .
            .          .          .
 32         .      URBNS2............
            .          V
            .          V
284         .      S2STOR
            .          .
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```
            .           .
290         .           .       TPER
            .           .          .
            .           .          .
 95         .           .          .       TIMP
            .           .          .          .
            .           .          .          .
300         .           .     URBANT............
            .           .          V
            .           .          V
302         .           .      TSTOR
            .           .          .
            .           .          .
308       PT25.......................
            V
            V
311         3B
            V
            V
315         3A
            V
            V
319       PT27
            .
            .
323         .       U1RUR
            .           .
            .           .
328         .           .      U1PER
            .           .          .
            .           .          .
333         .           .          .      U1IMP
            .           .          .          .
            .           .          .          .
338         .           .     URBNU1............
            .           .          V
            .           .          V
340         .           .     U1STOR
            .           .          .
            .           .          .
346         .         U1............
            .           V
            .           V
348         .       MCKEE
            .           V
            .           V
352         .        SHOP
            .           V
            .           V
356         .         CAP
            .           V
            .           V
360         .        I680
            .           .
            .           .
 64         .           .      U2RUR
            .           .          .
            .           .          .
369         .           .          .      U2PER
            .           .          .          .
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          .          .          .          .
374       .          .          .          .      U2IMP
          .          .          .          .          .
          .          .          .          .          .
 79       .          .          .     URBNU2............
          .          .          .          V
          .          .          .          V
381       .          .          .     U2STOR
          .          .          .          .
          .          .          .          .
387       .          .      ALLU2............
          .          .          .
          .          .          .
389       .       I680............
          .          V
          .          V
391       .        MIG
          .          .
          .          .
395       .          .      U3PER
          .          .          .
          .          .          .
400       .          .          .      U3IMP
          .          .          .          .
          .          .          .          .
405       .          .     URBNU3............
          .          .          V
          .          .          V
407       .          .     U3STOR
          .          .          .
          .          .          .
413       .        MIG............
          .          .
          .          .
416       .          .       VPER
          .          .          .
          .          .          .
421       .          .          .       VIMP
          .          .          .          .
          .          .          .          .
426       .          .      URBNV............
          .          .          V
          .          .          V
428       .          .      VSTOR
          .          .          .
          .          .          .
434       PT27........................
             V
             V
437       PT28
             .
             .
441          .      W1PER
             .          .
             .          .
 46          .          .      W1IMP
             .          .          .
             .          .          .
451          .     URBNW1............
             .          V
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            .          V
453         .         W1
            .          V
            .          V
 59         .       RTW1
            .          .
            .          .
463         .          .      W2PER
            .          .          .
            .          .          .
468         .          .          .       W2IMP
            .          .          .           .
            .          .          .           .
473         .          .     URBNW2............
            .          .          V
            .          .          V
475         .          .     W2STOR
            .          .          .
            .          .          .
481         .       I680............
            .          V
            .          V
483         .       PT28
            .          .
            .          .
487         .          .      W3PER
            .          .          .
            .          .          .
492         .          .          .       W3IMP
            .          .          .           .
            .          .          .           .
497         .     URBNW3........................
            .          V
            .          V
499         .     W3STOR
            .          .
            .          .
505         .          .       XPER
            .          .          .
            .          .          .
510         .          .          .        XIMP
            .          .          .           .
            .          .          .           .
515         .          .     URBNX............
            .          .          V
            .          .          V
517         .          .     XSTOR
            .          .          .
            .          .          .
523       PT28........................
             V
             V
526      WOOST
             V
             V
 30       PT29
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(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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****************************************                                    ****************************************
*                                      *                                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
*            SEPTEMBER 1990            *                                    *    HYDROLOGIC ENGINEERING CENTER     *
*             VERSION 4.0              *                                    *          609 SECOND STREET           *
*                                      *                                    *       DAVIS, CALIFORNIA 95616        *
* RUN DATE  06/14/2001  TIME  18:43:21 *                                    *          (916) 756-1104              *
*                                      *                                    *                                      *
****************************************                                    ****************************************


                        LOWER SILVER-THOMPSON CREEK FLOOD HYDROGRAPHS, AUGUST 2000
                        100YEAR FLOOD PEAKS rainfall 4.2 moisture 2.75,r0.75
                        URBAN AREA FULLY DEVELOPED BASED ON SAN JOSE 2020 GENERAL PLAN
                        PREPARED BY SCHAAF & WHEELER TO EXAMINE LAKE CUNNINGHAM STORAGE

  6 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN         10  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         196  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0830  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .17 HOURS
                      TOTAL TIME BASE   32.50 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	LAKE	2807.	19.50	2749.	2048.	1606.	26.28		
ROUTED TO	PT22	2806.	19.83	2749.	2048.	1600.	26.28		
HYDROGRAPH AT	PRUR	54.	18.33	40.	23.	17.	.25		
HYDROGRAPH AT	PPER	103.	18.67	84.	50.	38.	.56		
HYDROGRAPH AT	PIMP	89.	18.33	54.	33.	24.	.30		
2 COMBINED AT	URBANP	189.	18.33	135.	81.	62.	.86		
ROUTED TO	PSTOR	79.	18.67	79.	73.	60.	.86		
3 COMBINED AT	PT22	2927.	19.67	2867.	2140.	1677.	27.39		
HYDROGRAPH AT	Q1RUR	284.	18.33	210.	116.	87.	1.37		
HYDROGRAPH AT	Q2RUR	420.	18.33	291.	163.	121.	1.79		
2 COMBINED AT	Q1&Q2	704.	18.33	501.	279.	208.	3.16		
ROUTED TO	CLAY	700.	18.33	501.	279.	208.	3.16		
ROUTED TO	SBABB	698.	18.50	501.	279.	208.	3.16		
HYDROGRAPH AT	Q3RUR	53.	18.50	40.	23.	17.	.25		
HYDROGRAPH AT	Q3PER	44.	18.67	36.	21.	16.	.24		
HYDROGRAPH AT	Q3IMP	114.	18.33	70.	42.	31.	.39		
2 COMBINED AT	URBNQ3	157.	18.33	103.	63.	48.	.63		
ROUTED TO	Q3STOR	98.	18.83	92.	61.	47.	.63		
2 COMBINED AT	ALLQ3	148.	18.83	131.	85.	65.	.88		
2 COMBINED AT	SBABB	844.	18.50	629.	363.	272.	4.04		
2 COMBINED AT	PT22	3665.	18.50	3495.	2501.	1950.	31.43		
ROUTED TO	PT23	3664.	18.67	3495.	2500.	1947.	31.43		
HYDROGRAPH AT	R1RUR	85.	18.17	58.	33.	24.	.35		
HYDROGRAPH AT	R1PER	70.	18.50	53.	31.	23.	.34		
HYDROGRAPH AT	R1IMP	127.	18.17	72.	44.	32.	.40		
2 COMBINED AT	URBNR1	194.	18.17	122.	73.	55.	.74		

ROUTED TO	R1STOR	120.	19.17	110.	72.	55.	.74
2 COMBINED AT	R1	195.	18.33	164.	104.	79.	1.09
ROUTED TO	WHITE	195.	18.50	164.	104.	79.	1.09
ROUTED TO	NBABB	195.	18.50	164.	104.	79.	1.09
HYDROGRAPH AT	R2PER	99.	18.67	80.	47.	36.	.53
HYDROGRAPH AT	R2IMP	92.	18.33	56.	34.	25.	.31
2 COMBINED AT	URBNR2	189.	18.33	132.	79.	61.	.84
ROUTED TO	R2STOR	127.	20.00	120.	78.	60.	.84
HYDROGRAPH AT	R3PER	66.	18.83	55.	33.	25.	.38
HYDROGRAPH AT	R3IMP	68.	18.33	43.	26.	19.	.24
2 COMBINED AT	URBNR3	132.	18.50	96.	58.	45.	.62
ROUTED TO	R3STOR	127.	18.83	89.	57.	45.	.62
3 COMBINED AT	NBABB	441.	18.83	370.	237.	184.	2.55
HYDROGRAPH AT	R4PER	34.	18.67	28.	16.	12.	.19
HYDROGRAPH AT	R4IMP	30.	18.33	18.	11.	8.	.10
2 COMBINED AT	URBNR4	63.	18.33	45.	27.	20.	.29
ROUTED TO	R4STOR	54.	19.00	44.	26.	20.	.29
3 COMBINED AT	PT23	4157.	18.67	3906.	2764.	2152.	34.27
ROUTED TO	4B	4156.	18.83	3906.	2764.	2151.	34.27
ROUTED TO	PT24	4155.	18.83	3906.	2764.	2148.	34.27
HYDROGRAPH AT	S1PER	41.	19.50	38.	23.	18.	.30
HYDROGRAPH AT	S1IMP	20.	18.67	14.	9.	6.	.08
2 COMBINED AT	URBNS1	59.	19.00	50.	31.	24.	.38
ROUTED TO	S1STOR	57.	19.50	50.	31.	24.	.38
2 COMBINED AT	PT24	4208.	18.83	3954.	2794.	2172.	34.65
ROUTED TO	3F	4206.	18.83	3954.	2794.	2171.	34.65
ROUTED TO	3E	4205.	19.00	3954.	2794.	2170.	34.65
ROUTED TO	PT25	4205.	19.00	3953.	2794.	2169.	34.65
HYDROGRAPH AT	S2PER	76.	19.00	65.	38.	29.	.47
HYDROGRAPH AT	S2IMP	69.	18.50	44.	27.	20.	.25

2 COMBINED AT	URBNS2	142.	18.50	106.	64.	49.	.72
ROUTED TO	S2STOR	66.	19.33	66.	59.	48.	.72
HYDROGRAPH AT	TPER	81.	19.00	71.	41.	31.	.55
HYDROGRAPH AT	TIMP	66.	18.50	43.	26.	19.	.24
2 COMBINED AT	URBANT	144.	18.67	110.	65.	50.	.79
ROUTED TO	TSTOR	72.	20.17	72.	62.	49.	.79
3 COMBINED AT	PT25	4341.	19.00	4089.	2908.	2265.	36.16
ROUTED TO	3B	4340.	19.00	4088.	2908.	2264.	36.16
ROUTED TO	3A	4337.	19.17	4088.	2908.	2262.	36.16
ROUTED TO	PT27	4337.	19.17	4088.	2908.	2260.	36.16
HYDROGRAPH AT	U1RUR	180.	18.17	121.	66.	49.	.75
HYDROGRAPH AT	U1PER	10.	18.50	8.	4.	3.	.05
HYDROGRAPH AT	U1IMP	22.	18.17	13.	8.	6.	.07
2 COMBINED AT	URBNU1	32.	18.17	20.	12.	9.	.12
ROUTED TO	U1STOR	25.	18.67	20.	12.	9.	.12
2 COMBINED AT	U1	204.	18.17	141.	78.	58.	.87
ROUTED TO	MCKEE	204.	18.33	141.	78.	58.	.87
ROUTED TO	SHOP	203.	18.33	141.	78.	58.	.87
ROUTED TO	CAP	202.	18.33	141.	78.	58.	.87
ROUTED TO	I680	201.	18.50	141.	78.	58.	.87
HYDROGRAPH AT	U2RUR	2.	18.50	1.	1.	1.	.01
HYDROGRAPH AT	U2PER	162.	18.83	138.	76.	57.	1.11
HYDROGRAPH AT	U2IMP	195.	18.33	123.	75.	56.	.69
2 COMBINED AT	URBNU2	350.	18.50	251.	145.	113.	1.80
ROUTED TO	U2STOR	244.	20.00	230.	144.	112.	1.80
2 COMBINED AT	ALLU2	245.	20.00	231.	144.	113.	1.81
2 COMBINED AT	I680	425.	18.67	360.	222.	171.	2.68
ROUTED TO	MIG	425.	18.67	360.	222.	171.	2.68
HYDROGRAPH AT	U3PER	62.	19.00	55.	30.	22.	.49
HYDROGRAPH AT	U3IMP	50.	18.33	32.	20.	15.	.18

2 COMBINED AT	URBNU3	109.	18.50	83.	47.	37.	.67
ROUTED TO	U3STOR	81.	20.33	76.	47.	37.	.67
2 COMBINED AT	MIG	495.	18.83	434.	268.	207.	3.35
HYDROGRAPH AT	VPER	54.	19.00	47.	27.	20.	.38
HYDROGRAPH AT	VIMP	47.	18.50	30.	18.	14.	.17
2 COMBINED AT	URBNV	98.	18.67	74.	43.	34.	.55
ROUTED TO	VSTOR	89.	19.17	74.	43.	34.	.55
3 COMBINED AT	PT27	4915.	19.00	4591.	3218.	2501.	40.06
ROUTED TO	PT28	4911.	19.17	4590.	3218.	2497.	40.06
HYDROGRAPH AT	W1PER	141.	19.33	127.	76.	58.	.99
HYDROGRAPH AT	W1IMP	99.	18.67	67.	41.	31.	.38
2 COMBINED AT	URBNW1	234.	18.83	187.	113.	89.	1.37
ROUTED TO	W1	179.	20.83	173.	112.	88.	1.37
ROUTED TO	RTW1	179.	22.67	172.	112.	85.	1.37
HYDROGRAPH AT	W2PER	117.	19.33	106.	63.	48.	.85
HYDROGRAPH AT	W2IMP	121.	18.67	83.	51.	38.	.47
2 COMBINED AT	URBNW2	232.	18.83	181.	109.	86.	1.32
ROUTED TO	W2STOR	175.	20.67	167.	108.	85.	1.32
2 COMBINED AT	I680	349.	22.00	333.	219.	170.	2.69
ROUTED TO	PT28	348.	23.83	332.	217.	165.	2.69
HYDROGRAPH AT	W3PER	61.	19.33	56.	33.	25.	.47
HYDROGRAPH AT	W3IMP	74.	18.67	51.	31.	23.	.29
3 COMBINED AT	URBNW3	426.	23.50	402.	276.	213.	3.45
ROUTED TO	W3STOR	315.	28.00	314.	248.	190.	3.45
HYDROGRAPH AT	XPER	23.	19.00	20.	11.	8.	.18
HYDROGRAPH AT	XIMP	17.	18.50	11.	7.	5.	.06
2 COMBINED AT	URBNX	39.	18.67	30.	17.	13.	.24
ROUTED TO	XSTOR	36.	19.17	29.	17.	13.	.24
3 COMBINED AT	PT28	5223.	19.17	4898.	3459.	2699.	43.75
ROUTED TO	WOOST	5222.	19.17	4898.	3459.	2698.	43.75

ROUTED TO	PT29	5220.	19.33	4898.	3459.	2696.	43.75

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
PT22	MANE	10.00	2806.29	1190.00	3.07	10.00	2806.29	1190.00	3.07
CONTINUITY SUMMARY (AC-FT) - INFLOW= .4316E+04 EXCESS= .0000E+00 OUTFLOW= .4301E+04 BASIN STORAGE= .1891E+02 PERCENT ERROR= -.1									
CLAY	MANE	7.48	702.92	1106.30	3.31	10.00	699.65	1100.00	3.31
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5576E+03 EXCESS= .0000E+00 OUTFLOW= .5576E+03 BASIN STORAGE= .9012E-01 PERCENT ERROR= .0									
SBABB	MANE	4.11	700.03	1106.23	3.31	10.00	697.99	1110.00	3.31
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5576E+03 EXCESS= .0000E+00 OUTFLOW= .5576E+03 BASIN STORAGE= .5797E-01 PERCENT ERROR= .0									
PT23	MANE	6.31	3664.09	1116.40	3.12	10.00	3663.69	1120.00	3.12
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5238E+04 EXCESS= .0000E+00 OUTFLOW= .5231E+04 BASIN STORAGE= .1197E+02 PERCENT ERROR= -.1									
WHITE	MANE	4.67	195.21	1110.29	3.67	10.00	195.21	1110.00	3.67
CONTINUITY SUMMARY (AC-FT) - INFLOW= .2135E+03 EXCESS= .0000E+00 OUTFLOW= .2134E+03 BASIN STORAGE= .3314E-01 PERCENT ERROR= .0									
NBABB	MANE	1.64	195.14	1111.03	3.67	10.00	195.07	1110.00	3.67
CONTINUITY SUMMARY (AC-FT) - INFLOW= .2134E+03 EXCESS= .0000E+00 OUTFLOW= .2134E+03 BASIN STORAGE= .1886E-01 PERCENT ERROR= .0									
4B	MANE	2.39	4156.38	1125.16	3.16	10.00	4155.75	1130.00	3.16
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5779E+04 EXCESS= .0000E+00 OUTFLOW= .5776E+04 BASIN STORAGE= .4866E+01 PERCENT ERROR= .0									
PT24	MANE	4.77	4154.98	1131.24	3.16	10.00	4154.79	1130.00	3.16
TINUITY SUMMARY (AC-FT) - INFLOW= .5776E+04 EXCESS= .0000E+00 OUTFLOW= .5770E+04 BASIN STORAGE= .1006E+02 PERCENT ERROR= -.1									
3F	MANE	2.48	4207.06	1133.66	3.16	10.00	4205.64	1130.00	3.16

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5836E+04 EXCESS= .0000E+00 OUTFLOW= .5833E+04 BASIN STORAGE= .5354E+01 PERCENT ERROR= .0

3E	MANE	2.50	4205.43	1138.60	3.15	10.00	4205.18	1140.00	3.15

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5832E+04 EXCESS= .0000E+00 OUTFLOW= .5829E+04 BASIN STORAGE= .5301E+01 PERCENT ERROR= .0

PT25	MANE	2.09	4204.66	1140.48	3.15	10.00	4204.56	1140.00	3.15

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5828E+04 EXCESS= .0000E+00 OUTFLOW= .5826E+04 BASIN STORAGE= .4530E+01 PERCENT ERROR= .0

3B	MANE	2.57	4340.37	1142.72	3.15	10.00	4340.00	1140.00	3.15

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6085E+04 EXCESS= .0000E+00 OUTFLOW= .6081E+04 BASIN STORAGE= .6446E+01 PERCENT ERROR= .0

3A	MANE	3.40	4338.02	1144.64	3.15	10.00	4337.07	1150.00	3.15

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6082E+04 EXCESS= .0000E+00 OUTFLOW= .6076E+04 BASIN STORAGE= .8047E+01 PERCENT ERROR= .0

PT27	MANE	1.73	4336.75	1148.85	3.15	10.00	4336.65	1150.00	3.15

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6074E+04 EXCESS= .0000E+00 OUTFLOW= .6071E+04 BASIN STORAGE= .4398E+01 PERCENT ERROR= .0

MCKEE	MANE	5.15	203.97	1097.75	3.36	10.00	203.53	1100.00	3.36

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1558E+03 EXCESS= .0000E+00 OUTFLOW= .1558E+03 BASIN STORAGE= .5235E-02 PERCENT ERROR= .0

SHOP	MANE	.77	203.39	1100.94	3.36	10.00	203.34	1100.00	3.36

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1558E+03 EXCESS= .0000E+00 OUTFLOW= .1558E+03 BASIN STORAGE= .3061E-02 PERCENT ERROR= .0

CAP	MANE	5.54	202.61	1103.03	3.36	10.00	201.61	1100.00	3.36

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1558E+03 EXCESS= .0000E+00 OUTFLOW= .1558E+03 BASIN STORAGE= .4681E-02 PERCENT ERROR= .0

I680	MANE	1.81	201.65	1103.67	3.36	10.00	201.07	1110.00	3.36

TINUITY SUMMARY (AC-FT) - INFLOW= .1558E+03 EXCESS= .0000E+00 OUTFLOW= .1558E+03 BASIN STORAGE= .1600E-02 PERCENT ERROR= .0

MIG	MANE	5.43	424.90	1124.23	3.21	10.00	424.90	1120.00	3.21

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CONTINUITY SUMMARY (AC-FT) - INFLOW= .4585E+03 EXCESS= .0000E+00 OUTFLOW= .4583E+03 BASIN STORAGE= .2690E+00 PERCENT ERROR=    .0

            PT28  MANE        5.79   4911.24   1151.77      3.14     10.00   4910.87   1150.00        3.14

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6716E+04 EXCESS= .0000E+00 OUTFLOW= .6704E+04 BASIN STORAGE= .1537E+02 PERCENT ERROR=    .0

           WOOST  MANE        1.71   5222.43   1152.11      3.10     10.00   5221.83   1150.00        3.11

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7250E+04 EXCESS= .0000E+00 OUTFLOW= .7246E+04 BASIN STORAGE= .5820E+01 PERCENT ERROR=    .0

            PT29  MANE        2.33   5221.02   1153.90      3.10     10.00   5219.72   1160.00        3.10

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7246E+04 EXCESS= .0000E+00 OUTFLOW= .7240E+04 BASIN STORAGE= .7872E+01 PERCENT ERROR=    .0


*** NORMAL END OF HEC-1 ***
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APPENDIX E
HYDRAULIC BACKUP

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Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using Chow Equation (6-19)

Reach 1A
Station 0+73 to Station 10+67

Channel Element	b	Left SS	Right SS	depth	n
Left Bank		2			0.04
Maintenance Road	20				0.03
Grassed Floodplain	18	2		3	0.04
Wetland	28	2	2	3	0.05
Riparian Bench	5				0.15
Right Bank			2		0.15

Total Discharge	**5,220**	cfs
Maximum Depth	**16.5**	feet

Element	n_i	A_i	P_i	R_i	$P_iR_i^{5/3}/n_i$	Q_i	V_i	$V_i^3A_i$
Left Bank	0.040	110.25	23.48	4.70	7,729	236	2.14	1,087
Maintenance Road	0.030	210.00	20.00	10.50	33,565	1,027	4.89	24,532
Grassed Floodplain	0.040	315.00	24.71	12.75	42,976	1,314	4.17	22,886
Wetland	0.050	642.00	41.42	15.50	79,825	2,441	3.80	35,306
Riparian Bench	0.150	67.50	5.00	13.50	2,551	78	1.16	104
Right Bank	0.150	182.25	30.19	6.04	4,028	123	0.68	56
Summation		1,527.00	144.79	10.55	170,676	5,220		83,971

Average Velocity	3.42	fps
Composite n	0.043	
α	1.38	

n Used	0.045
α Used	1.4

Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using Chow Equation (6-19)

Reach 1B
Station 11+07 to Station 13+66

Channel Element	b	Left SS	Right SS	depth	n
Left Bank		1			0.045
Maintenance Road	20				0.03
Grassed Floodplain	15	1		3	0.04
Wetland	28	2	2	3	0.05
Riparian Bench	5				0.15
Right Bank			1		0.045

Total Discharge	**5,220**	cfs
Maximum Depth	**14**	feet

Element	n_i	A_i	P_i	R_i	$P_iR_i^{5/3}/n_i$	Q_i	V_i	$V_i^3A_i$
Left Bank	0.045	32.00	11.31	2.83	1,422	67	2.10	295
Maintenance Road	0.030	160.00	20.00	8.00	21,333	1,007	6.29	39,842
Grassed Floodplain	0.040	193.50	19.24	10.06	22,537	1,063	5.50	32,117
Wetland	0.050	542.00	41.42	13.09	60,198	2,840	5.24	78,010
Riparian Bench	0.150	55.00	5.00	11.00	1,814	86	1.56	207
Right Bank	0.045	60.50	15.56	3.89	3,325	157	2.59	1,055
Summation		1,043.00	112.53	9.27	110,629	5,220		151,526

Average Velocity	5.00 fps
Composite n	0.042
α	1.16

n Used	0.045
α Used	1.20

Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using Chow Equation (6-19)

Reach 1C
Station 13+50 to Station 18+00

Channel Element	b	Left SS	Right SS	depth	n
Left Bank		1			0.045
Maintenance Road	20				0.03
Grassed Floodplain	4	0.8		3	0.04
Wetland	28	2	2	3	0.05
Riparian Bench	5				0.15
Right Bank			0.8		0.045

Total Discharge	**5,220**	cfs
Maximum Depth	**14**	feet

Element	n_i	A_i	P_i	R_i	$P_iR_i^{5/3}/n_i$	Q_i	V_i	$V_i^3A_i$
Left Bank	0.045	32.00	11.31	2.83	1,422	79	2.46	478
Maintenance Road	0.030	160.00	20.00	8.00	21,333	1,182	7.39	64,573
Grassed Floodplain	0.040	66.80	7.84	8.52	6,966	386	5.78	12,895
Wetland	0.050	542.00	41.42	13.09	60,198	3,336	6.16	126,432
Riparian Bench	0.150	55.00	5.00	11.00	1,814	101	1.83	336
Right Bank	0.045	48.40	14.09	3.44	2,449	136	2.80	1,068
Summation		904.20	99.66	9.07	94,181	5,220		205,782

Average Velocity	5.77	fps
Composite n	0.042	
α	1.18	

n Used	0.045
α Used	1.2

Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using Chow Equation (6-19)

Reach 1C
Station 21+00 to Station 25+00

Channel Element	b	Left SS	Right SS	depth	n
Left Bank		0.3			0.045
Maintenance Road	20				0.03
Grassed Floodplain	0.00001	0		0	0.04
Wetland	50	2	2	3	0.05
Riparian Bench	5				0.15
Right Bank			0.3		0.045

Total Discharge	**4,920**	cfs
Maximum Depth	**14**	feet

Element	n_i	A_i	P_i	R_i	$P_iR_i^{5/3}/n_i$	Q_i	V_i	$V_i^3A_i$
Left Bank	0.045	18.15	11.48	1.58	547	20	1.10	24
Maintenance Road	0.030	220.00	20.00	11.00	36,271	1,321	6.00	47,615
Grassed Floodplain	0.040	0.00	0.00	11.00	0	0	4.50	0
Wetland	0.050	850.00	63.42	13.40	95,924	3,493	4.11	58,998
Riparian Bench	0.150	55.00	5.00	11.00	1,814	66	1.20	95
Right Bank	0.045	18.15	11.48	1.58	547	20	1.10	24
Summation		1,161.30	111.39	10.43	135,103	4,920		106,756

Average Velocity	4.24 fps
Composite n	0.041
α	1.21

n Used	0.040
α Used	1.2

Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using Chow Equation (6-19)

Reach 1D
Station 27+71 to Station 32+75

Channel Element	b	Left SS	Right SS	depth	n
Left Bank		2			0.04
Maintenance Road	20				0.03
Grassed Floodplain	15	2		3	0.04
Wetland	50	2	2	3	0.05
Riparian Bench	5				0.15
Right Bank			2		0.15

Total Discharge	**4,920**	cfs
Maximum Depth	**14**	feet

Element	n_i	A_i	P_i	R_i	$P_iR_i^{5/3}/n_i$	Q_i	V_i	$V_i^3A_i$
Left Bank	0.040	56.25	16.77	3.35	3,151	110	1.96	426
Maintenance Road	0.030	150.00	20.00	7.50	19,158	672	4.48	13,467
Grassed Floodplain	0.040	211.50	21.71	9.74	24,120	846	4.00	13,518
Wetland	0.050	819.00	63.42	12.91	90,164	3,161	3.86	47,093
Riparian Bench	0.150	52.50	5.00	10.50	1,678	59	1.12	74
Right Bank	0.150	110.25	23.48	4.70	2,061	72	0.66	31
Summation		1,399.50	150.37	9.31	140,332	4,920		74,610

Average Velocity	3.52	fps
Composite n	0.044	
α	1.23	

n Used	0.045
α Used	1.2

Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using Chow Equation (6-19)

Reach 1D
Station 32+75 to Station 36+50

Channel Element	b	Left SS	Right SS	depth	n
Left Bank		1.5			0.045
Maintenance Road	20				0.03
Grassed Floodplain	13	1		3	0.04
Wetland	50	2	2	3	0.05
Riparian Bench	5				0.15
Right Bank			2		0.15

Total Discharge	**4,920**	cfs
Maximum Depth	**13.5**	feet

Element	n_i	A_i	P_i	R_i	$P_iR_i^{5/3}/n_i$	Q_i	V_i	$V_i^3A_i$
Left Bank	0.045	42.19	13.52	3.12	2,002	74	1.75	226
Maintenance Road	0.030	150.00	20.00	7.50	19,158	707	4.71	15,686
Grassed Floodplain	0.040	163.50	17.24	9.48	18,312	675	4.13	11,530
Wetland	0.050	819.00	63.42	12.91	90,164	3,326	4.06	54,854
Riparian Bench	0.150	52.50	5.00	10.50	1,678	62	1.18	86
Right Bank	0.150	110.25	23.48	4.70	2,061	76	0.69	36
Summation		1,337.44	142.66	9.38	133,375	4,920		82,419

Average Velocity	3.68	fps
Composite n	0.045	
α	1.24	

n Used	0.045
α Used	1.25

Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using Chow Equation (6-19)

Reach 3A
Station 54+28 to Station 66+57

Channel Element	b	Left SS	Right SS	depth	n
Left Bank		2			0.04
Maintenance Road	20				0.03
Grassed Floodplain	3	1		2	0.04
Wetland	30	4	2	3	0.05
Riparian Bench	5				0.15
Right Bank			2		0.15

Total Discharge	**4,340**	cfs
Maximum Depth	**14.5**	feet

Element	n_i	A_i	P_i	R_i	$P_iR_i^{5/3}/n_i$	Q_i	V_i	$V_i^3A_i$
Left Bank	0.040	90.25	21.24	4.25	5,919	211	2.34	1,160
Maintenance Road	0.030	190.00	20.00	9.50	28,408	1,015	5.34	28,951
Grassed Floodplain	0.040	55.50	5.83	9.52	6,233	223	4.01	3,584
Wetland	0.050	669.00	49.08	13.63	76,352	2,727	4.08	45,335
Riparian Bench	0.150	57.50	5.00	11.50	1,953	70	1.21	103
Right Bank	0.150	132.25	25.71	5.14	2,627	94	0.71	47
Summation		1,194.50	126.86	9.42	121,492	4,340		79,180

Average Velocity	3.63 fps
Composite n	0.044
α	1.38

n Used	0.045
α Used	1.40

Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using Chow Equation (6-19)

Reach 3C&D
Station 89+08 to Station 103+28

Channel Element	b	Left SS	Right SS	depth	n
Left Bank		1.67			0.045
Maintenance Road	20				0.03
Grassed Floodplain	1E-07	0		0	0.04
Wetland	26	2	2	3	0.05
Riparian Bench	5				0.15
Right Bank			2		0.15

Total Discharge	**4,210**	cfs
Maximum Depth	**11**	feet

Element	n_i	A_i	P_i	R_i	$P_iR_i^{5/3}/n_i$	Q_i	V_i	$V_i^3A_i$
Left Bank	0.045	53.44	15.57	3.43	2,702	179	3.35	2,003
Maintenance Road	0.030	160.00	20.00	8.00	21,333	1,412	8.83	110,014
Grassed Floodplain	0.040	0.00	0.00	8.00	0	0	6.62	0
Wetland	0.050	400.00	39.42	10.15	37,498	2,482	6.21	95,593
Riparian Bench	0.150	40.00	5.00	8.00	1,067	71	1.77	220
Right Bank	0.150	64.00	17.89	3.58	998	66	1.03	70
Summation		717.44	97.88	7.33	63,598	4,210		207,900

Average Velocity	5.87	fps
Composite n	0.043	
α	1.43	

n Used	0.045
α Used	1.45

Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using Chow Equation (6-19)

Reach 3E
Station 108+84 to Station 115+19

Channel Element	b	Left SS	Right SS	depth	n
Left Bank		2			0.04
Maintenance Road	20				0.03
Grassed Floodplain	22	2		2	0.04
Wetland	26	4	2	3	0.05
Riparian Bench	5				0.15
Right Bank			2		0.15

Total Discharge	**4,210**	cfs
Maximum Depth	**10.5**	feet

Element	n_i	A_i	P_i	R_i	$P_iR_i^{5/3}/n_i$	Q_i	V_i	$V_i^3A_i$
Left Bank	0.040	30.25	12.30	2.46	1,378	81	2.67	575
Maintenance Road	0.030	110.00	20.00	5.50	11,425	669	6.08	24,778
Grassed Floodplain	0.040	191.00	26.47	7.22	17,829	1,044	5.47	31,235
Wetland	0.050	435.00	45.08	9.65	39,434	2,310	5.31	65,154
Riparian Bench	0.150	37.50	5.00	7.50	958	56	1.50	126
Right Bank	0.150	56.25	16.77	3.35	840	49	0.88	38
Summation		860.00	125.62	6.85	71,864	4,210		121,906

Average Velocity	4.90	fps
Composite n	0.043	
α	1.21	

n Used	0.045
α Used	1.20

Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using Chow Equation (6-19)

Reach 3F
Station 117+33 to Station 124+66

Channel Element	b	Left SS	Right SS	depth	n
Left Bank		2			0.04
Maintenance Road	20				0.03
Grassed Floodplain	51	2		2	0.04
Wetland	26	4	2	3	0.05
Riparian Bench	5				0.15
Right Bank			2		0.15

Total Discharge	**4,210**	cfs
Maximum Depth	**10.0**	feet

Element	n_i	A_i	P_i	R_i	$P_iR_i^{5/3}/n_i$	Q_i	V_i	$V_i^3A_i$
Left Bank	0.040	25.00	11.18	2.24	1,069	54	2.17	255
Maintenance Road	0.030	100.00	20.00	5.00	9,747	495	4.95	12,105
Grassed Floodplain	0.040	381.00	55.47	6.87	34,416	1,747	4.58	36,713
Wetland	0.050	413.00	45.08	9.16	36,167	1,836	4.44	36,257
Riparian Bench	0.150	35.00	5.00	7.00	854	43	1.24	66
Right Bank	0.150	49.00	15.65	3.13	699	35	0.72	19
Summation		1,003.00	152.38	6.58	82,951	4,210		85,416

Average Velocity	4.20	fps
Composite n	0.042	
α	1.15	

n Used	0.045
α Used	1.20

Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using Chow Equation (6-19)

Reach 4B
Station 132+10 to Station 153+80

Channel Element	b	Left SS	Right SS	depth	n
Left Bank		0.25			0.045
Maintenance Road	20				0.03
Grassed Floodplain	1E-08	0		0	0.04
Wetland	49	0.25	0.25	2.5	0.05
Riparian Bench	5				0.15
Right Bank			0.25		0.045

Total Discharge	**4,160**	cfs
Maximum Depth	**11.5**	feet

Element	n_i	A_i	P_i	R_i	$P_iR_i^{5/3}/n_i$	Q_i	V_i	$V_i^3A_i$
Left Bank	0.045	10.13	9.28	1.09	239	12	1.17	16
Maintenance Road	0.030	180.00	20.00	9.00	25,960	1,293	7.19	66,770
Grassed Floodplain	0.040	0.00	0.00	9.00	0	0	5.39	0
Wetland	0.050	576.31	54.15	10.64	55,767	2,778	4.82	64,564
Riparian Bench	0.150	45.00	5.00	9.00	1,298	65	1.44	134
Right Bank	0.045	10.13	9.28	1.09	239	12	1.17	16
Summation		821.56	97.71	8.41	83,502	4,160		131,501

Average Velocity	5.06	fps
Composite n	0.041	
α	1.23	

n Used	0.040
α Used	1.25

Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using Chow Equation (6-19)

Reach 4C
Station 157+61 to Station 170+50

Channel Element	b	Left SS	Right SS	depth	n
Left Bank		0.25			0.045
Maintenance Road	20				0.03
Grassed Floodplain	1E-08	0		0	0.04
Wetland	21	0.25	0.25	2.5	0.05
Riparian Bench	5				0.15
Right Bank			0.25		0.045

Total Discharge	**4,160**	cfs
Maximum Depth	**12.0**	feet

Element	n_i	A_i	P_i	R_i	$P_iR_i^{5/3}/n_i$	Q_i	V_i	$V_i^3A_i$
Left Bank	0.045	11.28	9.79	1.15	276	21	1.84	70
Maintenance Road	0.030	190.00	20.00	9.50	28,408	2,138	11.25	270,870
Grassed Floodplain	0.040	0.00	0.00	9.50	0	0	8.44	0
Wetland	0.050	265.44	26.15	10.15	24,885	1,873	7.06	93,289
Riparian Bench	0.150	47.50	5.00	9.50	1,420	107	2.25	542
Right Bank	0.045	11.28	9.79	1.15	276	21	1.84	70
Summation		525.50	70.74	7.43	55,265	4,160		364,841

Average Velocity	7.92	fps
Composite n	0.036	
α	1.40	

n Used	0.040
α Used	1.40

Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using Chow Equation (6-19)

Reach 5B
Station 170+50 to Station 180+25

Channel Element	b	Left SS	Right SS	depth	n
Left Bank		0.25			0.045
Maintenance Road	20				0.03
Grassed Floodplain	1E-08	0		0	0.04
Wetland	22	0.8	0.8	2.5	0.05
Riparian Bench	5				0.15
Right Bank			0.25		0.045

Total Discharge	**3,670**	cfs
Maximum Depth	**12.5**	feet

Element	n_i	A_i	P_i	R_i	$P_iR_i^{5/3}/n_i$	Q_i	V_i	$V_i^3A_i$
Left Bank	0.045	12.50	10.31	1.21	316	18	1.42	36
Maintenance Road	0.030	200.00	20.00	10.00	30,944	1,739	8.70	131,579
Grassed Floodplain	0.040	0.00	0.00	10.00	0	0	6.52	0
Wetland	0.050	320.00	28.40	11.27	32,164	1,808	5.65	57,720
Riparian Bench	0.150	50.00	5.00	10.00	1,547	87	1.74	263
Right Bank	0.045	12.50	10.31	1.21	316	18	1.42	36
Summation		595.00	74.02	8.04	65,287	3,670		189,635

Average Velocity	6.17	fps
Composite n	0.037	
α	1.36	

n Used	0.040
α Used	1.35

Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using Chow Equation (6-19)

Reach 5C
Station 183+28 to Station 201+68

Channel Element	b	Left SS	Right SS	depth	n
Left Bank		0.25			0.045
Maintenance Road	20				0.03
Grassed Floodplain	1E-08	0		0	0.04
Wetland	36	0.8	0.8	2.5	0.05
Riparian Bench	5				0.15
Right Bank			0.25		0.045

Total Discharge	**3,670**	cfs
Maximum Depth	**12.5**	feet

Element	n_i	A_i	P_i	R_i	$P_iR_i^{5/3}/n_i$	Q_i	V_i	$V_i^3A_i$
Left Bank	0.045	12.50	10.31	1.21	316	14	1.10	17
Maintenance Road	0.030	200.00	20.00	10.00	30,944	1,351	6.75	61,626
Grassed Floodplain	0.040	0.00	0.00	10.00	0	0	5.07	0
Wetland	0.050	495.00	42.40	11.67	50,946	2,224	4.49	44,896
Riparian Bench	0.150	50.00	5.00	10.00	1,547	68	1.35	123
Right Bank	0.045	12.50	10.31	1.21	316	14	1.10	17
Summation		770.00	88.02	8.75	84,068	3,670		106,679

Average Velocity	4.77	fps
Composite n	0.039	
α	1.28	

n Used	0.040
α Used	1.30

Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using Chow Equation (6-19)

Reach 6A
Station 201+68 to Station 217+19

Channel Element	b	Left SS	Right SS	depth	n
Left Bank		0.25			0.045
Maintenance Road	20				0.03
Grassed Floodplain	1E-08	0		0	0.04
Wetland	36	0.8	0.8	2.5	0.05
Riparian Bench	5				0.15
Right Bank			0.25		0.045

Total Discharge	**2,810**	cfs
Maximum Depth	**12.0**	feet

Element	n_i	A_i	P_i	R_i	$P_iR_i^{5/3}/n_i$	Q_i	V_i	$V_i^3A_i$
Left Bank	0.045	11.28	9.79	1.15	276	10	0.88	8
Maintenance Road	0.030	190.00	20.00	9.50	28,408	1,024	5.39	29,761
Grassed Floodplain	0.040	0.00	0.00	9.50	0	0	4.04	0
Wetland	0.050	475.00	42.40	11.20	47,561	1,715	3.61	22,346
Riparian Bench	0.150	47.50	5.00	9.50	1,420	51	1.08	60
Right Bank	0.045	11.28	9.79	1.15	276	10	0.88	8
Summation		735.06	86.99	8.45	77,941	2,810		52,182

Average Velocity	3.82 fps
Composite n	0.039
α	1.27

n Used	0.040
α Used	1.30

Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using Chow Equation (6-19)

Reach 6B
Station 218+20 to Station 230+09

Channel Element	b	Left SS	Right SS	depth	n
Left Bank		0.25			0.045
Maintenance Road	20				0.03
Grassed Floodplain	1E-08	0		0	0.04
Wetland	56	0.8	0.8	2.5	0.05
Riparian Bench	5				0.15
Right Bank			0.25		0.045

Total Discharge	**2,810**	cfs
Maximum Depth	**12.5**	feet

Element	n_i	A_i	P_i	R_i	$P_iR_i^{5/3}/n_i$	Q_i	V_i	$V_i^3A_i$
Left Bank	0.045	12.50	10.31	1.21	316	8	0.64	3
Maintenance Road	0.030	200.00	20.00	10.00	30,944	784	3.92	12,033
Grassed Floodplain	0.040	0.00	0.00	10.00	0	0	2.94	0
Wetland	0.050	745.00	62.40	11.94	77,831	1,971	2.65	13,799
Riparian Bench	0.150	50.00	5.00	10.00	1,547	39	0.78	24
Right Bank	0.045	12.50	10.31	1.21	316	8	0.64	3
Summation		1,020.00	108.02	9.44	110,954	2,810		25,862

Average Velocity	2.75	fps
Composite n	0.041	
α	1.21	

n Used	0.040
α Used	1.20

Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using Chow Equation (6-19)

Reach 6C
Station 231+94 to Station 241+05

Channel Element	b	Left SS	Right SS	depth	n
Left Bank		0.25			0.045
Maintenance Road	20				0.03
Grassed Floodplain	1E-08	0		0	0.04
Wetland	30	0.8	0.8	2.5	0.05
Riparian Bench	5				0.15
Right Bank			2		0.15

Total Discharge	**2,810**	cfs
Maximum Depth	**11.5**	feet

Element	n_i	A_i	P_i	R_i	$P_iR_i^{5/3}/n_i$	Q_i	V_i	$V_i^3A_i$
Left Bank	0.045	10.13	9.28	1.09	239	10	1.00	10
Maintenance Road	0.030	180.00	20.00	9.00	25,960	1,103	6.13	41,442
Grassed Floodplain	0.040	0.00	0.00	9.00	0	0	4.60	0
Wetland	0.050	386.00	36.40	10.60	37,261	1,583	4.10	26,645
Riparian Bench	0.150	45.00	5.00	9.00	1,298	55	1.23	83
Right Bank	0.150	81.00	20.12	4.02	1,366	58	0.72	30
Summation		702.13	90.80	7.73	66,124	2,810		68,209

Average Velocity	4.00	fps
Composite n	0.042	
α	1.52	

n Used	0.045
α Used	1.50

From: "Aldean, Jay/RNO" <jaldean@CH2M.com>
To: "Chuck Anderson (E-mail)" <canderson@swsv.com>
Date: 10/31/01 7:59AM
Subject: FW: Composite Freeboard Computation

Chuck, here is the NRCS memo approving the composite method for determining channel freeboard.

-----Original Message-----
From: Bill Ward [mailto:Bill.Ward@ca.usda.gov]
Sent: October 17, 2001 10:15 AM
To: Aldean, Jay/RNO
Cc: George Fowler (E-mail); Connie Eichhorn (E-mail); Charles Davis
Subject: Composite Freeboard Computation

Hi Jay,

We have determined that using a composite freeboard based on weighting the conveyance for individual channel areas within a section is a good approach for multi-staged channels and recommend its use in these cases. To meet NRCS Criteria you can simply use this procedure and replace the energy head with depth.

Of course the minimum freeboard should also not be less than 1 ft. and other requirements for freeboard (superelevation, unstable range) are on top of the calculated composite freeboard.

If you have any further questions please let me know.

Bill Ward P.E.
Design Staff Leader
NRCS, Davis, CA
(530) 792-5616

Natural Resources Conservation Service
430 G Street #4164.
Davis, California 95616

Speed Memo

(530) 792-5616, Fax 792-5791

To: Jay Aldean, Lower Silver Creek Project Manager **Date:** 10/10/01

From: Bill Ward, Design Staff Leader

Subject: NRCS Freeboard Requirements

Jay,

As requested, enclosed are the documents where NRCS channel freeboard requirements are defined. Hydraulic design critieria including freeboard is defined in our National Conservation Practice Standard No. 582, "Open Channels." In the practice standard, hydraulic criteria including freeboard is to meet the criteria in Technical Release 25, Design of Open Channels.

To summarize the freeboard criteria in TR-25 is as follows:

Subcritical Channel

Trapezoidal channel = 20% of the design depth
Rectangular lined channel = 10 % of design depth

Supercritical Channel

Trapezoidal Channel = 25% of design depth
Rectangular Channel = 20 % of design depth.

It is important to note that these freeboard requirements are in addition to any freeboard requirements for superelevation, or for being in the unstable slope range ($.7s_c<s_o<1.3\ s_c$).

Freeboard for superelevation or channel slope in this unstable range can be calculated using guidance in TR-25 page 5-4.

If you have any further questions please let me know.

Bill Ward

Santa Clara Valley Water District

MEMORANDUM

FC 14A (06-28-93)

TO: David Chesterman

FROM: Randy Talley

SUBJECT: Calculation of Channel Freeboard Using Composite Methods in Adobe Creek Reach 5

DATE: August 2, 1999

The purpose of this memorandum is to suggest one method of calculating the required freeboard in the compound channel proposed for Adobe Creek downstream of Edith Road (Reach 5).

The channel modification proposed in Reach 5 is an incised three-stage channel (cross-section attached) with a low-flow channel sized for the 1.5-year or bankfull flow, a densely vegetated midbank bench 3 feet above the low-flow channel, and a wide high-flow bench for any flows exceeding the capacity of the first two. Because these three areas of the channel cross-section have different characteristics, we are suggesting one way to establish freeboard requirements would be to calculate each area separately then put together into a composite number, similar to the composite "n" value (Manning's Roughness) commonly used.

The policy that establishes freeboard is Engineering Policy 3-218, dated September 16, 1994 (copy attached). The Reach 5 channel type is addressed in Policy Procedure B—Design Water Surface Below Natural Ground, and requires freeboard be the greater of 1 foot or two-tenths of the total energy.

The method suggested is to divide the channel cross-section into the three distinct areas (corresponding to the three stages of the channel) and calculate the energy for each area (see attached cross-section). After results are obtained for the three areas, they are multiplied by the proportion of the total discharge they carry and the results are added. An example is attached. I believe this approach complies with the District's policy, and gives appropriate weight to the different channel stages without skewing the results toward the deepest sections.

If you have any further questions, please feel free to call myself at extension 2611 or Scott Wilson at extension 2621.

ORIGINAL SIGNED BY

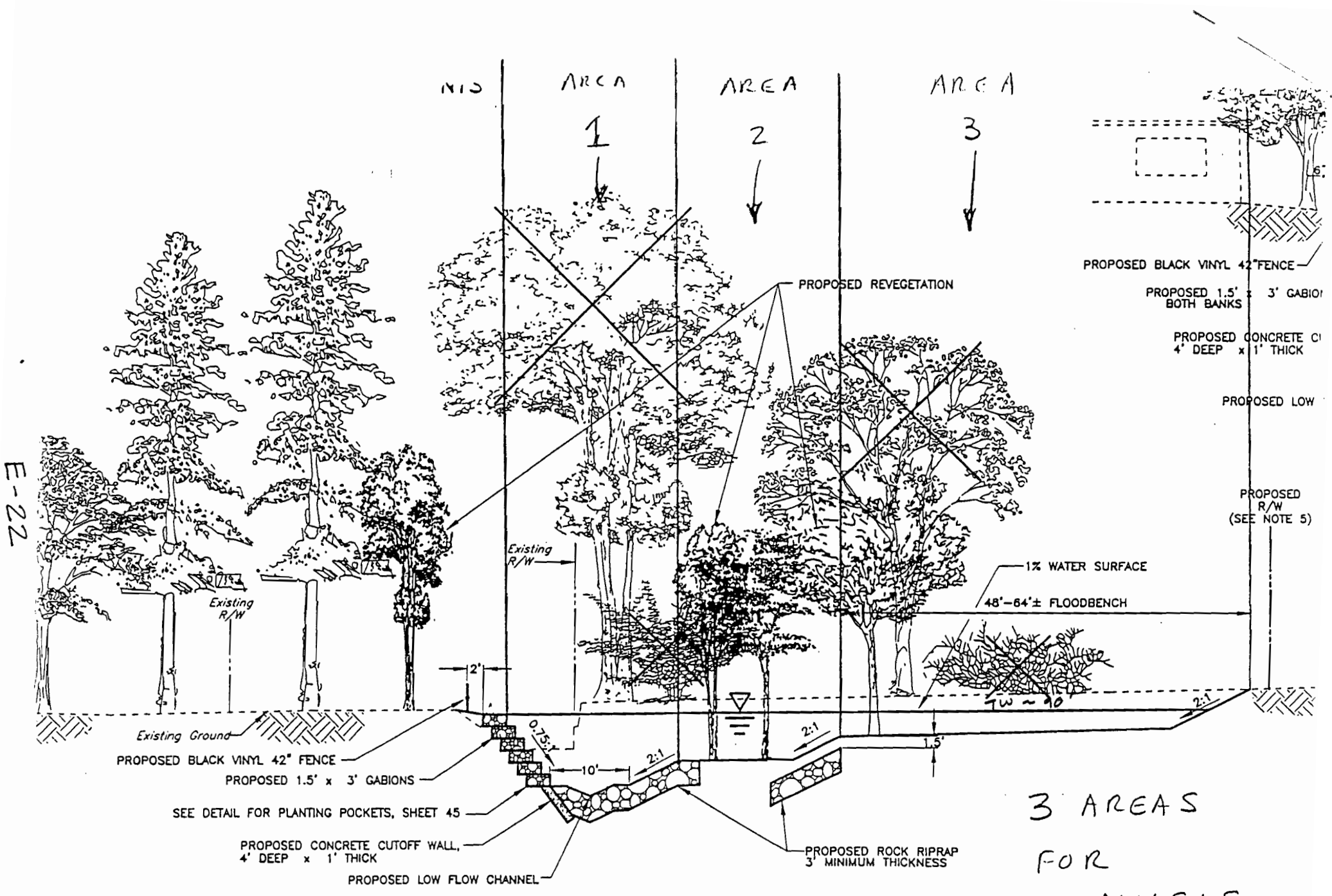
Engineering Unit Manager
Flood Management Policy and Planning Unit

Attachments

cc: R. Talley (w/att)
S. Wilson (w/att)
N. Hsueh (w/att)
D. Hook (w/att)
K. Uyeda (w/att)

SW:nn

0802a



SECTION C 36 STA. 392+00± TO STA. 398+00± (SEE NOTE 1)

APPROX. SCALE : 1" = 15'

3 AREAS FOR ANALYSIS WITH HEC-RAS

E-22

Santa Clara Valley Water District
5750 Almaden Expressway, San Jose 95118, Phone 265-2600

Page ____ of ____
Charge No. ____
By S. WILSON
Date 7/29/99
Checked by ____ Date 7/29/99

Subject ADOBE CREEK REACH 5
COMPOSITE FREEBOARD CALCULATION

EXAMPLE CALCULATION

AREA 1 -

59.6% OF FLOW = 1728 CFS

DEPTH = 7.8' (D)

VELOCITY = 4.7 FT/SEC (V)

A = 368 ft²

per new policy -

$$\text{FREEBOARD}_1 = .2\left(D + \frac{V^2}{2g}\right) = .2\left(7.8 + \frac{(4.7)^2}{64.4}\right) = 1.63'$$

1.56'

AREA 2 -

38.9% FLOW = 1128 CFS

D = 4.2' V = 4.5 ft/sec

A = 251 ft²

$$F_2 = .2\left(4.2 + \frac{(4.5)^2}{64.4}\right) = 0.90'$$

0.86'

AREA 3 - 18

1.5% FLOW = 44 CFS

D = 2.0' V = 2.5 ft/sec

A = 18 ft²

$$F_3 = .2\left(2.0 + \frac{(2.5)^2}{64.4}\right) = 0.42'$$

0.40'

COMPOSITE FREEBOARD -

A_{TOT} = 637 ft²
T.W. = 90'±
$d_{h.} = 637\,ft^2/7.0\,ft = 7.0\,ft$

$$F_c = (\%_1 \times F_1) + (\%_2 \times F_2) + (\%_3 \times F_3)$$

$$F_c = (0.596 \times \cancel{1.63}\ 1.56) + (0.389 \times \cancel{0.90}\ 0.86) + (0.015 \times \cancel{0.42}\ 0.40)$$

$$\boxed{F_c = 1.33'}$$

1.27' conveyance

0.2 × 7.41 = 1.4' hydraulic depth

$\Delta = \frac{1.4 - 1.3}{1.3} = 8\%$ OK

Freeboard based on Hydraulic Depth - Verification

Station	Flow (cfs)	Hydraul. Depth (ft)	Channel Velocity (ft/s)	0.2* Hyd. Depth (ft)	
7800	4340	10.6	7.04	**2.12**	**= Freeboard**

	max depth	Channel Velocity	
	13.08	7.04	2.62

Freeboard based on Flow Distribution: Station 7800 LOB = 5, CHAN = 10, ROB = 5

Left Station (ft)	Right Station (ft)	Flow (cfs)	Depth (ft)	Velocity (ft/s)	% Conv.	0.2*Depth (ft)	% Total
LB 970.90	976.72	172.58	8.10	3.67	3.98	1.62	0.06
976.72	982.54	319.62	8.28	6.64	7.36	1.66	0.12
982.54	988.36	332.03	8.60	6.63	7.65	1.72	0.13
988.36	994.18	463.71	10.59	7.52	10.68	2.12	0.23
994.18	1000.00	521.69	11.10	8.07	12.02	2.22	0.27
1000	1005.82	521.69	11.10	8.07	12.02	2.22	0.27
1005.82	1011.64	521.69	11.10	8.07	12.02	2.22	0.27
1011.64	1017.46	524.89	11.36	7.94	12.09	2.27	0.27
1017.46	1023.28	657.26	12.88	8.77	15.14	2.58	0.39
1023.28	RB 1029.10	304.83	12.84	4.08	7.02	2.57	0.18
		4339.99				**Freeboard =**	**2.19**

Freeboard based on Flow Distribution: Station 7950 LOB = 10, CHAN = 20, ROB = 10

Left Station (ft)	Right Station (ft)	Flow (cfs)	Depth (ft)	Velocity (ft/s)	% Conv.	0.2* D (ft)	% Total
LB 970.90	974	59.68	8.01	2.57	1.38	1.60	0.02
973.81	976.72	150.54	8.19	6.32	3.47	1.64	0.06
976.72	979.63	152.32	8.25	6.35	3.51	1.65	0.06
979.63	982.54	154.12	8.31	6.38	3.55	1.66	0.06
982.54	985.45	155.92	8.36	6.41	3.59	1.67	0.06
985.45	988.36	162.43	8.83	6.32	3.74	1.77	0.07
988.36	991.27	201.51	10.12	6.84	4.64	2.02	0.09
991.27	994.18	244.61	11.06	7.60	5.64	2.21	0.12
994.18	997.09	250.10	11.10	7.74	5.76	2.22	0.13
997.09	1000.00	250.09	11.10	7.74	5.76	2.22	0.13
1000.00	1002.91	250.09	11.10	7.74	5.76	2.22	0.13
1002.91	1005.82	250.10	11.10	7.74	5.76	2.22	0.13
1005.82	1008.73	250.09	11.10	7.74	5.76	2.22	0.13
1008.73	1011.64	250.10	11.10	7.74	5.76	2.22	0.13
1011.64	1014.55	250.09	11.10	7.74	5.76	2.22	0.13
1014.55	1017.46	253.33	11.62	7.49	5.84	2.32	0.14
1017.46	1020.37	307.55	12.82	8.25	7.09	2.56	0.18
1020.37	1023.28	322.91	12.94	8.57	7.44	2.59	0.19
1023.28	1026.19	322.91	12.94	8.57	7.44	2.59	0.19
1026.19	RB 1029.10	101.49	12.74	2.74	2.34	2.55	0.06
		4339.98				**Freeboard =**	**2.20**

Conclusion: Hydraulic Depth is a Reasonable Approximation of Depth Weighted by Conveyance.

Difference = -4%

LOWER SILVER CREEK REACHES 1 THRU 6

HYDRAULIC SUMMARY FOR PROPOSED CHANNEL IMPROVEMENTS

	Channel Parameters				Design Parameters						Program Freeboard Requirements			
Location	River Station	Channel Invert (NAVD)	LOB Elev[1] (NAVD)	ROB Elev[1] (NAVD)	10% WSEL (NAVD)	1% WSEL (NAVD)	Chan Velocity (fps)	a	E.G. Elev (NAVD)	Froude Number	Hydraulic Depth (ft)	0.2* D (ft)	Freeboard Line (NAVD)	Max. Wall Height[2] (feet)
Coyote Creek	73	63.70	84.0	74.0	79.75	84.75	0.80	1.40	84.76	0.04	14.28	2.86	87.75	no wall
	104	64.00	84.0	75.0	79.74	84.75	1.04	1.40	84.77	0.05	14.50	2.90	87.75	no wall
	106	65.00	84.0	75.0	79.73	84.75	1.06	1.40	84.77	0.05	14.27	2.85	87.75	no wall
	200	65.37	85.0	76.0	79.72	84.74	1.42	1.40	84.78	0.07	12.89	2.58	87.74	no wall
	400	66.14	83.2	82.0	79.79	84.74	1.50	1.40	84.79	0.07	10.94	2.19	87.74	no wall
	500	66.53	84.7	82.5	79.85	84.74	1.54	1.40	84.79	0.07	10.77	2.15	87.74	no wall
	600	66.92	85.6	84.2	79.88	84.74	1.76	1.40	84.81	0.09	10.41	2.08	87.74	no wall
	700	67.31	86.8	85.0	79.93	84.74	1.94	1.40	84.82	0.10	10.65	2.13	86.87	no wall
	830	67.82	88.0	86.0	80.06	84.75	1.96	1.40	84.83	0.10	8.88	1.78	86.53	no wall
	860	67.93	88.0	86.1	80.13	84.77	1.87	1.40	84.85	0.09	10.45	2.09	86.86	no wall
	930	68.21	88.0	86.2	80.19	84.78	1.99	1.40	84.87	0.10	11.88	2.38	87.16	no wall
	1025	68.21	89.7	88.5	80.24	84.78	2.39	1.40	84.90	0.12	13.25	2.65	87.43	no wall
	1067	68.74	89.9	90.4	80.17	84.77	2.90	1.40	84.95	0.14	12.64	2.53	87.30	no wall
Wooster	1107	68.90	89.9	90.4	80.38	84.93	2.90	1.20	85.09	0.14	12.63	2.53	87.46	no wall
	1120	68.95	90.0	90.5	80.41	84.93	2.91	1.20	85.09	0.14	12.60	2.52	87.45	no wall
	1148	69.06	86.9	88.5	80.64	84.98	2.53	1.20	85.10	0.13	12.15	2.43	87.41	no wall
	1253	69.47	89.0	88.0	80.91	85.02	2.28	1.20	85.12	0.12	11.69	2.34	87.36	no wall
	1273	69.55	89.1	88.1	80.93	85.03	2.29	1.20	85.13	0.12	11.62	2.32	87.35	no wall
	1350	69.85	88.0	88.4	80.68	84.97	3.64	1.20	85.22	0.20	10.75	2.15	87.12	no wall
	1390	70.00	89.5	89.7	80.64	84.94	4.47	1.20	85.31	0.24	11.06	2.21	87.15	no wall
UPRR	1410	70.08	89.9	89.6	82.05	85.11	4.40	1.20	85.47	0.23	11.18	2.24	87.35	no wall
	1450	70.24	89.9	89.6	82.26	85.15	4.42	1.20	85.51	0.23	11.12	2.22	87.37	no wall
	1525	70.53	89.2	85.0	83.21	85.39	3.18	1.20	85.58	0.17	10.88	2.18	88.39	no wall
	1622	70.91	88.5	85.4	83.45	85.46	2.91	1.20	85.62	0.16	10.53	2.11	88.46	no wall
	1667	71.08	89.6	87.0	83.46	85.46	3.23	1.20	85.65	0.18	10.17	2.03	87.49	no wall
	1763	71.46	89.6	87.0	83.63	85.50	3.34	1.20	85.71	0.19	9.91	1.98	87.48	no wall
	1845	71.78	88.0	87.0	83.78	85.54	3.48	1.20	85.77	0.18	11.14	2.23	87.77	no wall
	1884	71.92	87.8	88.4	83.69	85.51	4.42	1.20	85.87	0.24	10.32	2.06	87.57	no wall
	1885	71.92	87.8	88.4	83.70	85.51	4.42	1.20	85.87	0.24	10.32	2.06	87.57	no wall
Highway 101	2045	72.32	90.1	90.1	84.16	85.93	4.43	1.20	86.30	0.24	10.67	2.13	88.06	no wall
	2046	72.32	90.2	90.2	84.16	85.93	4.43	1.20	86.30	0.24	10.68	2.14	88.07	no wall
	2075	72.42	88.8	90.0	84.36	86.12	6.73	1.20	86.96	0.37	10.49	2.10	88.22	no wall
	2120	72.47	87.2	89.5	84.87	86.61	4.38	1.20	86.97	0.22	12.85	2.57	89.18	1.98
	2220	72.58	86.6	89.6	85.01	86.75	3.74	1.20	87.01	0.19	12.60	2.52	89.75	3.15
	2280	72.65	86.6	89.8	85.01	86.74	4.20	1.20	87.07	0.21	11.24	2.25	89.74	3.14
	2525	72.93	87.8	87.8	85.16	86.88	4.26	1.20	87.22	0.21	12.25	2.45	89.33	1.53
	2625	73.04	88.1	87.6	85.25	86.97	4.06	1.20	87.28	0.21	11.65	2.33	89.30	1.70
	2775	73.21	88.6	88.0	85.43	87.14	3.39	1.20	87.35	0.19	9.83	1.97	89.11	1.11
	3000	73.47	88.0	87.8	85.59	87.27	3.25	1.20	87.47	0.18	9.61	1.92	89.19	1.39
	3200	73.69	88.2	88.8	85.71	87.36	3.44	1.20	87.58	0.19	9.84	1.97	89.33	1.13
	3282	73.78	88.3	88.9	85.76	87.40	3.45	1.25	87.63	0.19	9.81	1.96	89.36	1.07
	3300	73.80	88.0	88.5	85.77	87.40	3.56	1.25	87.65	0.20	10.29	2.06	89.46	1.46
	3500	74.02	88.2	88.0	85.90	87.52	3.59	1.25	87.77	0.20	10.20	2.04	89.56	1.56
	3626	74.16	88.3	88.1	85.99	87.59	3.62	1.25	87.84	0.20	10.15	2.03	89.62	1.48
	3671	74.21	88.0	88.2	86.05	87.65	3.38	1.25	87.87	0.18	10.63	2.13	89.78	1.78
	3771	74.32	88.0	88.3	86.08	87.66	3.86	1.25	87.95	0.21	10.61	2.12	89.78	1.78
Miguelita Creek	3828	74.38	88.2	88.6	85.83	87.33	8.25	1.00	88.39	0.40	12.97	2.59	89.92	1.72
	4100	74.65	89.0	89.0	86.18	87.76	7.15	1.00	88.55	0.35	13.20	2.64	90.40	1.40
	4300	74.85	89.0	89.0	86.27	87.84	7.19	1.00	88.64	0.35	13.13	2.63	90.47	1.47
	4500	75.05	89.0	89.0	86.36	87.92	7.23	1.00	88.73	0.35	13.05	2.61	90.53	1.53
	4700	75.25	89.0	89.0	86.45	88.00	7.27	1.00	88.82	0.36	12.98	2.60	90.60	1.60
	4900	75.45	89.0	89.0	86.54	88.08	7.31	1.00	88.91	0.36	12.90	2.58	90.66	1.66
	5030	75.58	89.5	89.5	86.61	88.15	7.33	1.00	88.98	0.36	12.86	2.57	90.72	1.22
Walgreens	5070	75.62	89.6	90.0	86.63	88.17	7.34	1.00	89.01	0.36	12.86	2.57	90.74	1.14
	5100	75.65	89.6	92.0	86.63	88.18	7.34	1.00	89.02	0.36	12.85	2.57	90.75	1.15
	5105	75.65	89.0	92.0	86.60	88.15	7.57	1.00	89.04	0.38	12.48	2.50	90.65	1.65
	5174	75.77	90.2	92.0	86.63	88.18	7.60	1.00	89.08	0.38	12.41	2.48	90.66	0.46
	5240	75.96	90.4	92.0	86.66	88.21	7.73	1.00	89.14	0.39	12.03	2.41	90.62	0.22
McKee	5428	76.35	90.0	90.0	89.89	90.28	7.32	1.40	91.44	0.36	12.70	2.54	94.28	4.28
	5490	76.47	90.0	91.0	90.55	91.11	3.79	1.40	91.42	0.20	8.19	1.64	95.11	5.11
	5527	76.53	90.5	91.5	90.56	91.13	3.84	1.40	91.45	0.22	8.26	1.65	95.13	4.63
	5660	76.78	90.7	92.2	90.68	91.25	3.53	1.40	91.52	0.20	8.59	1.72	94.25	3.51
	5900	77.23	90.0	92.6	90.80	91.39	3.48	1.40	91.65	0.20	3.74	0.75	94.39	4.39
	6028	77.47	91.5	92.8	90.94	91.55	2.55	1.40	91.69	0.15	4.47	0.89	94.55	3.05
	6116	77.64	91.7	91.7	90.99	91.60	2.33	1.40	91.72	0.13	5.14	1.03	92.63	0.96
	6200	77.80	91.2	92.5	91.00	91.60	2.79	1.40	91.77	0.15	6.38	1.28	94.60	3.39
	6437	78.24	92.1	92.1	91.04	91.63	3.81	1.40	91.95	0.22	7.09	1.42	93.05	0.98
	6657	78.65	93.1	92.9	91.17	91.76	4.13	1.40	92.13	0.24	9.02	1.80	93.56	0.71
	6723	78.78	92.5	92.5	91.22	91.81	4.26	1.40	92.20	0.25	9.03	1.81	93.62	1.12
	6823	78.96	92.0	92.3	91.16	91.75	5.28	1.40	92.36	0.29	9.98	2.00	93.75	1.75
	6880	79.07	92.0	92.0	91.07	91.62	6.38	1.00	92.25	0.33	11.68	2.34	93.96	1.96
	7128	79.54	92.7	92.3	91.13	91.69	6.55	1.00	92.36	0.34	11.39	2.28	93.97	1.67
	7428	80.11	94.0	92.5	91.20	91.77	6.76	1.00	92.48	0.36	11.03	2.21	93.98	1.48
	7600	80.44	93.5	93.0	91.26	91.84	6.88	1.00	92.58	0.37	10.84	2.17	94.01	1.01
	7800	80.82	93.0	93.0	91.31	91.90	7.04	1.00	92.67	0.38	10.60	2.12	94.02	1.02
	8040	81.27	94.0	93.5	91.38	91.98	7.26	1.00	92.80	0.40	10.27	2.05	94.03	0.52
	8128	81.44	94.0	93.0	91.41	92.02	7.35	1.00	92.86	0.41	10.14	2.03	94.05	1.05

LOWER SILVER CREEK REACHES 1 THRU 6

HYDRAULIC SUMMARY FOR PROPOSED CHANNEL IMPROVEMENTS

	Channel Parameters				Design Parameters						Program Freeboard Requirements			
Location	River Station	Channel Invert (NAVD)	LOB Elev[1] (NAVD)	ROB Elev[1] (NAVD)	10% WSEL (NAVD)	1% WSEL (NAVD)	Chan Velocity (fps)	a	E.G. Elev (NAVD)	Froude Number	Hydraulic Depth (ft)	0.2* D (ft)	Freeboard Line (NAVD)	Max. Wall Height[2] (feet)
	16200	105.03	118.3	117.3	115.21	115.93	8.98	1.40	117.68	0.53	9.01	1.80	117.73	0.43
	16300	105.35	118.8	117.7	115.69	116.42	8.81	1.40	118.11	0.51	9.17	1.83	118.25	0.53
	16400	105.68	119.1	118.1	116.14	116.88	8.68	1.40	118.52	0.50	9.28	1.86	118.74	0.64
	16500	106.00	118.9	118.4	116.57	117.33	8.57	1.40	118.93	0.49	9.40	1.88	119.21	0.83
	16600	106.33	118.9	118.3	116.98	117.74	8.49	1.40	119.31	0.49	9.47	1.89	119.63	1.38
	16700	106.65	119.2	118.2	117.38	118.15	8.41	1.40	119.69	0.48	8.71	1.74	119.89	1.69
	16800	106.98	119.9	119.1	117.77	118.55	8.35	1.40	120.07	0.47	9.62	1.92	120.47	1.35
	16900	107.32	120.8	119.1	118.14	118.94	8.31	1.40	120.44	0.47	9.66	1.93	120.87	1.74
	17000	107.67	122.3	120.0	118.51	119.31	8.29	1.40	120.80	0.47	9.68	1.94	121.25	1.24
N Babb	17050	107.76	121.0	122.9	118.72	119.52	8.21	1.40	120.99	0.46	9.82	1.96	121.48	0.48
	17125	108.03	121.0	121.0	119.30	120.19	6.39	1.40	121.08	0.35	10.31	2.06	122.25	1.25
Granite Creek	17200	108.18	122.6	120.4	119.48	120.36	6.37	1.35	121.21	0.35	10.32	2.06	122.42	2.02
	17450	108.68	122.8	121.3	120.04	120.89	6.35	1.35	121.74	0.35	10.35	2.07	122.96	1.66
	17700	109.19	123.2	121.7	120.60	121.42	6.34	1.35	122.26	0.35	10.36	2.07	123.49	1.79
	17863	109.51	123.8	121.4	120.94	121.75	6.34	1.35	122.59	0.35	9.32	1.86	124.75	3.35
	18025	109.84	123.8	122.0	121.29	122.08	6.34	1.35	122.92	0.35	9.28	1.86	126.08	4.08
	18193	110.18	124.1	122.3	121.64	122.42	6.33	1.35	123.26	0.35	9.28	1.86	126.42	4.12
	18205	110.20	122.0	125.0	121.63	122.41	6.48	1.35	123.29	0.34	11.11	2.22	126.41	4.41
Story	18310	110.41	122.5	125.5	122.18	123.16	6.33	1.30	123.97	0.33	11.36	2.27	127.16	4.66
	18328	110.45	126.9	126.0	122.52	123.51	4.50	1.30	123.92	0.23	11.50	2.30	125.81	no wall
	18523	110.84	126.2	125.6	122.70	123.67	4.59	1.30	124.10	0.24	11.32	2.26	125.93	0.33
	18718	111.23	125.7	125.1	122.88	123.83	4.68	1.30	124.27	0.25	11.09	2.22	126.05	0.95
	18913	111.62	126.9	125.0	123.07	124.01	4.78	1.30	124.47	0.26	10.89	2.18	126.19	1.19
	19108	112.02	126.9	125.3	123.27	124.20	4.87	1.30	124.68	0.26	10.70	2.14	126.34	1.04
	19308	112.42	127.4	125.8	123.49	124.41	4.96	1.30	124.91	0.27	10.52	2.10	126.51	0.71
	19508	112.82	127.2	127.2	123.73	124.63	5.04	1.30	125.14	0.28	10.37	2.07	126.70	no wall
	19708	113.22	128.1	127.7	123.97	124.86	5.13	1.30	125.39	0.28	10.20	2.04	126.90	no wall
	19908	113.62	128.6	128.9	124.24	125.10	5.21	1.30	125.65	0.29	10.06	2.01	127.11	no wall
	19931	113.67	127.0	128.0	124.15	125.02	6.29	1.30	125.82	0.36	9.57	1.91	126.93	no wall
Murtha	19981	113.77	127.0	128.0	124.17	125.43	6.10	1.30	126.18	0.34	9.87	1.97	127.40	0.40
	19983	113.77	127.7	128.5	124.40	125.63	5.02	1.30	126.14	0.27	10.41	2.08	127.71	0.01
	20168	113.95	129.7	129.0	124.66	125.85	5.00	1.30	126.35	0.27	10.46	2.09	127.94	no wall
	20418	114.2	129.0	128.9	125.10	126.26	3.77	1.30	126.55	0.20	10.59	2.12	128.38	no wall
	20668	114.45	128.7	129.7	125.31	126.42	3.80	1.30	126.71	0.21	10.51	2.10	128.52	no wall
	20918	114.7	129.6	129.7	125.51	126.58	3.84	1.30	126.88	0.21	10.40	2.08	128.66	no wall
	21168	114.94	129.4	128.9	125.72	126.74	3.86	1.30	127.04	0.21	10.36	2.07	128.81	no wall
	21396	115.17	132.0	129.8	125.92	126.91	3.89	1.30	127.22	0.21	10.29	2.06	128.97	no wall
	21665	115.44	132.4	130.0	126.14	127.09	3.92	1.30	127.40	0.22	10.21	2.04	129.13	no wall
	21719	115.49	128.4	128.4	125.95	126.90	6.48	1.30	127.75	0.34	11.41	2.28	129.18	0.83
Moss Point	21780	115.54	128.4	128.4	126.56	127.46	6.20	1.20	128.18	0.32	11.92	2.38	129.84	1.49
	21820	115.58	131.0	131.8	127.12	128.00	2.76	1.20	128.14	0.14	11.25	2.25	130.25	no wall
	22070	115.8	130.7	131.2	127.20	128.07	2.79	1.20	128.22	0.15	11.13	2.23	130.30	no wall
	22320	116.03	132.0	130.2	127.28	128.15	2.83	1.20	128.30	0.15	10.98	2.20	130.35	0.15
	22570	116.25	131.8	129.2	127.37	128.22	2.87	1.20	128.37	0.15	10.83	2.17	130.39	1.19
	22820	116.48	131.6	131.2	127.46	128.30	2.91	1.20	128.46	0.16	10.69	2.14	130.44	no wall
	23009	116.65	131.9	129.8	127.54	128.37	2.94	1.20	128.53	0.16	10.60	2.12	130.49	0.69
	23091	116.72	131.0	131.6	127.46	128.29	4.68	1.20	128.70	0.26	9.71	1.94	130.23	no wall
Ocala	23173	116.78	129.6	130.6	127.48	128.31	4.70	1.50	128.82	0.27	9.67	1.93	130.24	0.61
	23194	116.85	130.6	130.7	127.54	128.37	4.34	1.50	128.81	0.26	8.78	1.76	130.13	no wall
	23444	117.68	130.6	129.2	127.91	128.68	4.25	1.50	129.10	0.26	8.57	1.71	130.39	1.19
	23605	118.21	130.3	129.5	128.12	128.87	4.40	1.50	129.32	0.27	8.32	1.66	130.53	1.03
	23855	119.04	129.1	129.0	128.51	129.20	4.48	1.50	129.67	0.28	6.13	1.23	132.20	3.20
	24105	119.87	129.5	129.5	128.92	129.55	4.35	1.50	129.99	0.28	6.27	1.25	132.55	3.05
	24232	120.29	129.5	129.7	129.17	129.77	3.59	1.20	130.01	0.22	7.62	1.52	132.77	3.27
	24358	120.71	130.0	130.0	129.26	129.85	3.74	1.20	130.11	0.23	8.19	1.64	131.49	1.49
	24462	121.05	131.0	132.0	128.81	129.40	9.62	1.00	130.84	0.59	8.35	1.67	131.07	0.07
Cunningham	24513	121.05	131.0	132.0	129.71	130.65	8.36	1.00	131.74	0.48	9.60	1.92	132.57	1.57

[1]Highest Natural Grade w/in R.O.W. to contain flow.

[2]Walls not allowed between Coyote Creek and Highway 101 (Coyote Creek floodplain).

LOWER SILVER CREEK REACHES 1 THRU 6

HYDRAULIC STABILITY AND SCOUR POTENTIAL FOR PROPOSED CHANNEL IMPROVEMENTS

	Channel Parameters				Design Parameters with Low Roughness							
Location	River Station	Channel Invert (NAVD)	LOB Elev[1] (NAVD)	ROB Elev[1] (NAVD)	1% WSEL (NAVD)	1% Chan Velocity (fps)	10% Chan Velocity (fps)	a	E.G. Elev (NAVD)	Froude Number	Freeboard Line (NAVD)	Energy Grade Contained?
Coyote Creek	73	63.70	84.0	74.0	67.53	18.68	17.84	1.20	74.03	2.33	87.75	YES
	104	64.00	84.0	75.0	69.58	15.95	15.49	1.20	74.32	1.52	87.75	YES
	106	65.00	84.0	75.0	70.44	14.31	13.83	1.20	74.26	1.34	87.75	YES
	200	65.37	85.0	76.0	72.23	11.31	10.72	1.20	74.61	1.00	87.74	YES
	400	66.14	83.2	82.0	72.88	11.66	10.37	1.20	75.41	1.05	87.74	YES
	500	66.53	84.7	82.5	72.65	13.85	11.94	1.20	76.22	1.34	87.74	YES
	600	66.92	85.6	84.2	73.45	13.57	12.72	1.20	76.88	1.24	87.74	YES
	700	67.31	86.8	85.0	74.63	11.93	11.31	1.20	77.28	1.00	86.87	YES
	830	67.82	88.0	86.0	75.44	10.94	10.35	1.20	77.67	0.90	86.53	YES
	860	67.93	88.0	86.1	76.03	9.49	9.39	1.20	77.71	0.78	86.86	YES
	930	68.21	88.0	86.2	76.11	9.88	9.51	1.20	77.93	0.78	87.16	YES
	1025	68.21	89.7	88.5	74.01	17.74	17.06	1.20	79.87	1.53	87.43	YES
	1067	68.74	89.9	90.4	75.68	15.38	14.54	1.20	80.09	1.29	87.30	YES
Wooster	1107	68.90	89.9	90.4	77.90	10.43	9.82	1.20	79.93	0.73	87.46	YES
	1120	68.95	90.0	90.5	77.93	10.47	9.86	1.20	79.97	0.73	87.45	YES
	1148	69.06	86.9	88.5	78.63	8.42	7.99	1.20	79.95	0.57	87.41	YES
	1253	69.47	89.0	88.0	74.92	20.07	18.64	1.20	82.43	1.79	87.36	YES
	1273	69.55	89.1	88.1	74.87	20.79	19.41	1.20	82.92	1.89	87.35	YES
	1350	69.85	88.0	88.4	75.84	20.77	19.89	1.20	83.88	1.70	87.12	YES
	1390	70.00	89.5	89.7	77.29	19.44	18.88	1.20	84.33	1.38	87.15	YES
UPRR	1410	70.08	89.9	89.6	81.76	10.31	9.78	1.20	83.74	0.62	87.35	YES
	1450	70.24	89.9	89.6	81.81	10.35	9.83	1.20	83.81	0.62	87.37	YES
	1525	70.53	89.2	85.0	83.14	6.62	6.35	1.20	83.96	0.39	88.39	YES
	1622	70.91	88.5	85.4	83.31	6.07	5.88	1.20	84.00	0.36	88.46	YES
	1667	71.08	89.6	87.0	83.22	6.86	6.66	1.20	84.10	0.41	87.49	YES
	1763	71.46	89.6	87.0	83.23	7.16	6.99	1.20	84.19	0.44	87.48	YES
	1845	71.78	88.0	87.0	83.26	7.23	6.84	1.20	84.23	0.41	87.77	YES
	1884	71.92	87.8	88.4	82.99	9.52	9.00	1.20	84.68	0.55	87.57	YES
	1885	71.92	87.8	88.4	82.99	9.52	9.00	1.20	84.68	0.55	87.57	YES
Highway 101	2045	72.32	90.1	90.1	83.52	9.39	8.89	1.20	85.16	0.54	88.06	YES
	2046	72.32	90.2	90.2	83.53	9.39	8.88	1.20	85.17	0.54	88.07	YES
	2075	72.42	88.8	90.0	83.88	8.45	8.11	1.20	85.21	0.49	88.22	YES
	2120	72.47	87.2	89.5	84.66	5.16	4.93	1.20	85.16	0.27	89.18	YES
	2220	72.58	86.6	89.6	84.81	4.42	4.24	1.20	85.17	0.24	89.75	YES
	2280	72.65	86.6	89.8	84.76	4.99	4.79	1.20	85.22	0.27	89.74	YES
	2525	72.93	87.8	87.8	84.81	5.10	4.91	1.20	85.29	0.28	89.33	YES
	2625	73.04	88.1	87.6	84.86	4.94	4.78	1.20	85.31	0.28	89.30	YES
	2775	73.21	88.6	88.0	84.99	4.28	4.25	1.20	85.33	0.26	89.11	YES
	3000	73.47	88.0	87.8	85.05	4.18	4.19	1.20	85.38	0.26	89.19	YES
	3200	73.69	88.2	88.8	85.08	4.43	4.42	1.20	85.45	0.27	89.33	YES
	3282	73.78	88.3	88.9	85.10	4.47	4.46	1.20	85.47	0.28	89.36	YES
	3300	73.80	88.0	88.5	85.10	4.56	4.51	1.20	85.49	0.28	89.46	YES
	3500	74.02	88.2	88.0	85.14	4.64	4.61	1.20	85.54	0.28	89.56	YES
	3626	74.16	88.3	88.1	85.17	4.71	4.67	1.20	85.58	0.29	89.62	YES
	3671	74.21	88.0	88.2	85.23	4.34	4.27	1.20	85.58	0.26	89.78	YES
	3771	74.32	88.0	88.3	85.19	4.98	4.88	1.20	85.65	0.29	89.78	YES
Miguelita Creek	3828	74.38	88.2	88.6	84.36	10.70	10.19	1.00	86.14	0.60	89.92	YES
	4100	74.65	89.0	89.0	85.03	9.01	8.94	1.00	86.29	0.49	90.40	YES
	4300	74.85	89.0	89.0	85.08	9.11	9.04	1.00	86.37	0.50	90.47	YES
	4500	75.05	89.0	89.0	85.12	9.21	9.15	1.00	86.44	0.51	90.53	YES
	4700	75.25	89.0	89.0	85.16	9.31	9.26	1.00	86.51	0.52	90.60	YES
	4900	75.45	89.0	89.0	85.20	9.42	9.37	1.00	86.58	0.52	90.66	YES
	5030	75.58	89.5	89.5	85.24	9.47	9.42	1.00	86.63	0.53	90.72	YES
Walgreens	5070	75.62	89.6	90.0	85.24	9.50	9.46	1.00	86.64	0.53	90.74	YES
	5100	75.65	89.6	92.0	85.24	9.52	9.47	1.00	86.65	0.53	90.75	YES
	5105	75.65	89.0	92.0	85.15	9.96	9.99	1.00	86.69	0.57	90.65	YES
	5174	75.77	90.2	92.0	85.17	10.04	10.09	1.00	86.74	0.58	90.66	YES
	5240	75.96	90.4	92.0	85.15	10.37	10.51	1.00	86.82	0.61	90.62	YES
McKee	5428	76.35	90.0	90.0	86.68	10.23	10.15	1.20	88.63	0.60	94.28	YES
	5490	76.47	90.0	91.0	88.29	5.07	5.06	1.20	88.77	0.30	95.11	YES
	5527	76.53	90.5	91.5	88.28	5.39	5.50	1.20	88.82	0.35	95.13	YES
	5660	76.78	90.7	92.2	88.41	4.86	4.93	1.20	88.85	0.31	94.25	YES
	5900	77.23	90.0	92.6	88.46	5.15	5.25	1.20	88.95	0.34	94.39	YES
	6028	77.47	91.5	92.8	88.56	4.88	5.22	1.20	89.00	0.34	94.55	YES
	6116	77.64	91.7	91.7	88.59	5.01	5.48	1.20	89.06	0.32	92.63	YES

LOWER SILVER CREEK REACHES 1 THRU 6

HYDRAULIC STABILITY AND SCOUR POTENTIAL FOR PROPOSED CHANNEL IMPROVEMENTS

	Channel Parameters				Design Parameters with Low Roughness							
Location	River Station	Channel Invert (NAVD)	LOB Elev[1] (NAVD)	ROB Elev[1] (NAVD)	1% WSEL (NAVD)	1% Chan Velocity (fps)	10% Chan Velocity (fps)	a	E.G. Elev (NAVD)	Froude Number	Freeboard Line (NAVD)	Energy Grade Contained?
	6200	77.80	91.2	92.5	88.62	4.99	5.34	1.20	89.08	0.31	94.60	YES
	6437	78.24	92.1	92.1	88.60	5.83	5.99	1.20	89.23	0.38	93.05	YES
	6657	78.65	93.1	92.9	88.67	6.12	6.29	1.20	89.37	0.41	93.56	YES
	6723	78.78	92.5	92.5	88.68	6.34	6.50	1.20	89.43	0.43	93.62	YES
	6823	78.96	92.0	92.3	88.52	7.64	7.68	1.20	89.61	0.49	93.75	YES
	6880	79.07	92.0	92.0	88.30	8.91	8.81	1.00	89.53	0.54	93.96	YES
	7128	79.54	92.7	92.3	88.33	9.29	9.24	1.00	89.67	0.58	93.97	YES
	7428	80.11	94.0	92.5	88.35	9.81	9.82	1.00	89.84	0.63	93.98	YES
	7600	80.44	93.5	93.0	88.37	10.12	10.17	1.00	89.96	0.66	94.01	YES
	7800	80.82	93.0	93.0	88.39	10.53	10.65	1.00	90.11	0.70	94.02	YES
	8040	81.27	94.0	93.5	88.41	11.14	11.35	1.00	90.34	0.76	94.03	YES
	8128	81.44	94.0	93.0	88.42	11.39	14.30	1.00	90.43	0.78	94.05	YES
	8300	81.77	94.0	95.7	88.42	11.99	14.19	1.00	90.65	0.85	94.06	YES
	8500	82.15	95.0	96.2	87.65	14.69	14.06	1.00	91.00	1.15	94.08	YES
	8700	82.53	95.6	97.2	88.16	14.32	13.72	1.00	91.34	1.10	94.11	YES
	8756	82.63	96.1	97.2	88.67	13.40	12.80	1.00	91.46	1.00	94.10	YES
	8763	82.65	98.0	98.0	89.36	11.95	11.36	1.00	91.58	0.84	94.17	YES
Alum Rock	8863	82.84	96.5	97.0	88.23	15.14	15.00	1.00	91.79	1.20	94.36	YES
	8908	82.94	96.0	96.5	89.53	12.51	12.00	1.20	92.45	1.00	94.24	YES
	8908	82.94	96.0	96.5	90.27	10.81	10.43	1.20	92.45	0.83	94.34	YES
	9100	83.61	96.6	96.6	90.66	11.41	11.03	1.20	93.09	0.89	95.08	YES
	9230	84.06	97.1	97.1	89.34	16.98	16.74	1.20	94.71	1.55	95.53	YES
	9325	84.39	97.5	97.5	90.57	16.67	16.39	1.20	95.75	1.56	95.81	YES
	9337	84.43	97.5	97.5	92.71	12.44	11.93	1.20	95.59	1.00	96.18	YES
	9387	84.60	98.0	98.0	95.29	7.28	6.69	1.20	96.28	0.39	97.30	YES
Sunset	9498	84.83	98.0	98.0	95.90	7.03	6.52	1.20	96.82	0.37	97.99	YES
	9559	85.07	98.1	98.1	96.01	6.67	6.39	1.20	96.84	0.42	97.52	YES
	9572	85.12	98.1	98.1	96.11	6.23	5.98	1.20	96.83	0.39	97.65	YES
	9800	86.08	99.1	99.1	96.14	7.04	6.80	1.20	97.06	0.46	98.20	YES
	10000	86.92	98.4	99.3	96.17	7.88	7.69	1.20	97.33	0.53	98.77	YES
	10200	87.76	100.8	100.8	96.21	8.90	8.76	1.20	97.69	0.63	99.42	YES
	10300	88.17	100.7	101.2	96.25	9.45	9.34	1.20	97.91	0.68	99.76	YES
	10349	88.31	100.8	101.3	96.58	8.50	8.19	1.20	97.93	0.58	99.99	YES
	10446	88.58	101.0	102.0	96.15	11.59	10.93	1.20	98.65	0.74	100.10	YES
San Antonio	10556	88.88	102.0	101.2	96.55	11.44	10.80	1.20	98.99	0.73	100.45	YES
	10630	89.08	101.3	101.0	96.82	11.00	11.29	1.20	99.07	0.82	100.57	YES
	10671	89.19	101.4	101.1	98.41	6.66	6.49	1.20	99.24	0.46	101.33	YES
	10884	89.79	101.0	101.5	98.68	6.24	6.16	1.20	99.41	0.45	101.78	YES
	11100	90.39	101.5	105.0	98.76	6.83	6.78	1.20	99.63	0.51	101.86	YES
	11300	90.94	102.3	103.0	98.87	7.43	7.40	1.20	99.90	0.58	102.41	YES
	11519	91.54	104.0	104.2	99.05	8.09	8.05	1.20	100.27	0.65	102.81	YES
	11733	92.13	103.5	105.5	99.73	6.34	6.25	1.20	100.48	0.51	103.34	YES
	11800	92.32	102.3	104.3	99.76	6.56	6.47	1.20	100.56	0.54	103.40	YES
	11900	92.59	102.6	104.6	99.83	6.86	6.78	1.20	100.71	0.57	103.52	YES
	12100	93.15	103.4	104.0	100.00	7.50	7.42	1.20	101.05	0.65	103.79	YES
	12250	93.56	103.8	104.0	100.18	7.94	7.83	1.20	101.35	0.70	104.02	YES
	12350	93.84	104.0	104.0	100.79	6.82	6.49	1.20	101.66	0.56	104.56	YES
(Hydraulic Jump	12450	94.12	104.0	104.0	98.38	18.59	17.39	1.20	104.82	2.16	104.58	NO
	12500	94.26	108.0	110.0	100.82	14.59	13.95	1.20	104.79	1.00	104.85	YES
I680	12794	94.15	110.0	110.0	105.05	8.78	8.36	1.00	106.25	0.47	107.39	YES
	12795	94.15	110.0	110.0	105.05	8.78	8.36	1.00	106.25	0.47	107.39	YES
	12829	94.20	108.2	106.3	105.25	8.10	7.72	1.00	106.27	0.43	107.64	YES
	12880	94.34	107.3	105.8	105.99	4.79	4.60	1.00	106.35	0.25	110.13	YES
	13013	94.72	107.5	106.7	105.98	4.97	4.79	1.00	106.36	0.27	108.29	YES
	13035	94.78	107.5	106.7	105.92	5.48	5.25	1.00	106.39	0.29	108.35	YES
Jackson	13125	95.05	107.5	106.7	106.63	5.27	5.15	1.20	107.15	0.27	110.82	YES
	13126	95.05	107.5	106.7	106.62	5.38	5.26	1.20	107.16	0.28	110.81	YES
	13210	95.30	107.2	106.2	106.69	5.15	5.16	1.20	107.18	0.28	110.95	YES
	13300	95.57	107.2	106.3	106.70	5.28	5.31	1.20	107.22	0.30	110.04	YES
	13400	95.87	106.9	107.0	106.71	5.44	5.49	1.20	107.26	0.31	110.14	YES
	13500	96.17	107.8	107.6	106.72	5.61	5.68	1.20	107.31	0.32	109.21	YES
	13600	96.47	107.8	107.7	106.73	5.79	5.89	1.20	107.35	0.34	109.29	YES
	13700	96.77	108.3	108.2	106.75	5.98	6.11	1.20	107.42	0.36	109.38	YES
	13800	96.77	109.3	109.0	106.80	5.95	6.05	1.20	107.46	0.35	109.56	YES
	13900	97.07	109.9	108.5	106.82	6.14	6.27	1.20	107.52	0.37	109.67	YES

LOWER SILVER CREEK REACHES 1 THRU 6

HYDRAULIC STABILITY AND SCOUR POTENTIAL FOR PROPOSED CHANNEL IMPROVEMENTS

	Channel Parameters				Design Parameters with Low Roughness							
Location	River Station	Channel Invert (NAVD)	LOB Elev[1] (NAVD)	ROB Elev[1] (NAVD)	1% WSEL (NAVD)	1% Chan Velocity (fps)	10% Chan Velocity (fps)	a	E.G. Elev (NAVD)	Froude Number	Freeboard Line (NAVD)	Energy Grade Contained?
	14000	97.67	109.7	108.5	106.81	6.61	6.84	1.20	107.62	0.41	109.70	YES
	14100	97.97	110.9	109.9	106.84	6.84	7.10	1.20	107.71	0.43	109.83	YES
	14200	98.27	111.1	111.2	106.87	7.08	7.39	1.20	107.80	0.46	109.96	YES
	14300	98.57	109.9	110.8	106.90	7.34	7.69	1.20	107.90	0.48	110.11	YES
	14400	98.87	110.2	110.9	106.94	7.61	8.00	1.20	108.02	0.51	110.27	YES
	14500	99.17	110.8	110.8	106.99	7.90	8.32	1.20	108.15	0.54	110.44	YES
	14600	99.47	110.9	111.3	107.05	8.19	8.64	1.20	108.30	0.57	110.62	YES
	14700	99.77	111.4	111.3	107.12	8.50	8.94	1.20	108.47	0.60	110.80	YES
	14800	100.07	111.9	112.2	107.19	8.81	9.24	1.20	108.64	0.63	111.00	YES
	14900	100.37	112.4	111.9	107.28	9.12	9.50	1.20	108.83	0.66	111.21	YES
	15000	100.67	113.1	112.5	107.40	9.41	9.75	1.20	109.05	0.69	111.43	YES
	15100	100.97	114.1	112.8	107.53	9.70	9.93	1.20	109.28	0.73	111.65	YES
	15200	101.27	114.1	114.1	107.68	9.97	10.09	1.20	109.53	0.76	111.88	YES
	15300	101.57	115.5	115.3	107.85	10.21	10.22	1.20	109.79	0.78	112.11	YES
	15380	101.81	116.8	116.8	106.03	16.71	15.69	1.20	111.23	1.63	112.32	YES
	15469	102.08	117.2	114.8	108.05	13.93	13.33	1.20	111.67	1.00	112.40	YES
	15470	102.08	117.2	114.8	108.08	13.87	11.33	1.20	111.66	1.00	112.41	YES
Capitol	15668	103.30	115.5	115.5	111.57	10.06	9.65	1.20	113.46	0.62	113.85	YES
	15669	103.30	115.5	115.5	111.58	10.04	9.65	1.20	113.46	0.62	113.86	YES
	15761	103.60	117.0	117.3	111.25	13.92	13.36	1.20	114.86	1.00	115.32	YES
	15800	103.73	117.0	117.3	111.86	12.87	12.28	1.20	114.95	0.89	115.57	YES
	15900	104.06	117.7	117.8	112.26	12.74	12.16	1.20	115.28	0.88	116.20	YES
	16000	104.38	117.5	117.6	112.65	12.61	12.04	1.20	115.61	0.87	116.74	YES
	16100	104.70	117.8	117.1	112.99	12.56	12.00	1.20	115.93	0.86	117.23	YES
	16200	105.03	118.3	117.3	113.30	12.60	12.03	1.20	116.26	0.87	117.73	YES
	16300	105.35	118.8	117.7	113.62	12.61	12.03	1.20	116.58	0.87	118.25	YES
	16400	105.68	119.1	118.1	113.93	12.65	12.06	1.20	116.91	0.87	118.74	YES
	16500	106.00	118.9	118.4	114.24	12.67	12.07	1.20	117.23	0.87	119.21	YES
	16600	106.33	118.9	118.3	114.55	12.70	12.10	1.20	117.56	0.88	119.63	YES
	16700	106.65	119.2	118.2	114.86	12.72	12.10	1.20	117.87	0.88	119.89	YES
	16800	106.98	119.9	119.1	115.17	12.75	12.13	1.20	118.20	0.88	120.47	YES
	16900	107.32	120.8	119.1	115.49	12.81	12.18	1.20	118.55	0.89	120.87	YES
	17000	107.67	122.3	120.0	115.80	12.89	12.25	1.20	118.90	0.89	121.25	YES
N Babb	17050	107.76	121.0	122.9	116.20	12.31	11.70	1.20	119.02	0.83	121.48	YES
	17125	108.03	121.0	121.0	117.73	8.36	8.35	1.20	119.03	0.52	122.25	YES
Granite Creek	17200	108.18	122.6	120.4	117.82	8.43	8.40	1.20	119.14	0.53	122.42	YES
	17450	108.68	122.8	121.3	118.09	8.68	8.64	1.20	119.49	0.55	122.96	YES
	17700	109.19	123.2	121.7	118.37	8.93	8.85	1.20	119.86	0.57	123.49	YES
	17863	109.51	123.8	121.4	118.57	9.08	8.99	1.20	120.11	0.59	124.75	YES
	18025	109.84	123.8	122.0	118.79	9.22	9.11	1.20	120.37	0.60	126.08	YES
	18193	110.18	124.1	122.3	119.03	9.34	9.21	1.20	120.66	0.61	126.42	YES
	18205	110.20	122.0	125.0	119.08	9.26	9.02	1.20	120.68	0.58	126.41	YES
Story	18310	110.41	122.5	125.5	120.62	8.16	7.92	1.20	121.86	0.48	127.16	YES
	18328	110.45	126.9	126.0	121.23	5.60	5.43	1.20	121.81	0.32	125.81	YES
	18523	110.84	126.2	125.6	121.28	5.81	5.65	1.20	121.91	0.34	125.93	YES
	18718	111.23	125.7	125.1	121.35	6.02	5.87	1.20	122.03	0.36	126.05	YES
	18913	111.62	126.9	125.0	121.42	6.25	6.11	1.20	122.15	0.38	126.19	YES
	19108	112.02	126.9	125.3	121.50	6.49	6.36	1.20	122.28	0.40	126.34	YES
	19308	112.42	127.4	125.8	121.59	6.75	6.63	1.20	122.44	0.42	126.51	YES
	19508	112.82	127.2	127.2	121.69	7.01	6.90	1.20	122.61	0.45	126.70	YES
	19708	113.22	128.1	127.7	121.81	7.28	7.18	1.20	122.80	0.47	126.90	YES
	19908	113.62	128.6	128.9	121.95	7.55	7.44	1.20	123.01	0.50	127.11	YES
	19931	113.67	127.0	128.0	121.71	9.50	9.37	1.20	123.39	0.64	126.93	YES
Murtha	19981	113.77	127.0	128.0	121.72	9.63	9.51	1.20	123.45	0.65	127.40	YES
	19983	113.77	127.7	128.5	122.41	7.23	7.11	1.20	123.38	0.47	127.71	YES
	20168	113.95	129.7	129.0	122.57	7.25	7.11	1.20	123.55	0.47	127.94	YES
	20418	114.2	129.0	128.9	123.15	5.31	5.46	1.20	123.68	0.34	128.38	YES
	20668	114.45	128.7	129.7	123.25	5.42	5.57	1.20	123.80	0.35	128.52	YES
	20918	114.7	129.6	129.7	123.36	5.52	5.67	1.20	123.93	0.36	128.66	YES
	21168	114.94	129.4	128.9	123.48	5.61	5.75	1.20	124.07	0.37	128.81	YES
	21396	115.17	132.0	129.8	123.6	5.70	5.83	1.20	124.21	0.37	128.97	YES
	21665	115.44	132.4	130.0	123.73	5.81	5.93	1.20	124.36	0.39	129.13	YES
	21719	115.49	128.4	128.4	123.33	9.43	9.56	1.20	124.99	0.59	129.18	YES
Moss Point	21780	115.54	128.4	128.4	124.77	8.01	7.96	1.20	125.97	0.46	129.84	YES
	21820	115.58	131.0	131.8	125.68	3.47	3.45	1.20	125.90	0.20	130.25	YES

LOWER SILVER CREEK REACHES 1 THRU 6

HYDRAULIC STABILITY AND SCOUR POTENTIAL FOR PROPOSED CHANNEL IMPROVEMENTS

	Channel Parameters				Design Parameters with Low Roughness							
Location	River Station	Channel Invert (NAVD)	LOB Elev[1] (NAVD)	ROB Elev[1] (NAVD)	1% WSEL (NAVD)	1% Chan Velocity (fps)	10% Chan Velocity (fps)	a	E.G. Elev (NAVD)	Froude Number	Freeboard Line (NAVD)	Energy Grade Contained?
	22070	115.8	130.7	131.2	125.71	3.54	3.53	1.20	125.94	0.21	130.30	YES
	22320	116.03	132.0	130.2	125.74	3.62	3.62	1.20	125.98	0.22	130.35	YES
	22570	116.25	131.8	129.2	125.77	3.70	3.70	1.20	126.03	0.22	130.39	YES
	22820	116.48	131.6	131.2	125.8	3.79	3.79	1.20	126.07	0.23	130.44	YES
	23009	116.65	131.9	129.8	125.84	3.86	3.86	1.20	126.12	0.24	130.49	YES
	23091	116.72	131.0	131.6	125.65	6.43	6.47	1.20	126.42	0.43	130.23	YES
Ocala	23173	116.78	129.6	130.6	125.66	6.47	6.51	1.20	126.44	0.42	130.24	YES
	23194	116.85	130.6	130.7	125.75	6.08	6.17	1.20	126.44	0.41	130.13	YES
	23444	117.68	130.6	129.2	125.9	6.18	6.28	1.20	126.61	0.43	130.39	YES
	23605	118.21	130.3	129.5	125.97	6.60	6.73	1.20	126.78	0.47	130.53	YES
	23855	119.04	129.1	129.0	126.14	7.05	7.20	1.20	127.07	0.53	132.20	YES
	24105	119.87	129.5	129.5	126.41	7.10	7.24	1.20	127.35	0.55	132.55	YES
	24232	120.29	129.5	129.7	126.87	5.42	5.45	1.20	127.42	0.4	132.77	YES
	24358	120.71	130.0	130.0	126.91	5.8	5.86	1.20	127.54	0.44	131.49	YES
	24462	121.05	131.0	132.0	126.89	13.74	13.45	1.20	130.41	1	131.12	YES
Cunningham	24513	121.05	131.0	132.0	129.87	9.1	9.55	1.20	131.41	0.54	132.57	YES

[1]Highest Natural Grade w/in R.O.W. to contain flow.

[2]Walls not allowed between Coyote Creek and Highway 101 (Coyote Creek floodplain).

COYOTE WATERSHED PROGRAM
LOWER SILVER CREEK IMPROVEMENTS
TRACTIVE FORCE ANALYSIS

Reach:	Coyote Creek to Highway 101	Highway 101 to Reach 2	Reach 3A	Reach 3D	Reach 3E&F	Reach 4B	Reach 4C	Reach 5	Reach 6A	Reach 6B
d_{90} (mm)	1.5	2.60	0.01	0.03	0.2	0.6	0.6	0.3	0.4	0.4
2-year Q	940	940	810	780	780	780	780	680	610	610
T.W.	52	50	48	38	38	49	21	21	21	56
q	18.1	18.8	16.9	20.5	20.5	15.9	37.1	32.4	29.0	10.9
n	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
depth	3.5	3.6	3.5	3.3	4.0	3.0	3.8	4	3.5	2.75
S_{EG}	0.0040	0.0007	0.0015	0.0035	0.0025	0.0030	0.0032	0.002	0.0009	0.0025
U_*	0.67	0.28	0.41	0.61	0.57	0.54	0.63	0.51	0.32	0.47
R_*	330	243	1	6	37	106	123	50	42	62
K_s	0.058	0.056	0.12	0.035	0.037	0.046	0.047	0.04	0.038	0.041
S_{eq}	5.9337E-05	1.1973E-04	1.3846E-07	9.6728E-08	1.5741E-06	1.2834E-05	6.4017E-06	2.1246E-06	3.2687E-06	8.4456E-06
$S_{initial}$	0.0039	0.0011	0.0019	0.0035	0.0028	0.003	0.0033	0.002	0.001	0.0033
Max. Unprotected L	1800	1675	1450	800	1150	2350	1380	1600	1700	1300
Max Degredation	6.9	1.6	2.8	2.8	3.2	7.0	4.5	3.2	1.7	4.3
Spacing for 3' Deg.	781	N/A	N/A	N/A	1072	1004	911	1502	3010	911

Total Degradation at 680 is 2.8' + 3.2' = 5.0'

Total Degradation at Moss Point is 3.2' + 1.7' = 4.9'

Total Degradation at Cunningham is 1.4' + 4.3' = 5.7'

LOWER SILVER CREEK REACHES 1 THRU 6

RELATIVE SEDIMENT TRANSPORT CAPACITY AND TRACTIVE FORCE ANALYSIS

		Transport Capacity				Low Roughness			High Roughness				
Location	River Station	1% Velocity w/ Low Roughness (fps)	Stream Power w/ Low Roughness (lb/ft-sec)	1% Velocity w/ High Roughness (fps)	Stream Power w/ High Roughness (lb/ft-sec)	Unit Tractive Force (lb/ft^2)	Tractive Force on Bed (lb/ft^2)	Tractive Force on Banks (lb/ft^2)	Unit Tractive Force (lb/ft^2)	Tractive Force on Bed (lb/ft^2)	Tractive Force on Banks (lb/ft^2)	Permissible Tractive Force (lb/ft^2)	Hard Bank Protection
Coyote Creek	73	18.68	58.78	1.53	0.09	3.15	3.06	2.36	0.06	0.06	0.05	0.14	No
	104	15.95	30.78	2.01	0.20	1.93	1.87	1.45	0.10	0.10	0.08	0.14	No
	106	14.31	21.94	2.04	0.21	1.53	1.48	1.15	0.10	0.10	0.08	0.14	No
	200	11.31	10.43	2.76	0.52	0.92	0.89	0.69	0.19	0.18	0.14	0.14	No
	400	11.66	11.54	2.93	0.63	0.99	0.96	0.74	0.22	0.21	0.17	0.14	No
	500	13.85	20.31	3.01	0.70	1.47	1.43	1.10	0.23	0.22	0.17	0.14	No
	600	13.57	18.43	3.46	1.07	1.36	1.32	1.02	0.31	0.30	0.23	0.14	No
	700	11.93	11.86	3.82	1.47	0.99	0.96	0.74	0.38	0.37	0.29	0.14	No
	830	10.94	8.98	3.87	1.54	0.82	0.80	0.62	0.40	0.39	0.30	0.14	No
	860	9.49	5.88	3.65	1.28	0.62	0.60	0.47	0.35	0.34	0.26	0.14	Yes
	930	9.88	6.49	3.91	1.59	0.66	0.64	0.50	0.41	0.40	0.31	0.14	Yes
	1025	17.74	40.02	4.61	2.61	2.26	2.19	1.70	0.57	0.55	0.43	0.14	Yes
	1067	15.38	25.78	5.66	4.95	1.68	1.63	1.26	0.87	0.84	0.65	0.14	Yes
Wooster	1107	10.43	7.19	5.65	4.90	0.69	0.67	0.52	0.87	0.84	0.65	0.14	Yes
	1120	10.47	7.28	5.66	4.95	0.7	0.68	0.53	0.87	0.84	0.65	0.14	Yes
	1148	8.42	3.68	4.87	3.13	0.44	0.43	0.33	0.64	0.62	0.48	0.14	Yes
	1253	20.07	59.11	4.37	2.29	2.95	2.86	2.21	0.52	0.50	0.39	0.14	Yes
	1273	20.79	66.36	4.40	2.34	3.19	3.09	2.39	0.53	0.51	0.40	0.14	Yes
	1350	20.77	62.05	7.17	10.24	2.99	2.90	2.24	1.43	1.39	1.07	0.14	Yes
	1390	19.44	47.75	8.82	19.60	2.46	2.39	1.85	2.22	2.15	1.67	0.14	Yes
UPRR	1410	10.31	6.40	8.11	14.99	0.62	0.60	0.47	1.85	1.79	1.39	0.14	Yes
	1450	10.35	6.48	8.05	14.63	0.63	0.61	0.47	1.82	1.77	1.37	0.14	Yes
	1525	6.62	1.64	5.46	4.42	0.25	0.24	0.19	0.81	0.79	0.61	0.14	Yes
	1622	6.07	1.28	4.93	3.29	0.21	0.20	0.16	0.67	0.65	0.50	0.14	Yes
	1667	6.86	1.85	5.49	4.56	0.27	0.26	0.20	0.83	0.81	0.62	0.14	Yes
	1763	7.16	2.13	5.62	4.93	0.3	0.29	0.23	0.88	0.85	0.66	0.14	Yes
	1845	7.23	2.09	5.82	5.26	0.29	0.28	0.22	0.90	0.87	0.68	0.14	Yes
	1884	9.52	4.89	7.42	11.38	0.51	0.49	0.38	1.53	1.48	1.15	0.14	Yes
	1885	9.52	1.48	7.42	1.82	0.16	0.16	0.12	0.25	0.24	0.19	concrete	Yes
Highway 101	2045	9.39	1.42	7.41	1.80	0.15	0.15	0.11	0.24	0.23	0.18	concrete	Yes
	2046	9.39	1.42	7.42	1.80	0.15	0.15	0.11	0.24	0.23	0.18	0.14	Yes
	2075	8.45	3.39	6.73	6.56	0.4	0.39	0.30	0.98	0.95	0.74	0.14	Yes
	2120	5.16	0.74	4.38	1.75	0.14	0.14	0.11	0.40	0.39	0.30	0.14	Yes
	2220	4.42	0.47	3.74	1.08	0.11	0.11	0.08	0.29	0.28	0.22	0.15	Yes
	2280	4.99	0.67	4.20	1.53	0.13	0.13	0.10	0.36	0.35	0.27	0.16	Yes
	2525	5.10	0.72	4.26	1.60	0.14	0.14	0.11	0.38	0.37	0.29	0.17	Yes
	2625	4.94	0.66	4.06	1.76	0.13	0.13	0.10	0.43	0.42	0.32	0.18	Yes
	2775	4.28	0.44	3.39	1.05	0.1	0.10	0.08	0.31	0.30	0.23	0.19	No
	3000	4.18	0.42	3.25	0.93	0.1	0.10	0.08	0.29	0.28	0.22	0.19	No
	3200	4.43	0.50	3.44	1.10	0.11	0.11	0.08	0.32	0.31	0.24	0.19	No
	3282	4.47	0.51	3.45	1.12	0.11	0.11	0.08	0.32	0.31	0.24	0.19	No
	3300	4.56	0.53	3.56	1.21	0.12	0.12	0.09	0.34	0.33	0.26	0.19	No
	3500	4.64	0.57	3.59	1.25	0.12	0.12	0.09	0.35	0.34	0.26	0.19	No
	3626	4.71	0.59	3.62	1.27	0.13	0.13	0.10	0.35	0.34	0.26	0.19	No
	3671	4.34	0.46	3.38	1.03	0.11	0.11	0.08	0.30	0.29	0.23	0.19	No
	3771	4.98	0.69	3.86	1.53	0.14	0.14	0.11	0.40	0.39	0.30	0.19	Yes
Miguelita Creek	3828	10.70	2.19	8.25	2.54	0.2	0.19	0.15	0.31	0.30	0.23	concrete	Yes
	4100	9.01	1.30	7.15	1.65	0.14	0.14	0.11	0.23	0.22	0.17	concrete	Yes
	4300	9.11	1.34	7.19	1.68	0.15	0.15	0.11	0.23	0.22	0.17	concrete	Yes
	4500	9.21	1.39	7.23	1.71	0.15	0.15	0.11	0.24	0.23	0.18	concrete	Yes
	4700	9.31	1.44	7.27	1.74	0.16	0.16	0.12	0.24	0.23	0.18	concrete	Yes
	4900	9.42	1.50	7.31	1.78	0.16	0.16	0.12	0.24	0.23	0.18	concrete	Yes
	5030	9.47	1.53	7.33	1.79	0.16	0.16	0.12	0.24	0.23	0.18	concrete	Yes
Walgreens	5070	9.50	1.54	7.34	1.80	0.16	0.16	0.12	0.24	0.23	0.18	concrete	Yes
	5100	9.52	1.55	7.34	1.80	0.16	0.16	0.12	0.24	0.23	0.18	concrete	Yes
	5105	9.96	1.79	7.57	1.98	0.18	0.17	0.14	0.26	0.25	0.20	concrete	Yes
	5174	10.04	1.84	7.60	2.01	0.18	0.17	0.14	0.26	0.25	0.20	concrete	Yes
	5240	10.37	2.04	7.73	2.12	0.2	0.19	0.15	0.27	0.26	0.20	concrete	Yes
McKee	5428	10.23	1.97	7.32	1.80	0.19	0.18	0.14	0.25	0.24	0.19	concrete	Yes
	5490	5.07	0.73	3.79	1.43	0.14	0.14	0.11	0.38	0.37	0.29	0.14	No
	5527	5.39	0.92	3.84	1.56	0.17	0.16	0.13	0.41	0.40	0.31	0.14	No
	5660	4.86	0.66	3.53	1.19	0.14	0.14	0.11	0.34	0.33	0.26	0.15	No
	5900	5.15	0.81	3.48	1.17	0.16	0.16	0.12	0.34	0.33	0.26	0.16	No
	6028	4.88	0.71	2.55	0.46	0.15	0.15	0.11	0.18	0.17	0.14	0.17	No
	6116	5.01	0.73	2.33	0.34	0.15	0.15	0.11	0.15	0.15	0.11	0.18	No
	6200	4.99	0.72	2.79	0.58	0.14	0.14	0.11	0.21	0.20	0.16	0.19	No
	6437	5.83	1.18	3.81	1.51	0.2	0.19	0.15	0.40	0.39	0.30	0.20	No
	6657	6.12	1.39	4.13	1.97	0.23	0.22	0.17	0.48	0.47	0.36	0.20	No
	6723	6.34	1.54	4.26	2.16	0.24	0.23	0.18	0.51	0.49	0.38	0.20	No
	6823	7.64	0.81	5.28	0.66	0.11	0.11	0.08	0.12	0.12	0.09	0.20	No
	6880	8.91	1.29	6.38	1.17	0.15	0.15	0.11	0.18	0.17	0.14	concrete	Yes
	7128	9.29	1.48	6.55	1.27	0.16	0.16	0.12	0.19	0.18	0.14	concrete	Yes
	7428	9.81	1.77	6.76	1.42	0.18	0.17	0.14	0.21	0.20	0.16	concrete	Yes
	7600	10.12	1.97	6.88	1.50	0.19	0.18	0.14	0.22	0.21	0.17	concrete	Yes
	7800	10.53	2.25	7.04	1.62	0.21	0.20	0.16	0.23	0.22	0.17	concrete	Yes
	8040	11.14	2.70	7.26	1.79	0.24	0.23	0.18	0.25	0.24	0.19	concrete	Yes
	8128	11.39	2.90	7.35	1.87	0.25	0.24	0.19	0.25	0.24	0.19	concrete	Yes
	8300	11.99	3.44	7.55	2.04	0.29	0.28	0.22	0.27	0.26	0.20	concrete	Yes
	8500	14.69	6.69	7.78	2.24	0.46	0.45	0.35	0.29	0.28	0.22	concrete	Yes
	8700	14.32	6.15	8.03	2.48	0.43	0.42	0.32	0.31	0.30	0.23	concrete	Yes
	8756	13.40	4.95	8.14	2.60	0.37	0.36	0.28	0.32	0.31	0.24	concrete	Yes
	8763	11.95	3.40	8.10	2.56	0.28	0.27	0.21	0.32	0.31	0.24	concrete	Yes
Alum Rock	8863	15.14	7.39	8.10	2.56	0.49	0.48	0.37	0.32	0.31	0.24	concrete	Yes
	8908	12.51	4.06	7.26	1.87	0.32	0.31	0.24	0.26	0.25	0.20	0.18	Left Only
	8908	10.81	8.44	7.18	11.31	0.78	0.76	0.59	1.57	1.52	1.18	0.18	Left Only
	9100	11.41	10.06	7.12	11.00	0.88	0.85	0.66	1.54	1.49	1.16	0.18	Left Only
	9230	16.98	36.47	7.07	10.86	2.15	2.09	1.61	1.54	1.49	1.16	0.18	Left Only

LOWER SILVER CREEK REACHES 1 THRU 6

RELATIVE SEDIMENT TRANSPORT CAPACITY AND TRACTIVE FORCE ANALYSIS

		Transport Capacity				Low Roughness			High Roughness				
Location	River Station	1% Velocity w/ Low Roughness (fps)	Stream Power w/ Low Roughness (lb/ft-sec)	1% Velocity w/ High Roughness (fps)	Stream Power w/ High Roughness (lb/ft-sec)	Unit Tractive Force (lb/ft^2)	Tractive Force on Bed (lb/ft^2)	Tractive Force on Banks (lb/ft^2)	Unit Tractive Force (lb/ft^2)	Tractive Force on Bed (lb/ft^2)	Tractive Force on Banks (lb/ft^2)	Permissible Tractive Force (lb/ft^2)	Hard Bank Protection
	9325	16.67	34.87	7.75	14.49	2.09	2.03	1.57	1.87	1.81	1.40	0.18	Left Only
	9337	12.44	3.99	9.53	4.50	0.32	0.31	0.24	0.47	0.46	0.35	0.18	Left Only
	9387	7.28	0.67	7.35	1.85	0.09	0.09	0.07	0.25	0.24	0.19	concrete	Yes
Sunset	9498	7.03	0.60	7.10	1.65	0.09	0.09	0.07	0.23	0.22	0.17	concrete	Yes
	9559	6.67	0.53	6.74	1.47	0.08	0.08	0.06	0.22	0.21	0.17	0.18	Left Only
	9572	6.23	1.42	6.28	7.40	0.23	0.22	0.17	1.18	1.14	0.89	0.18	Left Only
	9800	7.04	2.12	6.57	8.55	0.3	0.29	0.23	1.30	1.26	0.98	0.18	Left Only
	10000	7.88	3.02	6.77	9.42	0.38	0.37	0.29	1.39	1.35	1.04	0.17	Left Only
	10200	8.90	4.48	6.93	10.16	0.5	0.49	0.38	1.47	1.43	1.10	0.17	Left Only
	10300	9.45	5.45	6.98	10.43	0.58	0.56	0.44	1.49	1.45	1.12	0.16	Left Only
	10349	8.50	1.16	6.62	1.40	0.14	0.14	0.11	0.21	0.20	0.16	0.15	Yes
	10446	11.59	2.97	9.14	3.68	0.26	0.25	0.20	0.40	0.39	0.30	0.14	Yes
San Antonio	10556	11.44	2.85	9.09	3.62	0.25	0.24	0.19	0.40	0.39	0.30	0.14	Yes
	10630	11.00	8.61	7.64	13.52	0.78	0.76	0.59	1.77	1.72	1.33	0.14	Yes
	10671	6.66	1.82	5.42	4.74	0.27	0.26	0.20	0.87	0.84	0.65	0.14	No
	10884	6.24	1.54	4.83	3.39	0.25	0.24	0.19	0.70	0.68	0.53	0.14	No
	11100	6.83	2.06	5.01	3.79	0.3	0.29	0.23	0.76	0.74	0.57	0.14	No
	11300	7.43	2.72	5.16	4.19	0.37	0.36	0.28	0.81	0.79	0.61	0.14	No
	11519	8.09	3.58	5.29	4.54	0.44	0.43	0.33	0.86	0.83	0.65	0.14	No
	11733	6.34	1.72	4.26	2.37	0.27	0.26	0.20	0.56	0.54	0.42	0.14	No
	11800	6.56	1.92	4.33	2.50	0.29	0.28	0.22	0.58	0.56	0.44	0.14	No
	11900	6.86	2.23	4.42	2.67	0.32	0.31	0.24	0.60	0.58	0.45	0.14	No
	12100	7.50	2.99	4.59	3.03	0.4	0.39	0.30	0.66	0.64	0.50	0.14	No
	12250	7.94	3.61	4.71	3.28	0.45	0.44	0.34	0.70	0.68	0.53	0.14	No
	12350	6.82	2.15	4.47	2.70	0.32	0.31	0.24	0.60	0.58	0.45	0.14	No
	12450	18.59	55.24	5.17	4.27	2.97	2.88	2.23	0.83	0.81	0.62	0.14	No
	12500	14.59	6.20	12.29	9.50	0.42	0.41	0.32	0.77	0.75	0.58	concrete	Yes
I680	12794	8.78	1.19	8.68	3.08	0.14	0.14	0.11	0.35	0.34	0.26	concrete	Yes
	12795	8.78	1.19	8.68	3.80	0.14	0.14	0.11	0.44	0.43	0.33	concrete	Yes
	12829	8.10	0.93	8.00	2.94	0.11	0.11	0.08	0.37	0.36	0.28	concrete	Yes
	12880	4.79	0.18	4.73	0.59	0.04	0.04	0.03	0.12	0.12	0.09	concrete	Yes
	13013	4.97	0.21	4.89	0.65	0.04	0.04	0.03	0.13	0.13	0.10	concrete	Yes
	13035	5.48	0.28	5.39	0.87	0.05	0.05	0.04	0.16	0.16	0.12	concrete	Yes
Jackson	13125	5.27	0.24	5.18	0.76	0.05	0.05	0.04	0.15	0.15	0.11	concrete	Yes
	13126	5.38	0.86	5.29	3.25	0.16	0.16	0.12	0.62	0.60	0.47	0.08	Yes
	13210	5.15	0.76	5.02	2.80	0.15	0.15	0.11	0.56	0.54	0.42	0.08	Yes
	13300	5.28	0.83	5.11	2.97	0.16	0.16	0.12	0.58	0.56	0.44	0.08	Yes
	13400	5.44	0.91	5.21	3.18	0.17	0.16	0.13	0.61	0.59	0.46	0.08	Yes
	13500	5.61	1.01	5.32	3.39	0.18	0.17	0.14	0.64	0.62	0.48	0.08	Yes
	13600	5.79	1.12	5.42	3.61	0.19	0.18	0.14	0.67	0.65	0.50	0.08	Yes
	13700	5.98	1.24	5.52	3.83	0.21	0.20	0.16	0.69	0.67	0.52	0.08	Yes
	13800	5.95	1.22	5.43	3.63	0.21	0.20	0.16	0.67	0.65	0.50	0.08	Yes
	13900	6.14	1.35	5.53	3.84	0.22	0.21	0.17	0.70	0.68	0.53	0.08	Yes
	14000	6.61	1.72	5.82	4.55	0.26	0.25	0.20	0.78	0.76	0.59	0.08	Yes
	14100	6.84	1.93	5.91	4.79	0.28	0.27	0.21	0.81	0.79	0.61	0.08	Yes
	14200	7.08	2.16	6.00	5.04	0.31	0.30	0.23	0.84	0.81	0.63	0.08	Yes
	14300	7.34	2.44	6.10	5.29	0.33	0.32	0.25	0.87	0.84	0.65	0.08	Yes
	14400	7.61	2.74	6.18	5.54	0.36	0.35	0.27	0.90	0.87	0.68	0.08	Yes
	14500	7.90	3.09	6.26	5.78	0.39	0.38	0.29	0.92	0.89	0.69	0.08	Yes
	14600	8.19	3.49	6.34	6.02	0.43	0.42	0.32	0.95	0.92	0.71	0.08	Yes
	14700	8.50	3.93	6.41	6.25	0.46	0.45	0.35	0.97	0.94	0.73	0.08	Yes
	14800	8.81	4.43	6.48	6.46	0.5	0.49	0.38	1.00	0.97	0.75	0.08	Yes
	14900	9.12	4.97	6.54	6.67	0.54	0.52	0.41	1.02	0.99	0.77	0.08	Yes
	15000	9.41	5.51	6.60	6.86	0.58	0.56	0.44	1.04	1.01	0.78	0.08	Yes
	15100	9.70	6.09	6.65	7.04	0.63	0.61	0.47	1.06	1.03	0.80	0.08	Yes
	15200	9.97	6.66	6.70	7.22	0.67	0.65	0.50	1.08	1.05	0.81	0.08	Yes
	15300	10.21	7.20	6.75	7.38	0.71	0.69	0.53	1.09	1.06	0.82	0.08	Yes
	15380	16.71	36.57	6.77	7.48	2.19	2.12	1.64	1.10	1.07	0.83	0.08	Yes
	15469	13.93	18.10	9.85	23.42	1.3	1.26	0.98	2.38	2.31	1.79	0.08	Yes
	15470	13.87	5.40	9.85	4.74	0.39	0.38	0.29	0.48	0.47	0.36	concrete	Yes
Capitol	15668	10.06	1.90	9.84	4.72	0.19	0.18	0.14	0.48	0.47	0.36	concrete	Yes
	15669	10.04	6.23	9.84	23.29	0.62	0.60	0.47	2.37	2.30	1.78	0.08	Yes
	15761	13.92	18.04	12.62	52.35	1.3	1.26	0.98	4.15	4.03	3.11	0.08	Yes
	15800	12.87	13.96	11.12	34.67	1.08	1.05	0.81	3.12	3.03	2.34	0.08	Yes
	15900	12.74	13.51	10.03	24.81	1.06	1.03	0.80	2.47	2.40	1.85	0.08	Yes
	16000	12.61	13.07	9.51	20.86	1.04	1.01	0.78	2.19	2.12	1.64	0.08	Yes
	16100	12.56	12.91	9.19	18.67	1.03	1.00	0.77	2.03	1.97	1.52	0.08	Yes
	16200	12.60	13.02	8.98	17.31	1.03	1.00	0.77	1.93	1.87	1.45	0.08	Yes
	16300	12.61	13.08	8.81	16.25	1.04	1.01	0.78	1.85	1.79	1.39	0.08	Yes
	16400	12.65	13.20	8.68	15.54	1.04	1.01	0.78	1.79	1.74	1.34	0.08	Yes
	16500	12.67	13.25	8.57	14.87	1.05	1.02	0.79	1.74	1.69	1.31	0.08	Yes
	16600	12.70	13.37	8.49	14.44	1.05	1.02	0.79	1.70	1.65	1.28	0.08	Yes
	16700	12.72	13.43	8.41	13.98	1.06	1.03	0.80	1.66	1.61	1.25	0.08	Yes
	16800	12.75	13.55	8.35	13.67	1.06	1.03	0.80	1.64	1.59	1.23	0.08	Yes
	16900	12.81	13.75	8.31	13.47	1.07	1.04	0.80	1.62	1.57	1.22	0.08	Yes
	17000	12.89	14.02	8.29	13.36	1.09	1.06	0.82	1.61	1.56	1.21	0.08	Yes
N Babb	17050	12.31	12.29	8.21	13.25	1	0.97	0.75	1.61	1.56	1.21	0.08	Yes
	17125	8.36	3.65	6.39	6.11	0.44	0.43	0.33	0.96	0.93	0.72	0.07	Yes
Granite Creek	17200	8.43	3.75	6.37	6.07	0.44	0.43	0.33	0.95	0.92	0.71	0.07	Yes
	17450	8.68	4.12	6.35	6.01	0.48	0.47	0.36	0.95	0.92	0.71	0.07	Yes
	17700	8.93	4.52	6.34	5.96	0.51	0.49	0.38	0.94	0.91	0.71	0.07	Yes
	17863	9.08	4.78	6.34	5.95	0.53	0.51	0.40	0.94	0.91	0.71	0.07	Yes
	18025	9.22	5.01	6.34	5.96	0.54	0.52	0.41	0.94	0.91	0.71	0.07	Yes
	18193	9.34	5.23	6.33	5.95	0.56	0.54	0.42	0.94	0.91	0.71	0.07	Yes
	18205	9.26	1.52	6.48	1.27	0.16	0.16	0.12	0.20	0.19	0.15	concrete	Yes
Story	18310	8.16	1.01	6.33	1.18	0.12	0.12	0.09	0.19	0.18	0.14	concrete	Yes
	18328	5.60	1.03	4.50	2.03	0.18	0.17	0.14	0.45	0.44	0.34	0.07	Yes

LOWER SILVER CREEK REACHES 1 THRU 6

RELATIVE SEDIMENT TRANSPORT CAPACITY AND TRACTIVE FORCE ANALYSIS

		Transport Capacity				Low Roughness			High Roughness				
Location	River Station	1% Velocity w/ Low Roughness (fps)	Stream Power w/ Low Roughness (lb/ft-sec)	1% Velocity w/ High Roughness (fps)	Stream Power w/ High Roughness (lb/ft-sec)	Unit Tractive Force (lb/ft^2)	Tractive Force on Bed (lb/ft^2)	Tractive Force on Banks (lb/ft^2)	Unit Tractive Force (lb/ft^2)	Tractive Force on Bed (lb/ft^2)	Tractive Force on Banks (lb/ft^2)	Permissible Tractive Force (lb/ft^2)	Hard Bank Protection
	18523	5.81	1.16	4.59	2.16	0.2	0.19	0.15	0.47	0.46	0.35	0.07	Yes
	18718	6.02	1.31	4.68	2.31	0.22	0.21	0.17	0.49	0.48	0.37	0.07	Yes
	18913	6.25	1.47	4.78	2.46	0.24	0.23	0.18	0.51	0.49	0.38	0.07	Yes
	19108	6.49	1.66	4.87	2.61	0.26	0.25	0.20	0.54	0.52	0.41	0.07	Yes
	19308	6.75	1.89	4.96	2.77	0.28	0.27	0.21	0.56	0.54	0.42	0.07	Yes
	19508	7.01	2.14	5.04	2.93	0.3	0.29	0.23	0.58	0.56	0.44	0.07	Yes
	19708	7.28	2.42	5.13	3.10	0.33	0.32	0.25	0.60	0.58	0.45	0.07	Yes
	19908	7.55	2.72	5.21	3.26	0.36	0.35	0.27	0.63	0.61	0.47	0.07	Yes
	19931	9.50	1.60	6.29	1.14	0.17	0.16	0.13	0.18	0.17	0.14	0.07	Yes
Murtha	19981	9.63	1.67	6.10	1.02	0.17	0.16	0.13	0.17	0.16	0.13	0.07	Yes
	19983	7.23	2.37	5.02	2.88	0.33	0.32	0.25	0.57	0.55	0.43	0.07	Yes
	20168	7.25	2.38	5.00	2.85	0.33	0.32	0.25	0.57	0.55	0.43	0.07	Yes
	20418	5.31	0.93	3.77	1.22	0.17	0.16	0.13	0.32	0.31	0.24	0.07	Yes
	20668	5.42	0.99	3.80	1.25	0.18	0.17	0.14	0.33	0.32	0.25	0.07	Yes
	20918	5.52	1.05	3.84	1.29	0.19	0.18	0.14	0.34	0.33	0.26	0.07	Yes
	21168	5.61	1.11	3.86	1.32	0.2	0.19	0.15	0.34	0.33	0.26	0.07	Yes
	21396	5.70	1.17	3.89	1.35	0.21	0.20	0.16	0.35	0.34	0.26	0.07	Yes
	21665	5.81	1.24	3.92	1.38	0.21	0.20	0.16	0.35	0.34	0.26	0.07	Yes
	21719	9.43	1.45	6.48	1.11	0.15	0.15	0.11	0.17	0.16	0.13	concrete	Yes
Moss Point	21780	8.01	0.84	6.20	0.96	0.1	0.10	0.08	0.15	0.15	0.11	concrete	Yes
	21820	3.47	0.24	2.76	0.46	0.07	0.07	0.05	0.17	0.16	0.13	0.07	Yes
	22070	3.54	0.26	2.79	0.48	0.07	0.07	0.05	0.17	0.16	0.13	0.07	Yes
	22320	3.62	0.28	2.83	0.50	0.08	0.08	0.06	0.18	0.17	0.14	0.07	Yes
	22570	3.70	0.3	2.87	0.52	0.08	0.08	0.06	0.18	0.17	0.14	0.07	Yes
	22820	3.79	0.32	2.91	0.55	0.09	0.09	0.07	0.19	0.18	0.14	0.07	Yes
	23009	3.86	0.34	2.94	0.56	0.09	0.09	0.07	0.19	0.18	0.14	0.07	Yes
	23091	6.43	0.49	4.68	0.46	0.08	0.08	0.06	0.10	0.10	0.08	0.07	Yes
Ocala	23173	6.47	0.49	4.70	0.46	0.08	0.08	0.06	0.10	0.10	0.08	0.07	Yes
	23194	6.08	1.41	4.34	2.41	0.23	0.22	0.17	0.55	0.53	0.41	0.07	Yes
	23444	6.18	1.5	4.25	2.27	0.24	0.23	0.18	0.53	0.51	0.40	0.07	Left Only
	23605	6.60	1.86	4.40	2.53	0.28	0.27	0.21	0.58	0.56	0.44	0.07	Left Only
	23855	7.05	2.32	4.48	2.69	0.33	0.32	0.25	0.60	0.58	0.45	0.07	Left Only
	24105	7.10	2.41	4.35	2.49	0.34	0.33	0.26	0.57	0.55	0.43	0.07	Left Only
	24232	5.42	1.05	3.59	1.09	0.19	0.18	0.14	0.30	0.29	0.23	0.07	Left Only
	24358	5.80	1.32	3.74	1.24	0.23	0.22	0.17	0.33	0.32	0.25	0.07	Yes
	24462	13.74	16.28	9.62	19.84	1.18	1.14	0.89	2.06	2.00	1.55	concrete	Yes
Cunningham	24513	9.10	4.12	8.36	12.43	0.45	0.44	0.34	1.49	1.45	1.12	concrete	Yes

APPENDIX 3A-22

LSC MMP 1999

United States
Department of Agriculture
Natural Resources
Conservation Service
Davis, California

Lower Silver Creek Watershed Project

Santa Clara County, California

Mitigation & Monitoring Program

Sponsored by:
Santa Clara Valley Water District
Guadalupe - Coyote Resource Conservation District
USDA/ Natural Resources Conservation Service

February 1999

LOWER SILVER CREEK WATERSHED PLAN UPDATE

Mitigation and Monitoring Program

Santa Clara County, California

Sponsored By:

Santa Clara Valley Water District
Guadalupe - Coyote Resource Conservation District
U.S. Department of Agriculture /
Natural Resources Conservation Service

Prepared By:

U.S. Department of Agriculture /
Natural Resources Conservation Service
Davis, California

Santa Clara Valley Water District
San Jose, California

February 1999

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Watershed Project Summary

The purpose of this project is to reduce floodwater and related damages and the potential loss of life to the residents of San Jose along Lower Silver Creek. By modifying 4.58 miles of channel to convey the one- percent storm event, damages to buildings and vehicles, roadway closures and the need for emergency services would be greatly reduced.

The proposed plan was selected from a series of alternatives and includes constructing approximately 0.93 miles of vegetated earth channel; 2.14 miles of hybrid vegetated block wall channel, 0.57 miles of trapezoidal concrete channel and 0.25 miles of rectangular concrete channel. Approximately 0.40 mile of existing trapezoidal concrete channel will be retrofitted to provide deeper low flows and resting pools. About 0.34 miles of bridges and box culverts will be built or already exist. Please see companion report *"Section 404(B) 1 Alternatives Analysis and Plan Update"* for a complete description of the recommended plan structural features, analysis of watershed hydrology and alternatives analysis.

The project area includes all land within the Santa Clara Valley Water District right-of-way from just downstream of the Cunningham Avenue bridge west to the confluence with Coyote Creek. The land uses along the right-of-way include residential, commercial and industrial development. Proposed flood control modifications would be constructed completely within the existing 45' to 200' wide right-of-way. The updated project cost is $29.5 million ('98 dollars) with a benefit cost ratio of 1.04.

The permit applicant for Lower Silver Creek is the Santa Clara Valley Water District. The Water District will be responsible for phased construction of the flood control project in reaches. The lead federal agency is the USDA Natural Resources Conservation Service (NRCS).

The Water District and the NRCS will jointly take over responsibility for monitoring and maintenance of the revegetation areas immediately after installation.

The key map below and following location map illustrate the general arrangement of the reaches and urban setting of Lower Silver Creek.

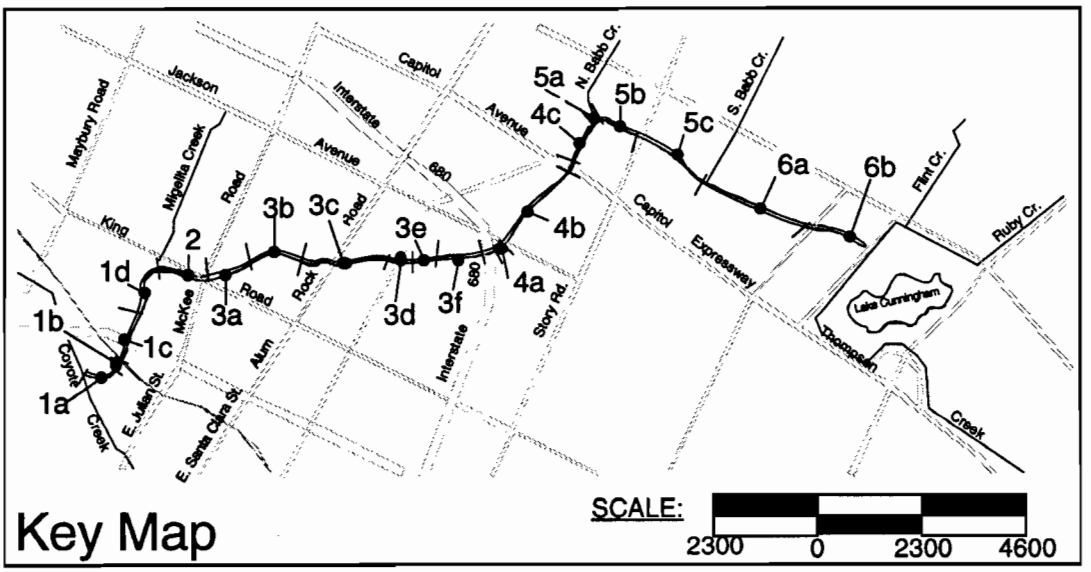


Figure 1.

The following table lists each reach number, proposed channel type and approximate length of the 1998 recommended plan. Detailed reach descriptions can be found starting on page 18 of the Plan Update companion report. Plan and section views of each reach and channel type can be found in the **Drawings**.

Table 1. Reach Summary:

Reach	Proposed Channel Type	Approx. Length
1a	Earth	770'
b	Hybrid Concrete Block w/ Topsoil over Riprap	530'
c	Trapazoidal concrete	1400'
d	Earth w/ floodwalls	985'
2	Rectangular concrete	1315'
3a	Earth	1600'
b	Trapazoidal concrete	975'
c	*(Existing Trapazoidal channel to be retrofitted)*	*2095'*
d	Trapazoidal concrete	655'
e	Earth	655'
f	Earth	900'
4a	Hybrid Concrete Block w/ Topsoil over Riprap	220'
b	Hybrid Concrete Block w/ Topsoil over Riprap	2300'
c	Hybrid Concrete Block w/ Topsoil over Riprap	1300'
5a	" " w/ Transition structure	240'
b	Hybrid Concrete Block w/ Topsoil over Riprap	860'
c	Hybrid Concrete Block w/ Topsoil over Riprap	1830'
6a	Hybrid Concrete Block w/ Topsoil over Riprap	1480'
b	Hybrid concrete block w/ earth bottom	2540'
	Existing and Proposed Bridge box culverts	1800'

Mitigation Plan

Summary

The mitigation plan was developed to specifically compensate unavoidable habitat losses resulting from the construction of the 1998 recommended plan. All the revegetation sites will be located within the Santa Clara Valley Water District's right-of-way. For those areas not owned in fee such as parkland access points, the Water District will have easements to install and maintain the flood control project, including revegetation sites in perpetuity. Please see companion report *"Addendum to the Final Environmental Impact Report for Lower Silver Creek Watershed Project"* for a full listing of project impacts.

Habitat Goals

The goals of the revegetation effort along Lower Coyote Creek are to replace riparian habitat and wetland habitat lost due to flood control construction; provide shade and hiding cover for fish species; and provide erosion control and weed control within the channel invert and channel banks. Habitat lost by the flood control project will be replaced with no net loss. Areas to be revegetated fall into five categories:

- **In-Channel Jurisdictional Habitat (Wetlands and Open Water):**
  Jurisdictional habitat will be created exclusively within the channel area. Created jurisdictional habitat will consist of areas of wetlands and jurisdictional waters. Wetlands will be comprised of areas along the low flow channel and select areas of the channel invert planted with facultative plant species. Jurisdictional waters will consist of open areas that possess soils that are saturated to the surface or pond for more than 7 days.

- **Top of Bank Riparian Forest:**
  The riparian forest revegetation sites will be planted along the top of the channel banks and select earth banks with a mix of plant species typical of the riparian vegetation that occurs within the project region. Tree species will include Fremont and black cottonwood, sycamore, red willow (*Salix laevigata)*, buckeye (*Aesculus californica)*, and valley and coast live oaks *(Quercus lobata, Q. agrifolia)*. Elderberry, box elder, arroyo willow *(Salix lasiolepis)*, coyote brush (*Baccharis pilularis)*, California rose *(Rosa californica)*, California blackberry, virgin's bower *(Clematis ligustifolia)*, and mugwort will comprise the dominant understory vegetation.

- **Channel Invert Riparian Habitat:**
  Riparian tree species, primarily cottonwood, alder and willow, along with select understory species will be planted in narrow strips immediately adjacent to the low flow channels, resting pools and riffles. These plantings will improve habitat for fish by providing increased shade and overhanging cover at the low flow channel's edge.

- **Channel Invert Herbaceous Cover:**
  The primary goal of this habitat type is to provide erosion control and aid in providing weed control. Species to be seeded in these area include a mixture of native forbs and grasses, but may also include non-invasive, non-native nurse crop to provide exceptional erosion control until native grasses can fully develop.

- **Hybrid Block Herbaceous, Shrub and Vine Cover:**
  This habitat type is intended as a native grass, shrub and vine matrix that eventually will cover most of the face of the block walls. It is designed to provide shade to the low flow channel, add organic material to the creek system and reduce solar absorption and reflectivity of the block walls. It is not intended to provide any specific wildlife use except for cover and possible food sites.

Revegetation Objectives:

The objectives of the revegetation effort for this project are:

- Restore 6.1 acres of emergent marsh along low flow channels and earth channel inverts. This wetland vegetation will only very rarely be removed for maintenance operations. Ephemeral wetlands - additional emergent marsh expected in the higher flow sections of the channel invert in areas of soil covered riprap will be removed at much greater frequency therefore it is not counted in this mitigation total.
- Restore 4.4 acres of open water in low flow channels and pools (summer flows).
- Shade the low-flow channel to 40% cover with riparian plant species in order to lower heat gain and provide a source of energy input to the creek; develop a continuous band of vegetation providing low cover for wildlife species moving along the creek corridor.
- Mitigate 2.0 acres of upland trees and shrubs to be removed during construction by establishing 22.2 acres of continuous riparian corridor along the length of the project to add foraging habitat, nesting sites, cover and perches for wildlife; reconnect historic ecological patches of vegetation existing upstream and downstream of the project site.
- Excavate and store wetland soils separately to preserve seed bank.
- Provide erosion control and weed control by revegetating the channel invert, slopes and block walls with desirable species.
- Plant native riparian stock, install irrigation, implement weed control efforts, and maintain the site and its immediate surroundings using methods that will maximize the survival of the planted stock, fulfillment of success criteria, and minimize maintenance effort and expense.
- Implement a statistically sound monitoring program for vegetation and wildlife that fulfills regulatory requirements; minimizes data collection and analysis efforts; allows for integration of wildlife and vegetation variables.

Target Jurisdictional Acreage

A new jurisdictional wetland delineation was performed. 8.8 acres of jurisdictional wetlands and waters of the United States were identified within the project area, 4.7 acres are wetlands and 4.1 acres are open water. The limit of jurisdictional waters was determined to be the elevation of the ordinary high water (OHW) line, calculated as the 2.3-year probability discharge of 1,340 cubic feet per second at the confluence with Coyote Creek and 700 cubic feet per second at Cunningham Avenue. Numerous factors were used to determine the OHW line. Stream gauge data, flood history and frequency of inundation were analyzed. Field visits were undertaken to observe inundation, saturated soil, sediment deposition, watermarks and erosion. The corresponding elevations were then transferred to base maps. Construction of the 1998 recommended plan would directly impact all 8.8 acres of jurisdictional waters and wetlands surveyed within the right-of-way. See companion report *"Identification of Waters of the U.S. Jurisdictional Delineation"*.

The mitigation plan proposes a net increase of wetland and other riparian habitat functions and values over the existing creek condition. The replacement ratio is approximately 1.3 acres to 1 acre removed for wetlands and approximately 5.4 acres to 1 acre for riparian habitat. The target acreages are 6.1 acres of wetlands and 22.2 acres of riparian habitat.

Success Criteria

Target Functions and Values

In-Channel Jurisdictional Habitat (Wetlands and Open Water):

The created jurisdictional habitat must meet the following success criteria:
The dominant vegetation present within the seasonal wetland must contain at least 50 percent species classifiable with a wetland indicator status of Obligate, Facultative Wet or Facultative (+). An 80 percent cover by native species will be required by the fifth year in a given reach. The created seasonal wetland and jurisdictional waters must meet the hydrology criteria as defined in the Corps 1987 Wetlands Delineation Manual.

Top of Bank Riparian Forest:

Trees and shrubs planted within the riparian forest habitat must meet the following success criteria: By year 5, all planted stock (trees and shrubs) must have either 80 percent survival, or the revegetation sites must have an average absolute middle to upper canopy cover of 45 percent or greater. In addition to these success criteria, the Santa Clara Valley Water District may have interim standards that will be applied to the contractor, and replanting of stock may occur prior to year 5. At year 10, the average absolute middle to upper canopy cover of trees and shrubs must show a steady trend towards 70 percent or greater, and no less than 50 percent absolute middle to upper canopy cover of trees and shrubs species is to occur in any revegetation site.

Success Criteria Continued:

Channel Invert Riparian Habitat:

By year 5, all plantings along the low flow channel must meet a success criteria of 70 percent absolute plant cover or greater.

Channel Invert Herbaceous Cover:

This habitat type is intended as a native grass community, however, it is not intended to provide any specific wildlife use other than a food and loafing area for waterfowl. The primary goal of this revegetation is to provide erosion control in the higher flow, non-jurisdictional subsection; therefore, no performance criteria are proposed.

Hybrid Block Herbaceous, Shrub and Vine Cover:

By year 5, the block wall plantings must meet a success criteria of 50 percent plant cover or greater.

Target Hydrological Regime

Only the targeted jurisdictional habitats: 4.4 acres of open waters and 6.1 acres of wetlands have a target hydrological regime, since most of the other areas are upland areas with vegetation supported by soil moisture and groundwater. The jurisdictional habitats must be saturated to the surface for a minimum of 7 days annually. The direction, volume and velocity of flows are detailed under the channel sections illustrated on the **Drawings**.

Figure 2.

Section through "Creek Restoration"

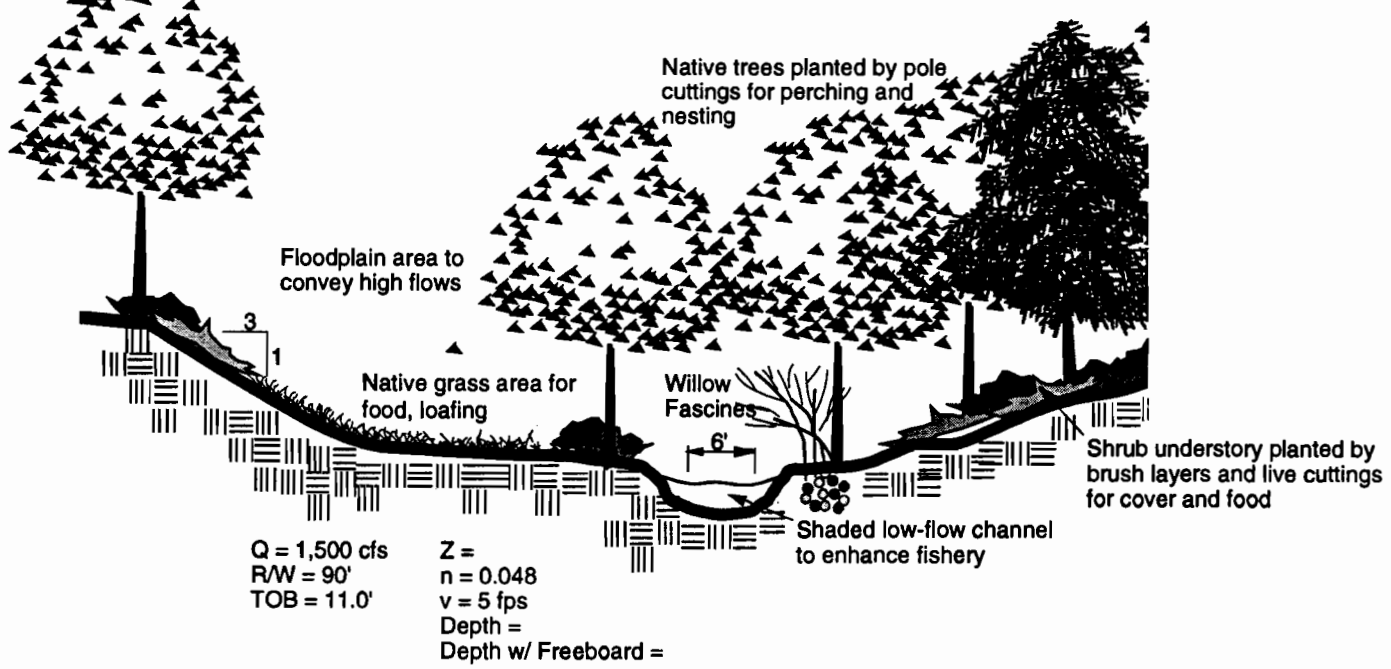
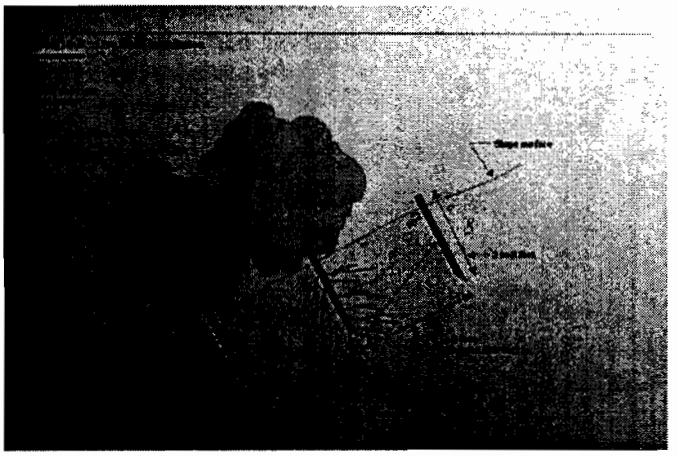
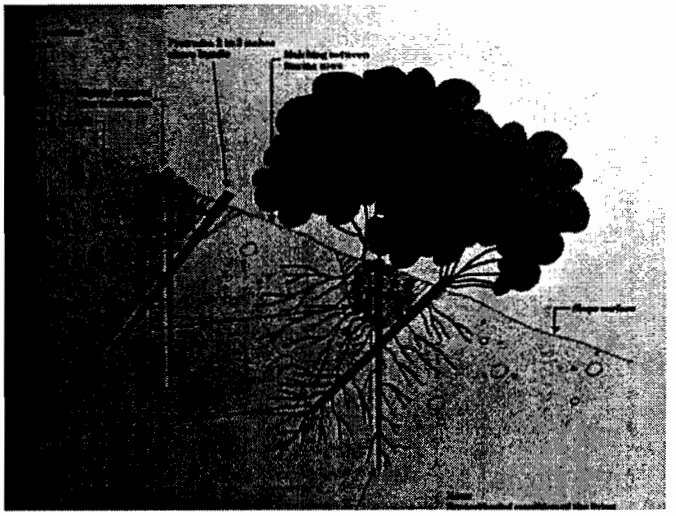


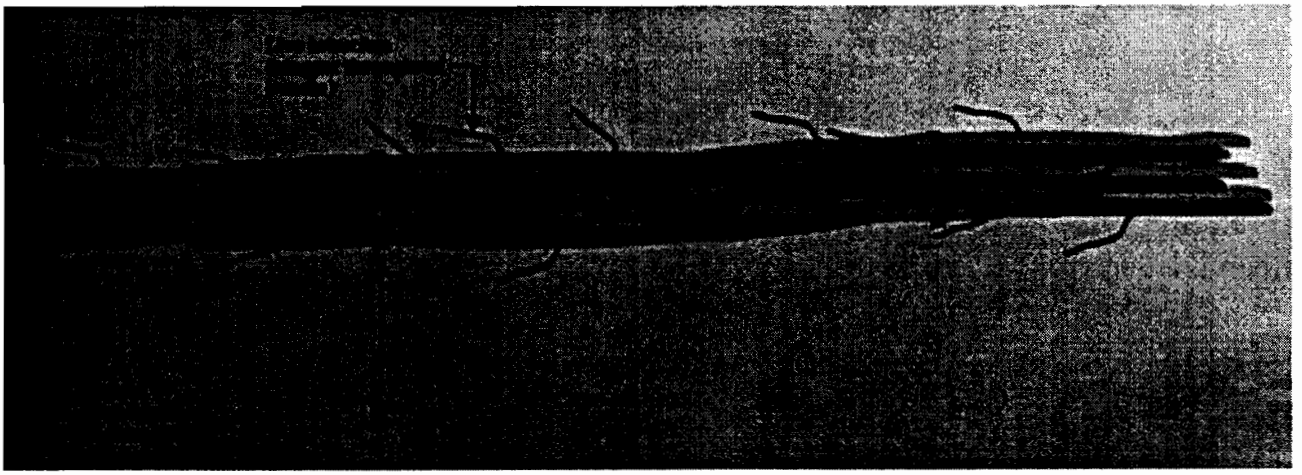
Figure 4.
Typical Soil Bioengineering Practices to be used:



Live Staking



Live Staking through Fascine



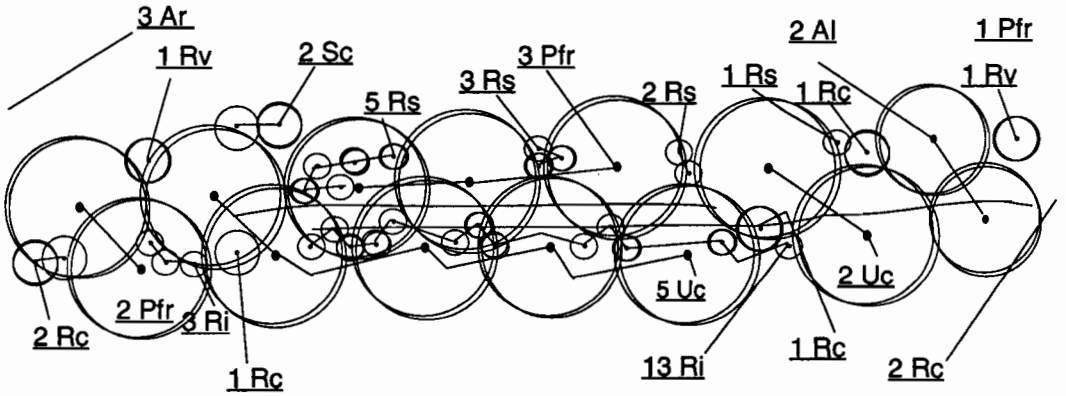
Construction of Live Facines

Planting Plans

Native trees, shrubs, vines, perennials and grasses will be used to revegetate the channel after earth moving and block wall construction. Five distinct planting zones will be planted with species chosen for their ability to adapt to anticipated site conditions.

The size of the plant materials to be used will range from seed, rooted and unrooted cuttings, one, five and fifteen gallon container stock. Cuttings will be taken of cottonwood, willows, alders and other species from on-site, adjacent sources. Planting depth of cuttings will vary by species e.g. two feet for willows to three feet for cottonwoods. Willow fascines, brush layering, joint planting and other soil bio-engineering techniques will be used to stabilize and vegetate earth channel banks and hybrid block walls. Trees, shrubs and groundcovers will be established along the tops of banks and along the sides of the low-flow channel, as directed by the plans. The hybrid vegetated block walls will have grasses, shrubs and vines established in spaces between blocks. **Plates 1 through 23** illustrate the preliminary planting plan. Final planting plans, details, specifications, cost estimates and detailed mitigation maintenance and operation plans will be prepared concurrently with the preparation of the phased structural construction drawings.

The proposed planting density is 350 trees per acre (with planting basins spaced 12 feet on center, triangular spacing), and 500 shrubs or vines per acre (with planting basins spaced at 10 feet on center, triangular spacing). Some herbaceous species will be planted at a density of 650 planting basins per acre (equivalent to 8 feet on center, triangular spacing).



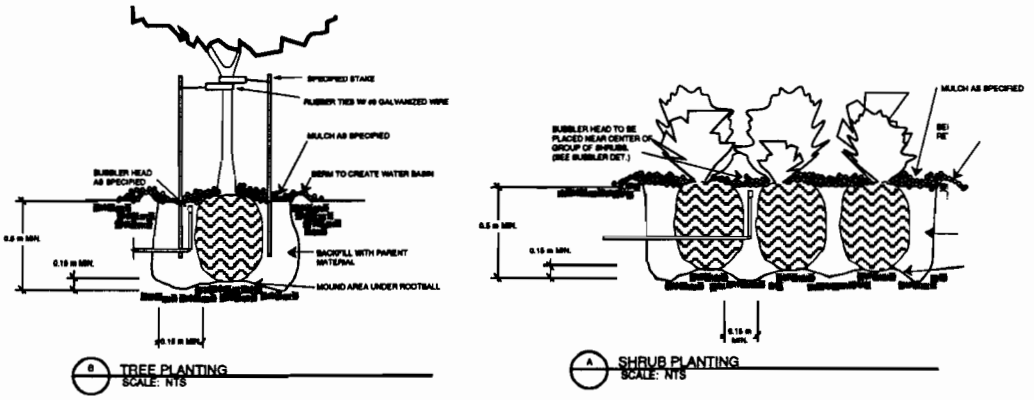
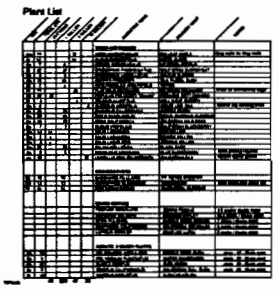


Table 2. Plant List



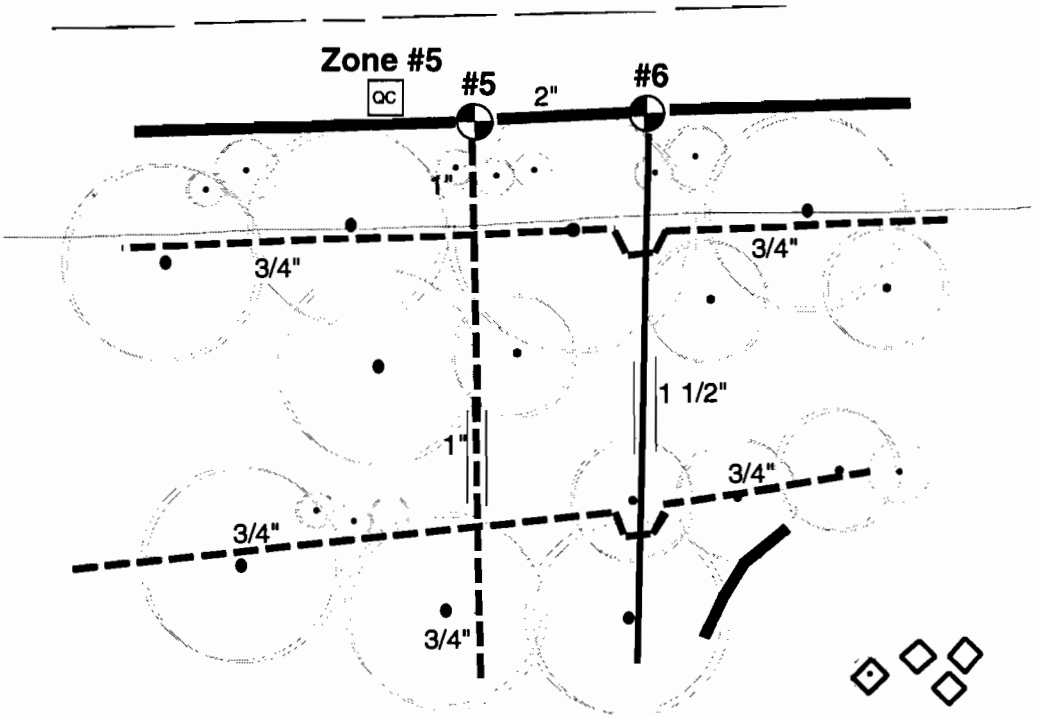
The following list of native plant species will be used:

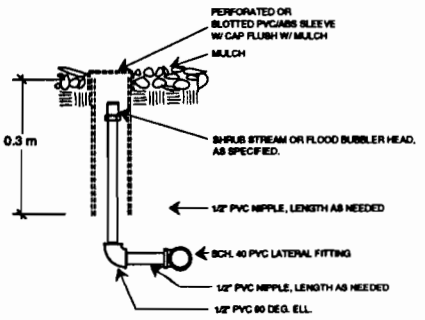
Botanical Name	Common Name
Trees:	
Aesculus California	California Buckeye
Acer Macrophylum	Bigleaf Maple
Acer Negundo	Box Elder
Alnus Rhombifolia	White Alder
Fraxinus latifolia	Oregon Ash
Juglans Hindsii	California Black Walnut
Platanus racemosa	California Sycamore
Populus Fremontii	Fremont Cottonwood
Populus balsamifera	Black Cottonwood
Quercus Agrifolia	Coast Live Oak
Quercus lobata	Valley Oak
Salix laevigata	Red Willow
Salix exigua	Sandbar Willow
Salix gooddingii	Goodding Willow
Salix lasiolepis	Arroyo Willow
Sambucus Caerulea	Blue Elderberry
Shrubs, Grasses and Aquatic Species:	
Arctostaphylos Uva-ursi	Bearberry
Artemisia douglasiana	Mugwort
Aster chilensis	Common Aster
Atriplex lentiformis	Quailbush
Baccharis Pilularis	Coyote Brush
Baccharis douglasii	
Ceanothus 'Concha'	Ceanothus spp.
C. 'Frosty-blue'	
C. 'Louis Edwards'	
C. 'Joyce Coulter'	
C. 'Julia Phelps'	
C. 'Ray Hartman'	
Cephalanthus occidentalis	Buttonbush
Clematis ligustifolia	Virgin's Bower
Deschanpsia danthonioides	Annual Hairgrass
Festuca californica	California Fescue
Festuca rubra	Red Fescue
Fremontodendron 'California Glory'	Flannel Bush
Heteromeles Arbutifolia	Toyon
Nassella (Stipa) lepida	Foothill Needlegrass
Nassella (Stipa) pulchra	Purple Needlegrass
Prunus Ilicifolia	Hollyleaf Cherry
Rhamnus California	Coffeeberry
Rosa Californica	California Rose
Rubus ursinus	California Blackberry
Scirpus acutus	Hardstem bulrush
Symphoricarpos albus	Snowberry
Typha angustifolia	Cattail
Typha latifolia	Narrow leaf cattail
Vitus californicus	California Grape

Irrigation Plans

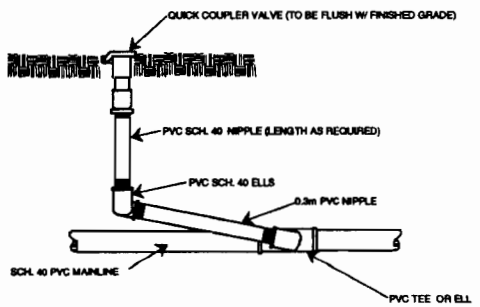
All plants that are planted in areas where groundwater is not immediately available to the root system will have an irrigation system. Trees, shrubs and vines planted in the tops of banks, earth slopes and in dry areas of the hybrid block wall will be irrigated by means of drip, bubblers and other spray heads. The irrigation systems will be zoned and electrically controlled. Irrigation water will be from municipal sources. Watering will occur from April through November, extended as-needed in dry years. Supplemental irrigation will decrease at the end of year 2 to wean planted stock, and regular irrigation will not occur in year 3 except on an as needed basis only. Regular inspections outside the April through November irrigation season will be conducted the first year in any 3-week period where no rainfall is received.

Irrigation plans will be prepared as part of the mitigation plan package and will be installed prior to planting. The irrigation system will be operated and maintained for up to five years or until plants are well established and can grow without supplemental water.





C BUBBLER HEAD IN PROTECTIVE SLEEVE
SCALE: NTS



A QUICK COUPLER VALVE (W/ SWING JOINT)
SCALE: NTS

Mitigation Installation Contracts
Due to the large number of plants required for this project, plant procurement contracts will be let in advance of the planting contract to insure the needed varieties and quantities by time of installation. The large quantities of container plants, live stakes, cuttings, native tree, shrub, wildflower and grass seed will then be made available to the revegetation contractor. This lowers bids and avoids plant shortages and species substitutions.

Several large commercial nurseries are located in the vicinity of the project site. Local nurseries and other local organizations will be invited to bid on propagule collection and contract growing the plants. All plant source material (seeds and cuttings) will be custom collected from nearby areas along Coyote Creek, Lake Cunningham Park and along Thompson Creek. Wetland plant material will be collected directly from Lower Silver Creek prior to channel construction. Preparation for stock collection will begin in 1-2 years prior to planting. All cuttings will be harvested while the plants are dormant, typically in December and January.

Planting of cuttings will occur when the plants are dormant (January and February); plants grown in containers will be installed in the early rainy season, typically between October 1 and December 1. Seeding of the jurisdictional wetland area will be conducted in the fall, to coincide with the onset of early rains. Mycorrhizal fungi inoculation may occur in select planting areas.

Plants susceptible to browsing by rabbits and ground squirrels will be protected using Blue X for seeds and chicken wire, hardware cloth, or other enclosures. Perches consisting of 15- to 20-foot 4-foot x 4-foot redwood posts or appropriately sized dead trees or branches may be installed throughout the project site to encourage predation of ground squirrels and rabbits by raptors.

All planted species will be protected from weed invasion by use of organic mulch. Mulch will be applied at a depth of 4-6 inches filling all planting basins. Mulch will be pulled away to expose the crown of the plant to prevent burial of growing points and/or rotting.

Construction Inspection
The mitigation contract will be administered by the Santa Clara Valley Water District or the USDA/ Natural Resources Conservation Service as a county or federal contract. The contractor will be monitored by an inspector to insure full compliance with the project plans and specifications.

Implementation Schedule
Mitigation contracts will be installed reach by reach directly after the completion of the structural contract for that reach. In some cases, certain components (e.g. Irrigation mainlines) will be installed by the structural contractor. Irrigation systems may be installed at any time with the plants installed only during certain fall and spring planting periods.

As-Built Drawings
The mitigation contractor will be obligated to prepare a set of as-built drawings while construction is in progress. All changes in locations of irrigation system components, plants or other mitigation features or changed site conditions will be illustrated on a final as-built drawing set and turned over to the contracting officer for reference.

Establishment Period
The contractor will be retained for a one-year establishment period to insure proper function of the irrigation systems and to monitor for possible changed site conditions, plant stress or other emergency. The contractor will be responsible for weed control, irrigation system inspection and maintenance, basin repair, herbivore protection, replanting of any dead or dying plant material and assisting in site assessment and joint inspections.

Long-Term Maintenance
The Water District is responsible for long-term maintenance activities. Most of the revegetation areas are planned to become self-sustaining systems and are expected to not require maintenance past year 5. However, yearly maintenance of revegetation in the higher flow channel inverts and along the low flow channels, pools and riffles may be required. The revegetation areas will be inspected yearly to identify any potentially significant problems, such as large downed trees, or invasion of non-native species.

Monitoring Program

Five Year Monitoring Methods
Mitigation monitoring will occur jointly by the Natural Resources Conservation Service, the Guadalupe - Coyote Resource Conservation District and the Santa Clara Valley Water District for the first five years after completion of each phase of the project. Monitoring procedures will be followed to determine overall success rate of the created wetland and riparian characteristics and functions. Monitoring transects will be set up at representative reaches. Permanent photographic points will be established within and overlooking the project area. Panoramic photos will be taken twice annually at the same time each year, in spring and fall. Monitoring sessions will start at the downstream end of the project and proceed upstream. Elements to be monitored include:

- Successful development of hydrologic characteristics.
- Development and/or existence of hydric soils.
- Wetland vegetation diversity and vigor.
- Macroinvertebrate indicator species.
- Wildlife and fishery surveys
- Other wetland ecosystem functions

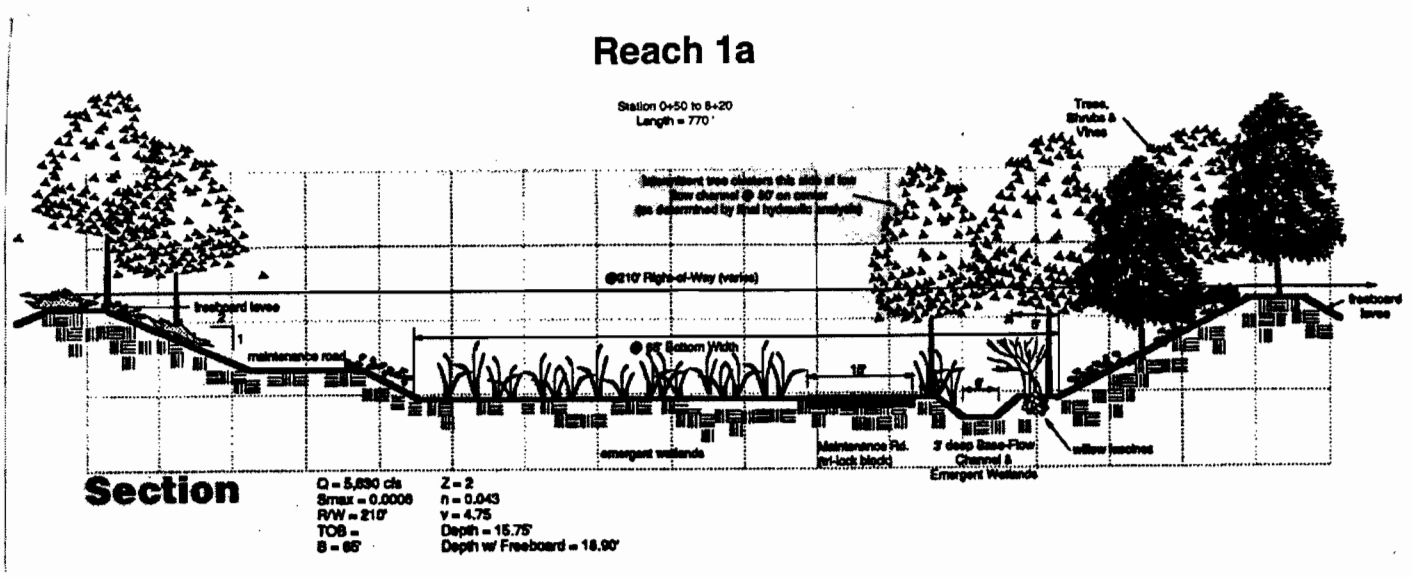
In-Channel Jurisdictional Habitat (Wetlands and Open Water):
Short-term monitoring of the created in-channel jurisdictional habitat will include monitoring of wetland vegetation in years 1, 3 and 5, and wetland hydrology in year 5. Qualitative and/or visual observations of hydrology will be made in years 1 and 3. It is anticipated that the constructed jurisdictional wetland and jurisdictional waters will meet the vegetation and hydrology criteria for a formal wetland determination by the end of the 5-year period.

If monitoring efforts determine that any of the success criteria have not been met, corrective measures must be taken in order to correct the parameter. This may require regrading of the jurisdictional area, or other measures to be determined by the Water District Environmental staff, and short-term monitoring will be reinstated.

Top of Bank Riparian Forest, Channel Invert Riparian Habitat and Hybrid Block Herbaceous, Shrub and Vine Cover:
A representative sample of all planted stock will be evaluated annually during the establishment period (years 1 through 5) to determine and document how well success criteria are being met. Yearly monitoring is to occur in the fall and is to include an assessment of survival, vigor, structure, browse, regeneration and percent canopy cover. Representative sampling is to be conducted by means of permanent transects and analyzed on a site by site basis. A minimum of one transect will be permanently marked in the following representative reaches: 1a, 1c, 2, 3a, 3c, 4a, 5c, and 6b. See Pages 19 through 26. Areas to be selected for monitoring will be identified on the detailed planting plans.

Survival will be monitored until year 5, unless it becomes unfeasible to monitor individual plants, then absolute percent canopy cover will be monitored alone. Survival will be monitored at least 1 year after irrigation of planted stock has been discontinued.

Channel Invert Herbaceous Cover:
No performance criteria and, therefore, no monitoring is proposed.



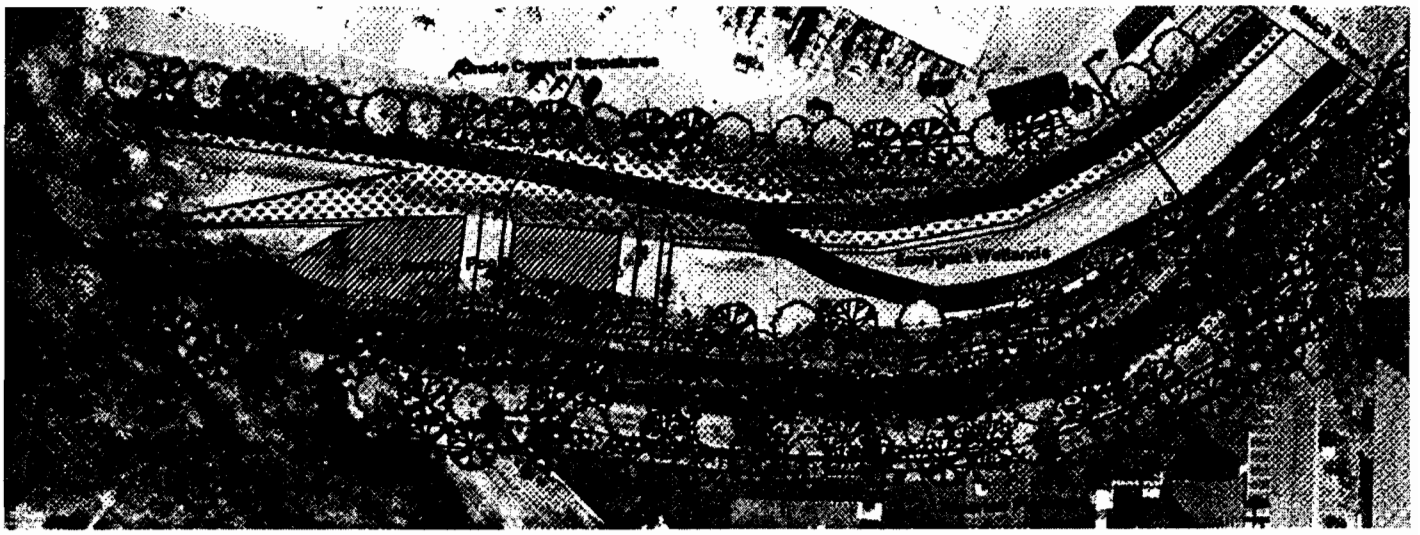
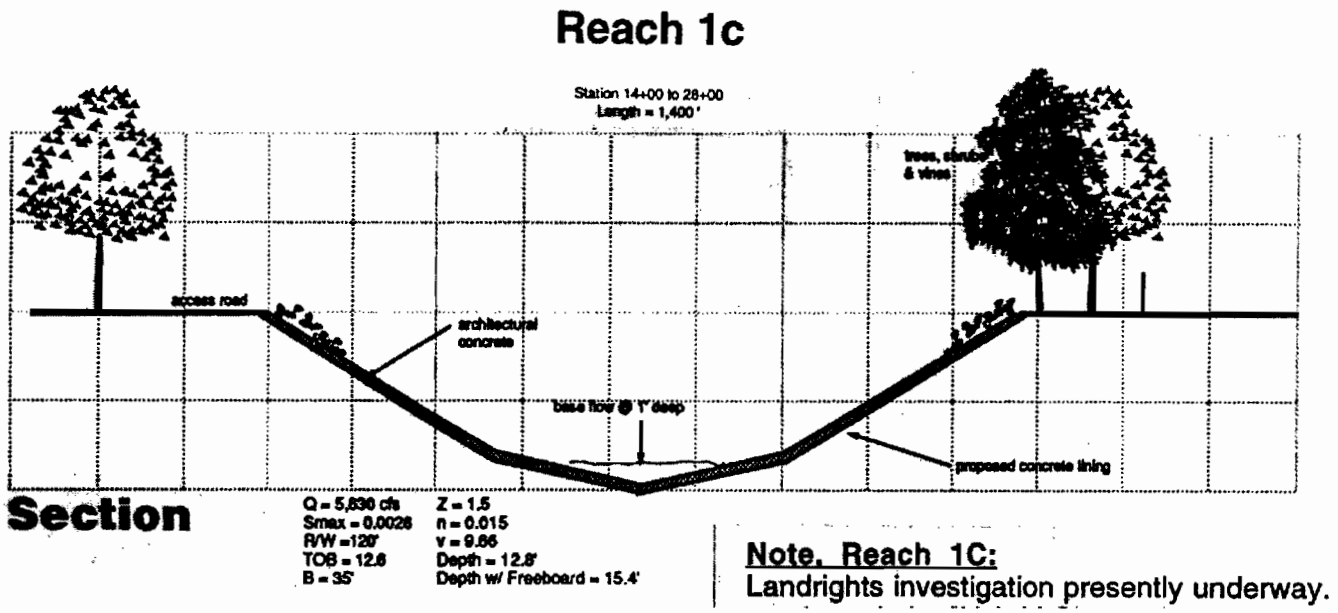


Figure 5. Transect location Reach 1a



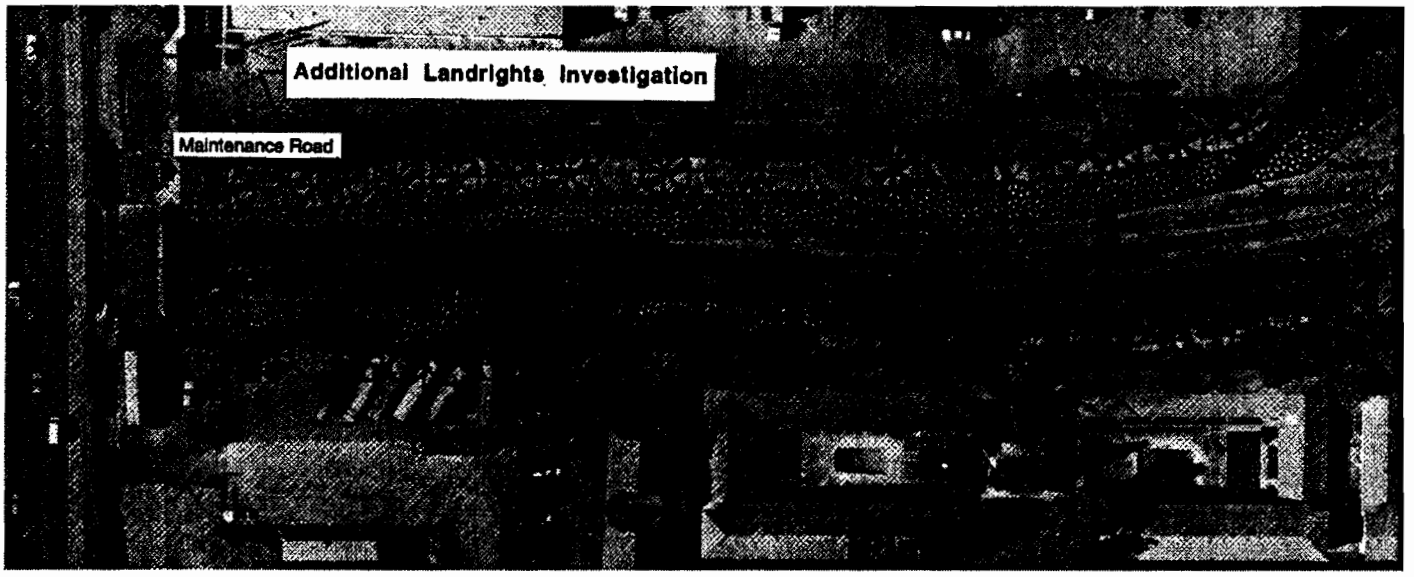
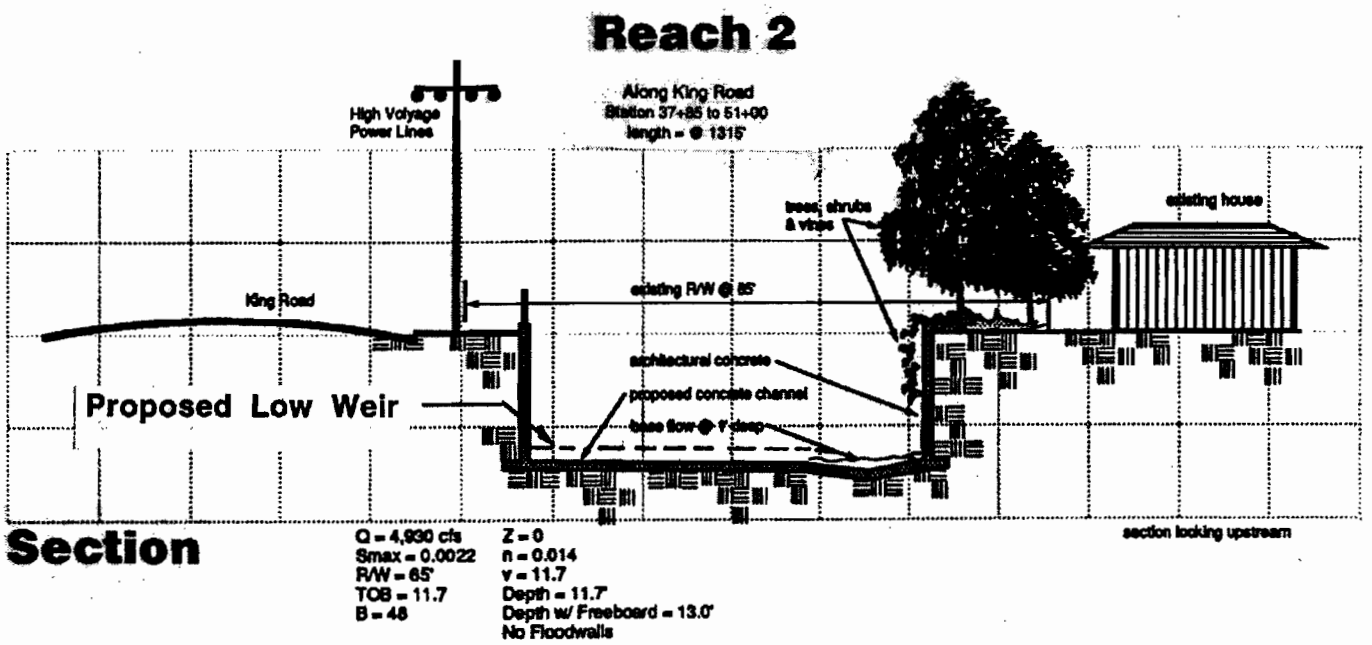


Figure 6. Transect location Reach 1c



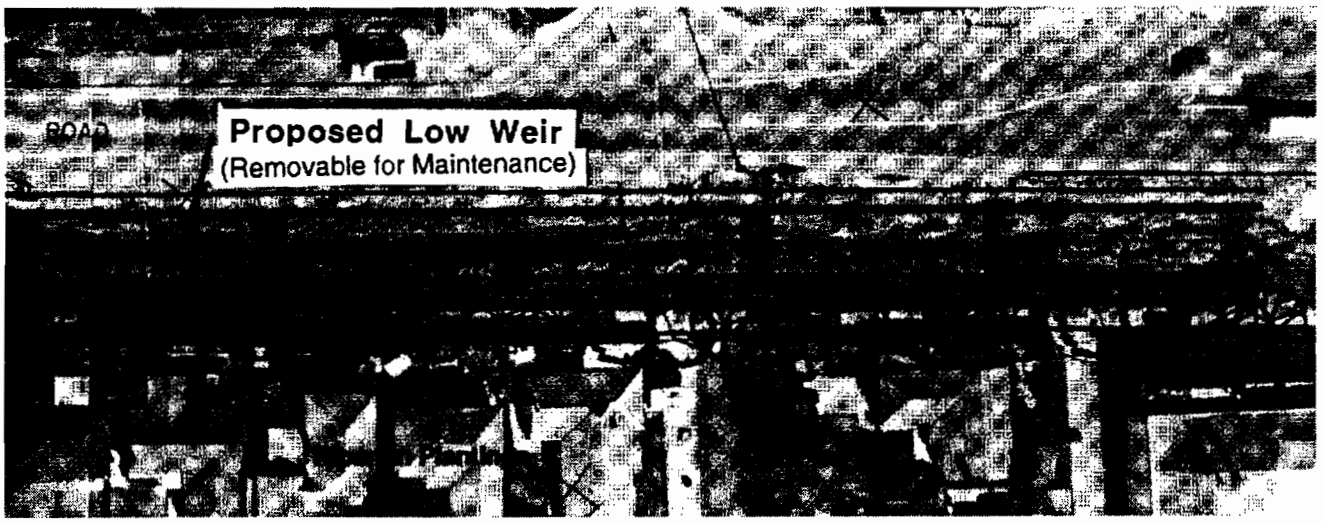


Figure 7. Transect location Reach 2

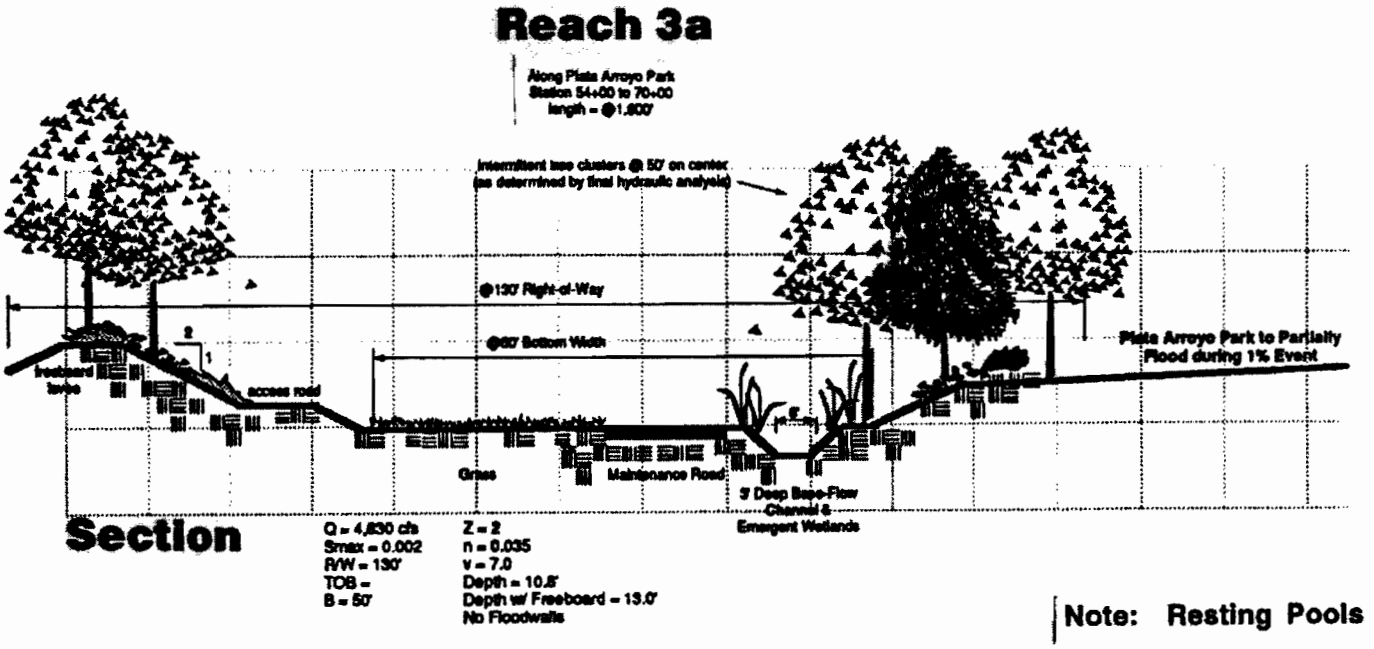


Figure 8. Transect location Reach 3a

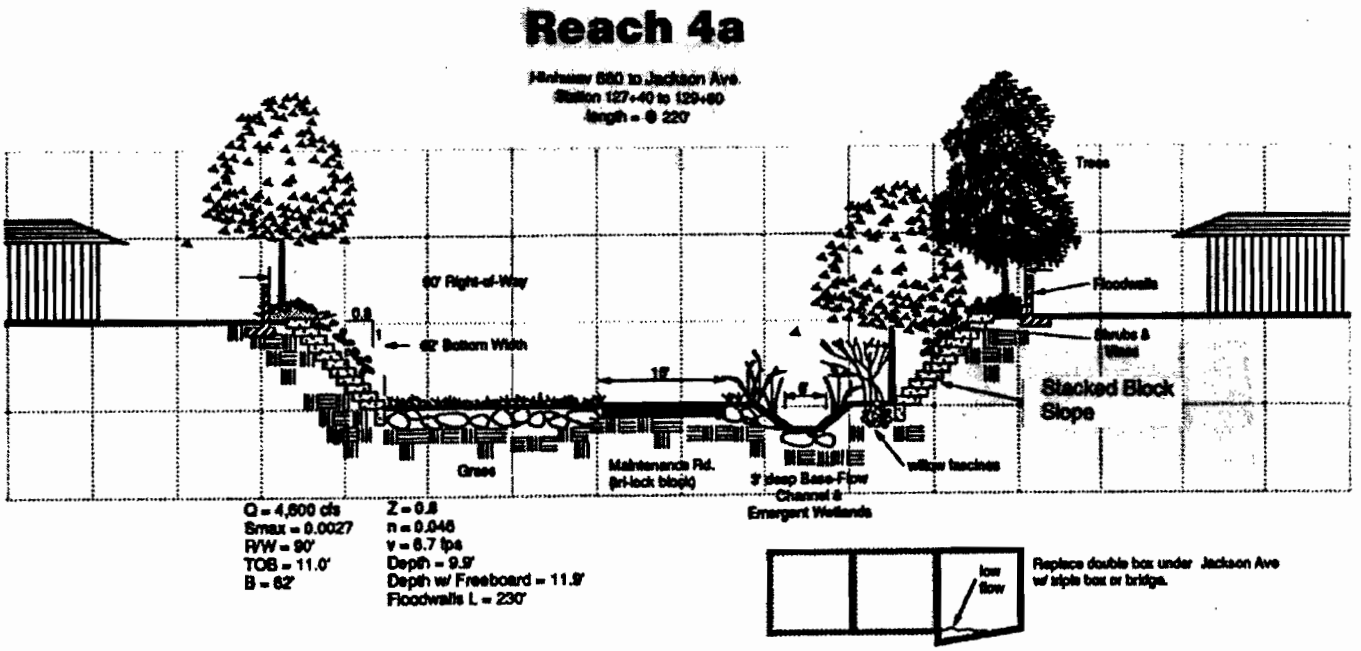
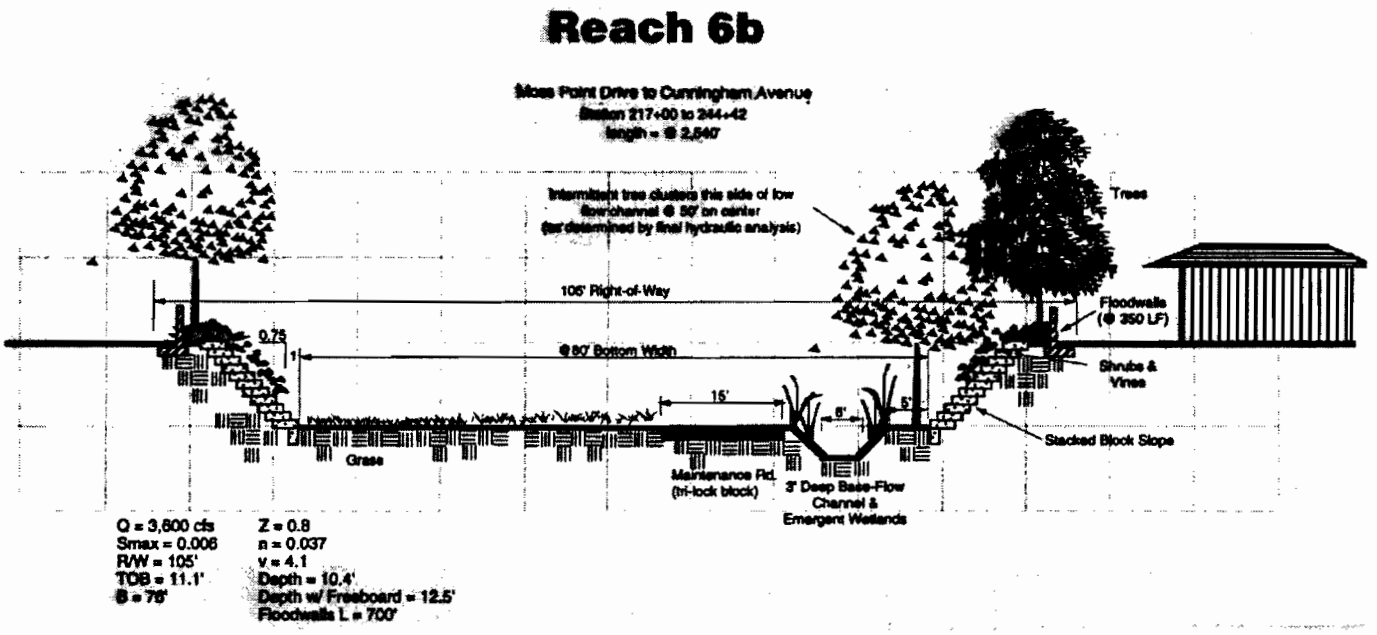


Figure 10. Transect location Reach 4a



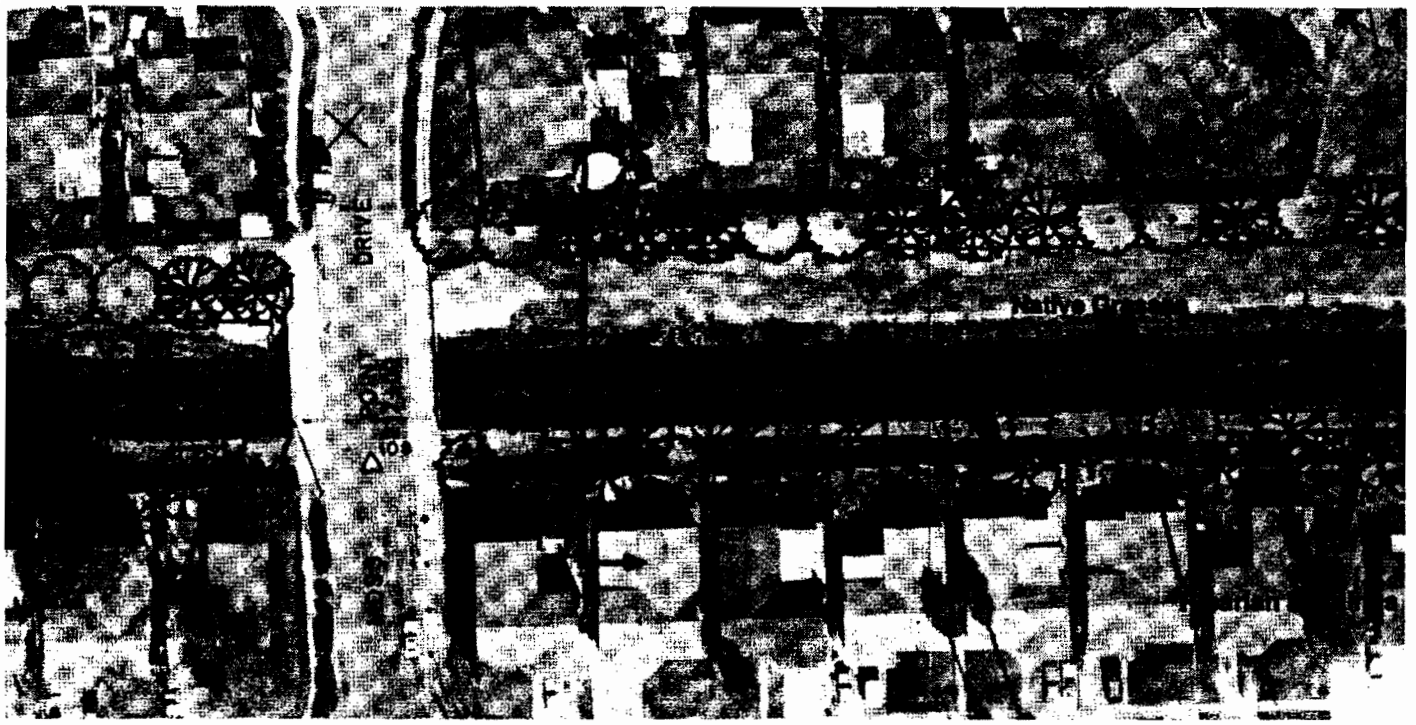
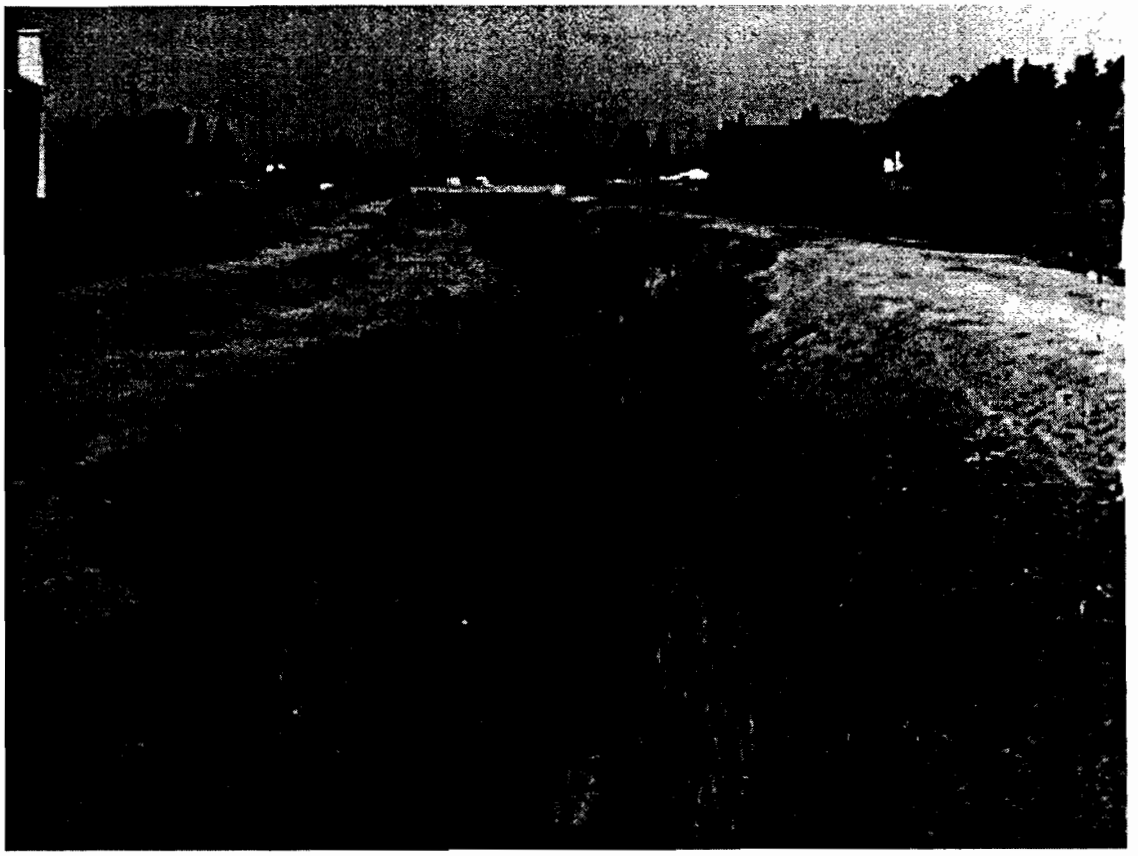
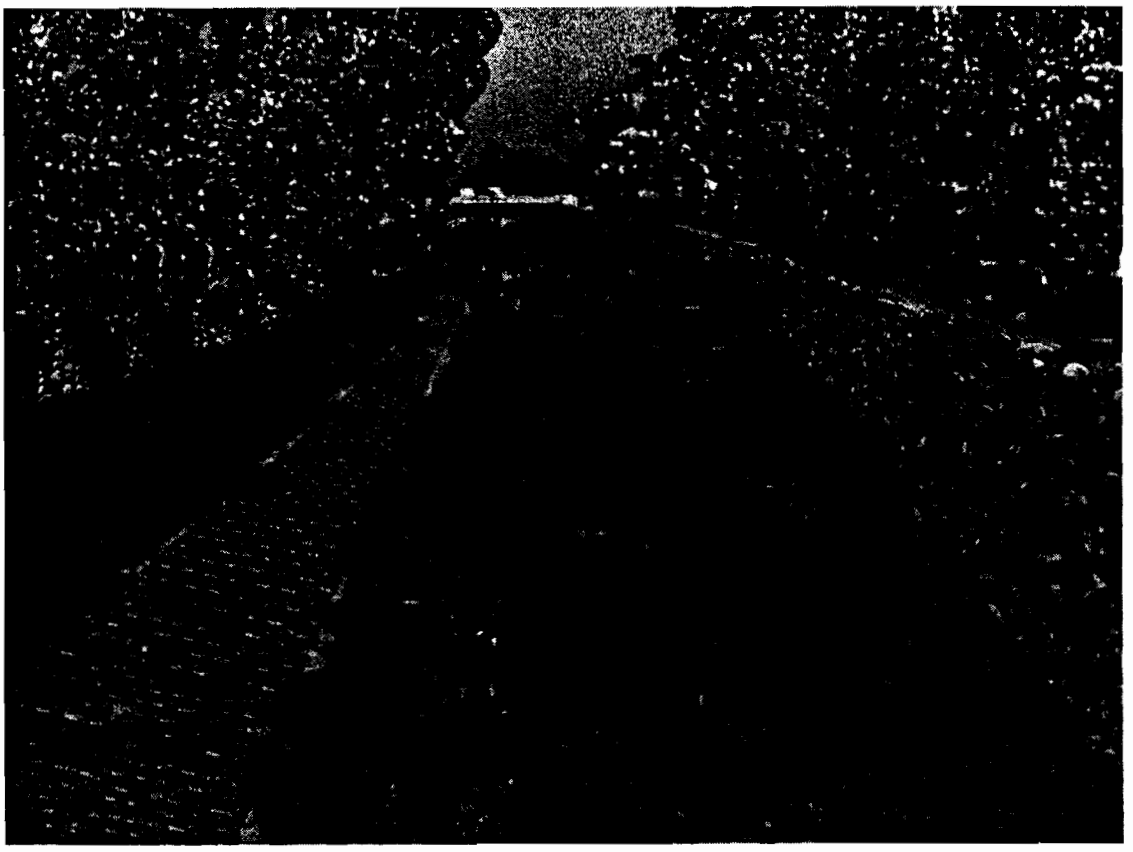


Figure 12. Transect location Reach 6b

Figure 13.
Existing View:
Reach 6b, Looking downstream from Cunningham Ave.



Proposed Construction:
Reach 6b, Computer simulation of hybrid block walls, low flow channel and planted riparian habitat. Maintenance road on flexible block pavers in invert, low flow shaded by riparian vegetation. Emergent wetlands along sides of low flow channel. Resting pools and riffles installed in low flow channel.



Long-Term Monitoring Methods:

Long-term monitoring of the revegetation sites will occur for the life of the project (100 years) in order to establish and document a general trend towards reaching a self-sustaining system. Long-term monitoring for vegetation will begin in year 10, repeat in year 15, and then every 10th year until year 100. Long-term monitoring for wildlife will be conducted at 5-year intervals for 15 years, and then every 10 years, for the duration of the project life. Reports are to be submitted for agency review in December of each monitoring year.

Between years 5 through 9, and in subsequent years of no scheduled monitoring, annual site assessments will be conducted. During these annual site assessments, the general site condition will be recorded and the need for additional maintenance will be determined. If site conditions during a nondata collecting year appear to warrant investigation, an additional year of monitoring may be conducted. In year 8, a qualitative evaluation will be conducted to assess whether the sites are likely to meet the long-term success criteria.

Long-term vegetation monitoring will consist of measuring percent canopy cover and will be conducted in the same manner as described for the short-term monitoring program above but on a less frequent basis.

Wildlife monitoring will include sampling bird populations in comparably sized plots of existing riparian habitat. Standardized observational techniques (point counts) will assess the more common and easily observed species, while capture/recapture program (standardized mist netting) will provide data on more secretive species. In addition, a breeding bird census and mammal, reptile and amphibian sampling will be conducted.

Annual Reports

Reports of monitoring results will be submitted annually. The reports will include the names of monitoring personnel, a copy of the Corps permit and special conditions and modifications, analysis of monitoring data, photographs from all specified photopoints, maps or plans of monitoring areas and copies of field data sheets.

The Santa Clara County Water District and the Natural Resources Conservation Service will jointly inspect the project for conformance to the original goals and objectives annually. Any deficiencies will be noted and a plan prepared for remedial action.

Mitigation and monitoring reports for the Lower Silver Creek mitigation will be prepared in May of each year for the first five years and then in year seven with a final report in year ten. Special reports will be prepared for any unforeseen occurrence or for any repair or replacement necessary to bring the mitigation areas to targeted success criteria.

Completion of Monitoring Period and Final Report

When the initial monitoring period is complete and after it is demonstrated that the final success criteria has been met, the sponsor will submit a final report and new jurisdictional wetland delineation to the US Army Corps of Engineers for approval. A site visit to be attended by the Corps and the project sponsors will then be arranged.

Contingency Measures
As stated in the Operation and Maintenance handbook for this project, the sponsors are obligated to insure the integrity and success of the mitigation areas. If the mitigation performance is not met during any annual period as identified during the annual inspections a deficiency report is written and a repair plan is prepared and implemented.

Remedial Action
Should the revegetation plan fail to meet the established success criteria, corrective measures will be undertaken based on the determination of the causes of mortality. Contingency measures will generally consist of review of the monitoring, study of possible contributing factors, adjustment of those factors , and replacement of the lost plantings.

A report discussing the additional studies conducted, the results of the analyses of contributing factors, and outlining remediation measures and proposed revegetation measures will be prepared and submitted to the Corps, USFWS, NMFS, and CDFG for approval prior to implementation of the proposed new plantings or remediation action.

Funding Mechanism
Any required contingency actions will be funded by the same mechanism used to fund the mitigation installation. This funding consists of existing revenues from property tax allocation and flood control benefit assessments, and debt financing by way of certificates of participation or other borrowing mechanisms.

Responsible Parties
The responsible party for contingency actions is the Director of the Environmental Section, Project Development Branch of the Santa Clara Valley Water District. This office is located at 5750 Almaden Expressway, San Jose, California 95118-3686.

Fishery Mitigation

The 1998 Recommended Plan includes numerous features to mitigate the damages that channel and habitat modification have caused the Lower Silver fishery. Measures will be taken to reverse the decline in the existing urban fishery and reduce Lower Silver Creek's turbidity and water temperature.

Fishery mitigation and enhancement is now incorporated into the 1998 plan. Low flow channels will be continuous from Coyote Creek to Lake Cunningham. Riparian vegetation will be planted to shade low flow channels. Resting pools and riffles and other instream shelters will be installed in the channel invert. Santa Clara Valley Water District will install fish ladders on the existing Quimby Road drop structure.

Proposed Fishery Enhancement Plan:
The Guadalupe - Coyote Resource Conservation District is preparing to lead a fishery assessment and enhancement plan. The GCRCD has agreed to seek grants and other assistance to implement additional fishery enhancement features in the watershed. The items that the GCRCD is investigating to improve the fishery include:

- Consult with the CA Dept. of Fish and Game to develop fishery enhancement measures that support steelhead migration in the watershed.
- Excavation of spawning sites and pools above the Thompson Creek drop structures
- Stirring and cleaning of gravel beds
- Install and maintain rearing pools and riparian habitat in upper watershed
- Citizen monitoring program to determine water quality and ongoing fishery needs
- Use Proposition 70 and 99 funds towards fishery restoration and operation
- Post signs and promote public awareness of fishery issues
- Continue implementing upper watershed Best Management Practices

Literature Cited

Santa Clara Valley Water District. July 1994, Coyote Creek Reach 3 Mitigation and Monitoring Program, San Jose, CA.

U.S. Army Corps of Engineers, San Francisco District. October 1991, Habitat Mitigation and Monitoring Proposal Guidelines, San Francisco, CA.

USDA Natural Resources Conservation Service, December 1998, Lower Silver Creek Watershed Project, Section 404(B)1 Alternatives Analysis and Plan Update, Davis, CA

USDA Natural Resources Conservation Service, July 1998, Lower Silver Creek Watershed Project, Identification of Waters of the U.S. Jurisdictional Delineation, Davis, CA

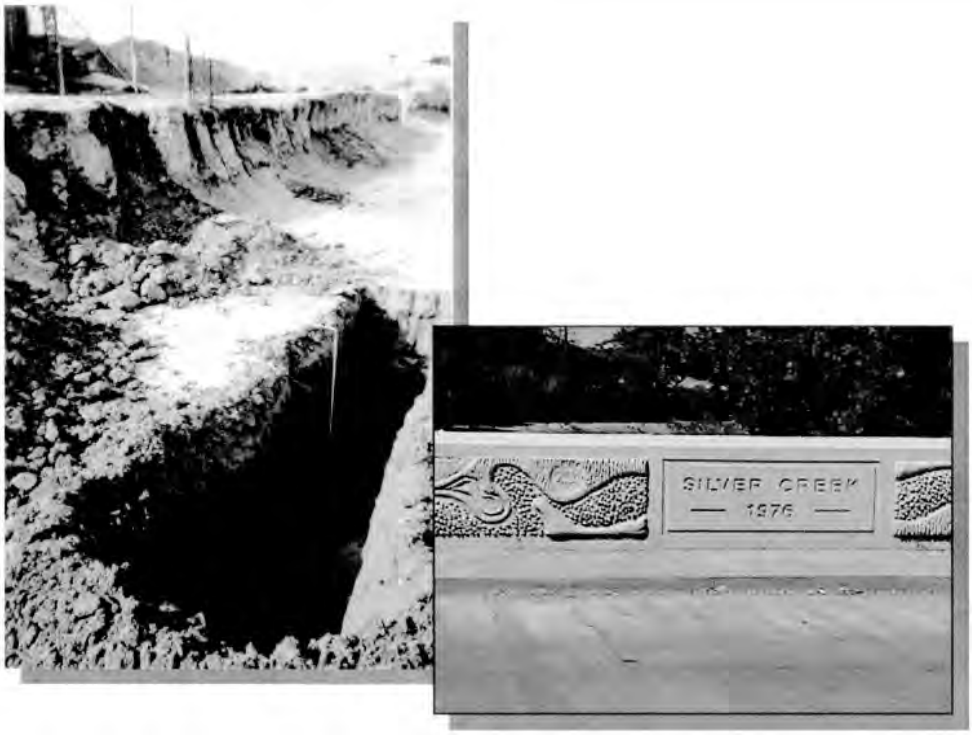
APPENDIX 3A-23

REVEGETATION REPORT

Santa Clara Valley Water District

Lower Silver Creek Flood Protection Project

Reaches 5 and 6



Revegetation Report

PARSONS

REVEGETATION REPORT

INTRODUCTION

Site Description

This revegetation report and amended conceptual (30%) design, and planting plan, concerns lower Silver Creek, Reaches 5 and 6. The focus of the present report is to amend the existing Natural Resources Conservation Service (NRCS) conceptual mitigation plan to restore riparian woodland and to enhance emergent wetlands (USDA, NRCS; 1999). This modification is the 30% (conceptual) design needed to establish suitable vegetation on edaphically hostile and erosive banks of a historically excavated channel.

As an option, ideas are presented that may map a way to improve fisheries habitat within the Santa Clara Valley Water District's (SCVWD) right-of-way (ROW). Reaches 5 and 6 are located in eastern San Jose on the realigned portion of Silver Creek between Cunningham Avenue and the confluence of the main stem with North Babb Creek, 7,000 feet downstream of Cunningham Avenue and Lake Cunningham.

These two reaches are located in Township 7 South, Range 1 East, Mount Diablo Meridian on the San Jose East USGS quad (USGS 1961 [photorevised 1980]). The National Wetlands Inventory for that quad (NWI 1994 [based on 1985 aerial photography]) shows the creek at that time to be an excavated, intermittent, riverine streambed with a seasonally flooded water regime. This classification is consistent with the fact that Reaches 5 and 6 were not part of the historic alluvial channel of Silver Creek, and were excavated in uplands to convey floodflow.

The project *Soils Report* which is equivalent to the "Soils Technical Memorandum", of the original request for proposals exists as a separate Appendix document. Parsons chose to treat our year 2000 study of site soils as a separate document, due in large part, to the far-reaching regulatory, engineering, and financial consequences of its results, namely:

- Most of the historically, excavated channel of Silver Creek Reach 6, upstream of its confluence with South Babb Creek, contains subsoils unsuitable for plant growth and development, including;
  - hostile, ultramafic, edaphic environments possessing severe calcium imbalances,
  - high pH (up to pH 9.1),
  - high magnesium, boron, and sodium content.
- The channel may need to be graded or excavated even deeper than engineered for 100-year flows, to permit the importation of an indeterminate number of cubic yards of topsoil, organic matter, and chemicals such as gypsum and sulfur, to plantable surfaces, and to place the gabions and foundations.

- There is little or no opportunity for the establishment of riparian woodland or scrub in Reach 6 (the principal result of expensive soil amendments and special plantings would be a non-riparian, serpentine bunchgrass and chaparral association).

Our goals, constrained by soils problems identified in the report and by substitution of gabions in place of channel block, deviate *significantly* from the conceptual restoration plans developed by the NRCS presented in the *Lower Silver Creek Project Santa Clara County California Mitigation and Monitoring Program* (USDA, NRCS; 1999). Therefore, interagency consensus should be achieved among the stakeholders, including the CDFG, National Marine Fisheries Service (NMFS), NRCS, Regional Water Quality Control Board (RWQCB), Department of the Army, Corps of Engineers (USACOE), and United States Fish & Wildlife Service (USFWS), to take into account departures from the NRCS conceptual design.

Figure 1, modified from our soils report (Parsons 2001), illustrates the likely end result of the restoration of the excavated channel of Reach 6, even after the importation of many cubic yards of topsoil, organic matter, and chemicals to the plantable surfaces.

CONSTRUCTION CONSIDERATIONS

Project-Wide Construction Practicalities

Habitat restoration on a large scale requires considerable advance planning not only from the standpoint of regulatory process and permit approvals, but also from a practical point of view. Parsons has not yet finalized the sequence of construction tasks. Some suggestions are presented for discussion. For example, following the dewatering and grading of short segments of the channel, revegetation of the sediment transport channel to create a palustrine, emergent wetland should be accomplished. This is the first step in revegetation, and must be accomplished with a valid CDFG 1601 Streambed Alteration Agreement, USACOE Section 404 Individual Permit, and RWQCB Section 401 Certification, to be amended to include the Parsons approach outlined in the next section. Construction should occur during the dry season to increase the efficiency of equipment, protect the safety of laborers and operators, to give plantings time to grow under ideal conditions, and to reduce total suspended solids of the channel.

For most of Reach 6 all graded material must be trucked away since the subsoil is completely unsuitable for plant growth and development. The SCVWD must secure an approved soil and rock disposal site, preferably nearby, that will require its own habitat restoration plan.

The soils report revealed interleaved high clay and coarse loam or sand containing layers especially near the ancient Babb Creek alluvial fan, but also includes most portions of both reaches (Geotechnical Consultants, Inc. 2001). Soils layer-caked in this way are most susceptible to compaction by grading equipment. Compacted soil particles often retard root growth of expensive plantings and inhibit hydration of the soil surfaces and root hairs. It is also important that heavy equipment be kept away from planting

locations where topsoil, greenwaste humus and gypsum have been introduced over the graded surface, or where planting wells have been prepared with soil amendments. This is to avoid either compaction of expensive soil amendments, or dispersal of them away from the planting locations.

Following the excavation of the sediment transport channel, construction of the maintenance roadbed (to include construction of the finished, graveled surface) on the 20-foot wide floor of the high flow channel could take place. This activity would also include importation of an indeterminate volume of suitable topsoil, mixed with soil amendments, and placement of that medium on the planting surfaces in the high flow channel area, but only at precise planting locations. Underground plumbing and electrical lines could be installed at this time on the sides and top of the high flow channel in concert with floodwall design.

Once the plantable soil, drain trenches, and irrigation lines are installed, the high flow channel will be ready for the installation of floodwalls, gabions and planting wells together with nursery stock according to landscape specifications. Security fencing would be installed at this time, together with upland plantings at the upper lip of the high flow channel, around the floodwall foundations, and to screen the floodwalls and access road ramps.

The final step to be completed before the onset of winter rains, would be installation of seed, and perennial grass plugs, and shrub stock on the sides and floor of the high flow channel and, on either side of the maintenance road.

Wetland Establishment

Three types of wetland will be created: an extensive emergent wetland in the sediment transport channel having year-round wetland hydrology, palustrine shrub-scrub wetland clumps bioengineered into the rip-rap slope of the maintenance road, and seasonally wet meadow/seepage slope planters with hydrophytic grasses being the dominant species. Successful establishment of these three plant community types will require differing approaches since the hydrologic conditions that must be created for wetland establishment differ in two of these cases (palustrine and seasonal types).

For example, the reducing environment created by year-round water saturation of an ultramafic, clay matrix will require establishment of a microflora and fauna before hydrophytes such as bulrushes and sedge will flourish. Therefore, microbial inoculation using imported swamp mud is proposed. As each segment of the creek is dewatered prior to grading and graded and/or excavated, microbial inoculation and planting will occur.

Sediment Transport Channel

The construction contractor must closely work with the revegetation contractor in order to make the plan work. Over a two-week period the following events take place, in proper sequence, for successful establishment of wetland:

- Coffer dam installation and dewatering of the segment to be reconstructed,
- Excavation and removal of sediment,
- Grading to finished surfaces,
- Installation of three-foot deep cores on four-foot centers on the floor of the sediment transport channel,
- Inoculation of each core with freshly excavated swamp mud imported from offsite,
- Capping of each core with a bentonite clay "lid", and staking and flagging of each capped hole,
- Introduction of soil amendments in container stock planting and live stake holes of the rip-rap slope of the maintenance road edge,
- Planting of the staked and flagged, capped core-holes with transplanted wetland plants,
- Removal of coffer dams and rewatering,
- Repeat above procedures, through to the end of the project reach.

It is critical that the inoculant swamp mud is **NOT** left to dry in the air and that each core hole inoculated, is capped with clay to retard infiltration of air. This protocol will ensure that the purple, sulfur reducing bacteria, protozooans, and fungi indigenous to the chemically reducing mud of the source wetland do not die upon exposure to the chemically oxidizing air. The source wetland will be a swamp located offsite, well away from the ultramafic soils of the site. Construction should proceed from the lower end of the project, upstream.

The binomial "swamp mud" will meet Parsons's specifications. It must come from a local, freshwater source, possibly from an ongoing SCVWD sediment removal project, and must consist of:

- Sediment that has been in a reducing environment for at least two decades;
- Must not contain ultramafic or other contaminated sediments;
- Should contain rhizomes of local tules and water plants.
- Should show evidence of gleization to include:
  - Fine texture;
  - Low chroma;
  - Presence of purple sulfur bacteria.

Staking and flagging of each inoculated and capped core-hole is important to prevent physical injury to the revegetation contractor's team of laborers. The revegetation contractor will install transplants of prescribed species from the planting palette on top of each staked and flagged, inoculated, core-hole.

The final step of the sediment transport channel restoration will be the importation of boulders, cobbles, and gravels suitable for temporary control of low flow erosion and to create microenvironments for possible colonization by aquatic organisms from upstream sources. At the same time, the toe of slope adjacent to the sediment transport channel will be planted with live stakes and container stock according to specifications. Once a

construction segment of the sediment transport channel is planted in this way, the cofferdam upstream may be breached to allow normal low flow. The process is repeated until the reach under contract has been reconstructed.

PLANTING PLAN

Gabion Design

The SCVWD is apparently shifting away from the NRCS channel block concept which was presented to the stakeholders in a series of regulatory documents (NRCS, 1999). A keystone-style channel block engineering design has been suggested for most of Reaches 5 and 6 (Keystone Retaining Wall Systems, Inc. 1998). However, gabions are now being considered: these may include box gabions, sack gabions, and/or Reno mattresses (Maccaferri Products, 2000). There are two types of gabions recommended by Parsons: box gabions, and Reno mattresses (Figure 2). Due to the relative thickness of gabion rock in each of the two types (Reno mattresses have only a thin layer of rock), we recommend that Reno mattresses be placed in arrays, protected by the more substantial box gabions (Figure 2).

Seasonally Wet Meadow Side-slope Seep Gabion Planters

Parsons proposes to create seasonally wet meadow seeps at the lower end drainage points of gabion planters of the side-slopes (Figure 2). The principal native species to be installed will be slender hairgrass (*Deschampsia caespitosa, Juncus balticus,* and *Juncus xiphioides*). Alkali wild rye (*Leymus triticoides*) would be used together with the gabion design for bank support. All three species will be propagated as living plugs or live bare-root plants (one to two-year old stock) for installation through the wire holes of the Reno mattress gabions. Plugs and one gallon nursery grown stock of native vines and small shrubs will also be used to vegetate the Reno mattress gabions above the wetter weep points. Brush thickets will be designed to be placed within Reno mattress gabion planters on the better drained upper portions of Reno mattress arrays (Figure 2).

Riparian Woodland of Side-slope Gabion Planters

Severe calcium imbalance, high pH, and high magnesium of much of Reach 6 substrates, and the local semi-arid conditions, will make establishment of woody vegetation extremely difficult even following soil amendments and irrigation protocols. For example, the entire historically excavated segment of Reach 6 to be restored is presently underlain by alkaline and ultramafic; heavy, fine-textured clay subsoils toxic for most plant growth and development. The type of "riparian" to be established here, would more resemble a wet meadow interspersed with brush thickets and rimmed by gabions planters colonized by brush species.

But along Reach 5 the soil problems are not as severe as the excavated channel of Reach 6. In order to establish thickets of vegetation in either reach, each planting hole or basin and their immediate environs, will require these physical modifications:

- Excavation of each hole or planting basin to at least ten times the volume of the container stock to be installed underneath each Reno mattress array (Figure 2);
- Excavation of a drain trench to be filled with gravel, for each hole or planting basin to allow for water drainage from the bottom of holes/basins out to the channel edge;
- Placement of the block gabions and Reno mattress gabions around each hole and over each planting basin, and over each drain trench (Figure 2);
- Preparation of amended soil for planting to increase organic matter, fertility, and decrease alkalinity (riparian vegetation establishment will be difficult despite extensive soil amendments due to severe soil conditions);
- Installation of container stock;
- Plumbing for drip irrigation;
- Installation of weed mat between planting basins.

Woodland to be created will exhibit biodiversity and stratification. The only four trees along reach 5 to be saved are large black walnuts (*Juglans californica* var. *hindsii*), probably sprouts from burls of old orchard stock. These will form the canopy layer of the future riparian woodland to be established along Reach 5.

The second stratum will consist of planted container stock of California sycamore (*Platanus occidentalis*), black cottonwood (*Populus balsamifera*), Fremont cottonwood (*Populus fremontii*), white alder (*Alnus rhomboidea*), Oregon ash (*Fraxinus latifolia*), red willow (*Salix laevigata*), Pacific willow (*Salix lasiolepis*), California buckeye (*Aesculus californica*), supplemented with deepots of Valley oak (*Quercus lobata*), blue oak (*Quercus douglasii*) and coast live oak (*Quercus agrifolia*).

Limited thickets of shrubs and vines are envisioned to be established by one and five-gallon plantings of several species from the planting palette within the confines of Reno mattress gabion arrays (Figure 2). In some cases, the shrubs will be planted together with the trees to form the stratified woodland. On the other hand, shrubs will be planted together to form thickets as cover for wildlife, or to minimize human intrusion.

Serpentine Chaparral and Bunchgrass of Gabion Side-slope Planters

The historic excavated channel of Reach 6 will require extraordinary measures to get plants established. In many areas, presently barren even after nearly thirty years since the original excavation, only grasses and forbs may become established. In view of harsh soil conditions and engineering considerations, Parsons suggests a gabion planter design to use arrays of Reno mattress gabion planters protected by block gabions for the sideslopes of the high flow channel (Figure 2).

Almost all of Reach 6 from South Babb Creek upstream to Cunningham Road will need an indeterminate volume of topsoil (from, tested, non-serpentine sources), and organic matter (Zanker or BFI wood-waste), nitrogen-containing fertilizers, phosphates, potassium sulfates, sulfur, and gypsum imported to the gabion planter locations.

Considerable expense and effort is needed to apply soil amendments along Reach 6 between the Ocala Avenue and Moss Point Drive bridges, and for at least 500 feet on either side of each bridge. The habitat restoration effort will require liberal amounts of nitrogen-containing fertilizer, 8 lbs. of treble superphosphate, 12 lbs. of potassium sulfate, 33 lbs. of sulfur, and up to 140 lbs. of gypsum to be applied per every 1000 sq. ft of planting surface (i.e. planter surface). Fewer amendments would be required in other areas within Reaches 5.

The planting palette listed in the NRCS documents must be amended to include upland species adapted to serpentine soils and alkaline clays (Kruckeberg 1984). Suggested species are serpentine endemic varieties of flannelbush (*Fremontodendron californica* ssp. *obispoensis*) and the local endemic Ferris' ceanothus (*Ceanothus ferrisae*).

So-called "bodenvag" species (species that grow on both serpentine and non-serpentine substrates) will be used (Kruckeberg, 1984). These include a planting palette of annual wildflowers, grasses and forbs and native perennial grasses and subshrubs.

In addition, attention must be paid to the placement of serpentine adapted, brush species immediately adjacent to residential properties. The chaparral plant communities that may grow after many years will accumulate fuel and eventually become a fire hazard, if not managed properly. Ideally, the chaparral plantings should be confined to gabion planters to be set on the upper sides of the trapezoidal high flow channel to allow for periodic controlled burning or trimming (Figure 2). Therefore, it is essential that mowable, grassed firebreaks, be established at the rear of residential and commercial lots to prevent wildfire, and to offer points of physical ingress and egress by firefighters control wildfire, if outbreaks occur.

Comprehensive Planting Palette (Species List for All Habitats to be Created)

It was necessary to modify the NRCS suggested planting palette to accomplish several goals:

- To include plants adapted to ultramafic soils having extreme chemistry (severe calcium imbalances, high pH and high magnesium)
- To increase biodiversity within the limits set by the soil chemistry;
- To allow for maintenance of the channel as a flood conveyance utility;
- To take into account the high clay and magnesium content of the reach soils;
- To provide habitat for wildlife, specifically:
  - Shading of aquatic habitat and the fishery to be restored,
  - Food for mammals and birds,
  - Cover for all forms of wildlife,
- To create conditions for the eventual establishment of special status species.
- To design plant communities in concert with local fire protection policy, and to facilitate management by the SCVWD ranger staff.

The NRCS plan and the SCVWD aesthetic guidelines (SCVWD 2000) take into account the above factors. We restate them to convince the reader that the planting palette modifications in Table 1 remain consistent with the original goals of habitat restoration. Parsons compiled its planting palette from the Jepson Manual (Hickman, 1993), the approved SCVWD list (including reinstatement of several species thrown-out by the SCVWD), and from native plant nursery contract grower catalogs. The Parsons botanist was well aware of the source of the original SCVWD plant list having been employed in the last decade by the two environmental consulting companies that produced the list more than twenty years ago.

Table 1

Finalized Planting Palette (Species List)

Species[1,2,3]	Common Name	Planting Position on the cross-section[3]	Fully Grown Position in the Plant Community to be Created	Suitability for Clay, High Magnesium, and Drought
Acer negundo var. *californicum*	Box elder	TS/MS	Mid-story	No/No/Yes
Aesculus californica	California buckeye	MS/TS	Mid-story	Yes/No/Yes
Artemisia californica	California sagebrush	MS/TS	Understory	?/?/Yes
Artemisia douglasiana	Mugwort	MS-RM	Understory	?/?/Yes
Aster chilensis	Aster	GS/MS-RM	Understory	?/?/Yes
Atriplex lentiformis	Big saltbush	GS/MB/HF TB-RM	Mid-story	Yes/No/Yes
Baccharis douglasii	Douglas baccharis	LF/RD/HF TS-RM	Understory	?/?/No
Baccharis pilularis	Coyote bush	TB	Understory	Yes/No/Yes
Baccharis salicifolius	Mule fat	CI/LF	Understory	Yes/No/Yes
Bromus carinatus	California brome	GS-RM	Understory	?/?/Yes
Ceanothus ferrisae[2]	Ferris' buckbrush	GS/MB/TB	Mid-story	Yes/Yes/Yes
Cercis occidentalis[3]	Western redbud	MB/TB	Mid-story	?/?/Yes
Dendromecon rigida[3]	Bush poppy	MB/TB	Mid-story	?/?/Yes
Deschampsia caespitosa	Caespitose hairgrass	LF/RD/HF TS-RM	Understory	?/?/No
Deschampsia danthonioides	Slender hairgrass	LF/RD/HF TS-RM	Understory	?/?/No
Epilobium canum	California fuschia	MB/TS-RM	Understory	?/?/No
Eschscholtzia californica[3]	California poppy	MB/TB-RM	Understory	?/?/Yes
Festuca californica[3]	California fescue	TS/GS/MB-RM	Understory	?/?/Yes
Fremontodendron californicum ssp. *obispoense*[1]	San Luis Obispo flannel bush	TB/GS/MB	Mid-story	Yes/Yes/Yes
Heteromeles arbutifolia	Toyon	MB/TS	Understory	?/?/No
Holodiscus discolor[3]	Ocean spray	TB	Mid-story	?/?/No
Hordeum brachyantherum[3]	Meadow barley	LF/HF/TS-RM	Understory	?/?/No

Species[1,2,3]	Common Name	Planting Position on the cross-section[3]	Fully Grown Position in the Plant Community to be Created	Suitability for Clay, High Magnesium, and Drought
Juncus balticus[3]	Baltic rush	LF/RD/HF TS-RM	Understory	Yes/Yes/No
Juncus xiphioides[3]	Iris-leaved rush	CI/HF/LF-RM	Understory	?/?/No
Leymus triticoides	Alkali wild rye	LF/RD/HF/ TS-RM	Understory	Yes/Yes/Yes
Nassella lepida	Foothill needlegrass	GS/MB/TS-RM	Understory	?/?/Yes
Nassella pulchra	Purple needlegrass	GS/MB/TS-RM	Understory	?/?/Yes
Platanus occidentalis	Western sycamore	MS	Overstory	?/?/No
Populus fremontii	Fremont cottonwood	MS	Overstory	Yes/No/No
Prunus ilicifolia	Holly-leaf cherry	MS/TS	Mid-story	?/?/Yes
Quercus agrifolia	Coast live oak	TB	Overstory	Yes/No/Yes
Quercus douglasii	Blue oak	TB	Overstory	Yes/No/Yes
Quercus lobata	Valley oak	TB	Overstory	Yes/No/Yes
Rhamnus californica[3]	Coffeeberry	TB	Mid-story	?/?/Yes
Ribes divaricatum	Straggly gooseberry	TS-RM	Mid-story	?/?/No
Rosa californica[3]	California wild rose	GS/MB/TS-RM	Mid-story	Yes/No/Yes
Rubus ursinus	Creeping blackberry	GS/MB/TS-RM	Understory	?/?/No
Sambucus mexicana	Mexican elderberry	GS/MB/TS	Mid-story	Yes/No/Yes
Salix exigua	Arroyo willow	CI/LF	Mid-story	?/?/No
Salix laevigata	Red willow	LF/TS	Overstory	Yes/Yes/No
Salix lasiolepis	Pacific willow	LF/TS	Overstory	?/?/No
Satureja douglasii	Yerba buena	GS/MB/TB-RM	Understory	?/?/Yes
Scirpus californica	California bulrush	CI/LF-RM	Understory	Yes/Yes/No
Symphoricarpos albus	Snowberry	MB/TB-RM	Mid-story	Yes/No/Yes
Symphoricarpos mollis	Creeping snowberry	MB/TB-RM	Understory	Yes/No/Yes
Toxicodendron diversilobum[3]	Poison oak	MB/TB	Mid-story	Yes/No/Yes
Umbellularia californica	California bay	TB	Overstory	?/?/Yes

1 = Species with local or regional preference for ultramafic soil substrates in California according to Kruckeberg (1984).
2 = Serpentine endemic species with the highest fidelity to grow on ultrabasic substrates according to Kruckeberg (1984).
3 = Bodenvag plant species, taxa indifferent to serpentine substrates confirmed by Kruckeberg (1984) and/or Franklin & Dyrness 1973.

CI = sediment transport channel invert, GS = gabion slope, HF = high flow invert channel invert, LF = earthen banks of sediment transport channel, MB = mid-bank, RD = maintenance road edge, RM = Reno mattress compatible, TB = top-of-bank, TS = toe-of-slope of high flow channel

Planting Stock

In order to plan for installation and bid for the job, growers, suppliers, and installers will propagate and prepare the desired form of the plant material to be delivered to the site and installed. It is also critical that the form and condition of the plant material grown and purchased be compatible with conditions at the time of installation including time of year, drip irrigation regimes, presence of Reno mattresses, weed mat and so forth. The conventions to be shown in the 60% design are:

- Seed and hydroseed
- Plugs and plug trays (not illustrated)
- Deepots
- Treebands (not illustrated)
- Treepots
- Two-inch pots (not illustrated)
- Conetainers
- Supercells (not illustrated)
- One, five, and 15-gallon (not illustrated) container nursery grown stock
- Root balls (salvaged from another SCVWD project; not illustrated)
- Cuttings (long-enough for 2-foot deep planting for willows and 3-foot deep for cottonwoods; not illustrated)
- Bound willow fascia (live stakes, several feet in length; not illustrated)
- Transplants (not illustrated)

Considerations of Plant Propagation, Construction Timing, and Planting

For the revegetation of Silver Creek, Reach 5 & 6 to succeed, key milestones must be reached. These are:

- Many of the plants prescribed in the present report, will require two or three-year's growth from seed or cutting, before they are suitable for installation on the prepared surface.
- The SCVWD will need accurate projections of plants to be propagated on the plantable surfaces.
- Permits for alteration of the streambed below top-of-bank, should be amended as needed, to complement any possible change to the NRCS conceptual design.
- The present CDFG 1601, RWQCB 401 Certification, and federal permits do not take into account the details of the Parsons approach.
- Permits must be amended to take into account coring of the streambed for mass microbial inoculation.
- Landscape installations will require specifications unique to solve the soils problems associated with ultramafic subsoils.
- The SCVWD aesthetics guidelines must be interleaved with the landscape design.

- Construction must occur in phases, closely in tune with seasonal channel flow, requirements to export and import thousands of tons of gabion rock, soil, plumb the landscape for irrigation, install gabion wire baskets and floodwalls, and prepare sites for landscape installation.
- Parsons suggests SCVWD plant list specifications be waived so that four walnut trees on the creek bank just below Murtha Drive may be saved, and not cut down.
- These trees and the soil below the drip line, and any sensitive wetland areas to be left undisturbed must be encircled with bright, orange exclusion fencing so that heavy equipment will avoid them.

Projected Costs

Parsons has provided the projected unit cost for the plant materials suggested for installation (Table 2). It is very important that the right contract grower is chosen to propagate the plants needed for restoration. Commercial Silicon Valley firms are often poorly qualified to grow native plant materials suitable for restoration since their main business is to grow non-native landscape species.

Habitat restoration requires specialists, not novice "low-ball-type vendors" who will provide inadequate materials on the fringes of required specifications. Parsons therefore suggests the commercial native plant nurseries listed in the next section, for Silver Creek Reaches 5 & 6.

Labor costs, haulage costs (to remove excavated, unsuitable subsoil; import concrete, rock, gravel, topsoil, woodwaste, and plants), and costs of soil amendments will be extensive. We have identified these costing categories:

- Grading & site preparation;
- Augering of planting holes;
- Backhoe operations needed to excavate planting wells and trenches;
- Subsoil removal to an approved offsite disposal site;
- Boulders, cobbles, and sand (delivered to the segment of the reach to be restored);
- Gabion rock (non-serpentinite);
- Reno mattress gabions;
- Box gabions;
- Steel stakes;
- Perforated drain pipe;
- Geotextile fabric and drain rock for planters;
- Gravel, crushed rock, and geotextile fabric road base;
- Zanker or BFI woodwaste (delivered to staging/mixing areas);
- Approved topsoil (delivered to staging/mixing areas);
- Soil amendment chemicals (delivered to storage, staging/mixing areas);
- Storage shed (with security locks) for soil amendment chemicals;
- Steel drums (55 gal-size) for swamp mud inoculant;
- Plant materials;

- Weed mat;
- Labor and equipment.

Table 2

Projected Nursery Stock Needs

Species	Common Name	Form and Specifications including Propagation Source	Number of Units	Unit Cost
Acer negundo var. *californica*	Box elder	Treepots from cuttings or seed		
Aesculus californica	California buckeye	Treepots from cuttings or seed		
Artemisia californica	California sagebrush	Deepots from cuttings or achenes		
Artemisia douglasiana	Mugwort	Tree-bands or supercells from cuttings		
Aster chilensis	Aster	Deepots from cuttings or achenes		
Atriplex lentiformis	Big saltbush	Treepots from cuttings or seed		
Baccharis douglasii	Douglas baccharis	Treepots from cuttings or seed (achenes)		
Baccharis pilularis	Coyote bush	Treepots from cuttings or seed (achenes)		
Baccharis salicifolius	Mule fat	Deepots from cuttings or achenes		
Bromus carinatus	California brome	Plug trays from seed		
Ceanothus ferrisae	Ferris' buckbrush	Treepots from cuttings or seed		
Cercis occidentalis	Western redbud	Supercells from cuttings or seed		
Dendromecon rigida	Bush poppy	Supercells from cuttings or seed		
Deschampsia caespitosa	Caespitose hairgrass	Supercells from seed		
Deschampsia danthonioides	Slender hairgrass	Plug trays from seed		
Epilobium canum	California fuschia	One-year old conetainer from cuttings		
Eschscholtzia californica	California poppy	Seed in seed mix		
Festuca californica	California fescue	Supercells from seed		
Fremontodendron californicum ssp. *obispoense*	San Luis Obispo flannel bush	Treepots from cuttings or seed		

Species	Common Name	Form and Specifications including Propagation Source	Number of Units	Unit Cost
Heteromeles arbutifolia	Toyon	Treepots from cuttings or seed		
Holodiscus discolor	Ocean spray	Supercells from cuttings or seed		
Hordeum brachyantherum	Meadow barley	Plug trays or 2" pots from seed		
Juncus balticus	Baltic rush	Bareroot		
Juncus xiphioides	Iris-leaved rush	2" pots from seed		
Leymus triticoides	Alkali wild rye	Plug trays or liners from seed		
Nassella lepida	Foothill needlegrass	Plug trays or 2" pots from seed		
Nassella pulchra	Purple needlegrass	Plug trays or 2" pots from seed		
Platanus occidentalis	Western sycamore	Treepots from cuttings or seed		
Populus fremontii	Fremont cottonwood	15-gallon from cuttings or seed		
Prunus ilicifolia	Holly-leaf chary	Treepots from cuttings or seed		
Quercus agrifolia	Coast live oak	Treepots from acorns		
Quercus douglasii	Blue oak	Treepots from acorns		
Quercus lobata	Valley oak	Treepots from acorns		
Rhamnus californica	Coffeeberry	Supercells from cuttings or seed		
Ribes divaricatum	Straggly gooseberry	Treepots from cuttings or seed		
Rosa californica	California wild rose	Treepots from cuttings or seed		
Rubus ursinus	Creeping blackberry	Treepots from cuttings or seed		
Sambucus mexicana	Mexican elderberry	Treepots from cuttings		
Salix exigua	Arroyo willow	Deepots from cuttings		
Salix laevigata	Red willow	Root balls/transplants		
Salix lasiolepis	Pacific willow	Live stakes from cuttings		
Satureja douglasii	Yerba buena	One-year old Conetainer from cuttings		
Scirpus californica	California bulrush	Treepots, root balls & transplants		
Symphoricarpos albus	Snowberry	Treepots from cuttings or seed		
Symphoricarpos mollis	Creeping snowberry	One-year old Conetainer from cuttings		
Toxicodendron diversilobum	Poison oak	Root balls/transplants		
Umbellularia californica	California bay	1-gallon from cuttings or seed		

Species	Common Name	Form and Specifications including Propagation Source	Number of Units	Unit Cost
Mycorrhizal inoculum[1]	**GroPower Brand**	**Granular and pellets**		
Swamp mud	**SCVWD Sediment Removal Projects or Other Local Source**	**55 gallon drums, sealed, containing freshly excavated swamp mud and rhizomes in a water saturated state**		

Bold-typed = (1) non-plant, fungal and bacterial organic supplement nursery item available from GroPower, Inc. (see next page); and (2) excavated, wetland (swamp) mud containing naturally occurring fungi, bacteria, protozooans, invertebrates, and plant underground parts.

PLANT SOURCES AND SPECIFICATIONS

Contract Growers and Wholesale Native Plant Nurseries

Parsons suggests these California contract growers and wholesale native plant nurseries (retail native plant nurseries have been excluded from the list):

Circuit Rider Productions, Inc.
9619 Old Redwood Hwy.
Windsor, CA 95492
707 838-6641 (telephone)
707 838-4503 (FAX)
crpnursery@crpinc.org (EMAIL)
http://www.crpinc.org (WEB Page)

Elkhorn Native Plant Nursery
1957B Highway 1
Moss Landing, CA 95039
831 763-1207 (telephone)
831 763-1659 (FAX)
jpritchard@elkhornnursery.com
http://www.elkhornnursery.com

GroPower, Inc.
15065 Telephone Avenue
Chino, CA 91710
800 473-1307 (telephone)
909 393-2773 (FAX)
http://www.grolife.com

Las Pilitas Nursery
3232 Las Pilitas Road
Santa Margarita, CA 93453
805 438-5992 (telephone)
http://www.laspilitas.com

Rana Creek Habitat Restoration
35351 E. Carmel Valley Rd.
Carmel, CA 93924
831 659-3820 (telephone)
831 659-7532 (FAX)
marketing@ranacreek.com
http://www.ranacreek.com

Tree of Life Nursery
33201 Ortega Highway

P. O. Box 635
San Juan Capistrano, CA 92693
http://www.treeoflifenursery.com

The plants to be propagated by the contract growers in the form and numbers listed above should be planted as designed in concept by the Parsons habitat restoration team, and as described in the following subsections. All nursery installers and construction contractors will follow the plans and specifications by Suzman Design, Inc., with supplementary irrigation detail (supplied by Brookwater, Inc.) as they appear on full-sized, engineered plan sheets certified by the Landscape Architect.

PLANTING DETAIL

Planting should be accomplished within the Reno blanket gabion arrays outfitted with wire collars and underlain by excavated, earthen wells (scarified and trenched with drain rock), as shown conceptually in Figure 2 and 3. Only the sediment transport channel will be earthen, however, bioengineered rip-rap is proposed on the side to protect the maintenance road. It is important that each planting well is at least ten times the volume (more volume of imported, amended soil is better, than less around each plant) of the container specified for installation.

The density of planting proposed by the NRCS (NRCS, 1999) is:

- 350 trees per acre (planting basins spaced 12-feet on center, triangular spacing);
- 500 shrubs or vines per acre (planting basins spaced 10-feet on center, triangular spacing);
- 650 herb planting basins per acre (planting basins spaced 8-feet on center, triangular spacing).

Planting detail specifics, at bid-level detail, will follow the plans and specifications of Suzman Design, Inc., as they appear on the inset blocks of full-sized engineered plan sheets certified by the Landscape Architect.

Parsons engineers, the hydrologist, and the geotechnical team have determined that the high flow channel will consist principally of gabions. Planters would be designed into each sidewall type according to the concept in Figure 2.

Table 3

High Flow Channel Design: Gabion Type and Number, Reno Mattress Planter Array Frequency along the Trapezoidal Channel, and Projected Costs

Reach	Station	Lineal Feet of Design[1]	Planter Frequency N/1000 ft-sq. of gabion covered channel wall	Gabions (Number of Units)[2]	
				Reno mattresses	Box gabions
5a	25+50 to 00 +00	xx-ft BG/xx-ft RM			
5a					
5b					
5b					
6a					
6b					

1 BG = Box gabion; RM = Reno mattress gabion.
2 Gabion unit costs =

Box gabions do not make suitable substrates for trees or shrubs. Grasses and forbs will grow on them with great difficulty, as the roots must penetrate more than a foot or more of rock before reaching the foundation of the gabion. Furthermore, the geotextile base (which should not be punctured) and drain gravels that form the base of the box gabions are unsuitable for plant root growth.

Reno mattresses are rectangular gabions that are better suited for plantable surfaces. The Reno mattress gabion is often placed so that box gabions may protect them (Figure 2). Grass plugs, if installed in amended topsoil through individual wire mesh, are effective, and, when fully grown into bunchgrass tussocks, may stabilize the Reno mattress.

Larger plants, especially soft shrubs, are more risky due to excessive root or rhizome growth that may weaken the Reno mattress/box gabion joints. If shrubby plants are to be used, these must be accompanied by single planting wells should be excavated beneath each Reno mattress and filled with topsoil according to specifications. Each planting well is outfitted with gravel filled trenches that lead to the base of the adjoining box gabion or other "weep" point. Care must be taken not to make the planting well too large as to adversely affect the integrity of the gabion slope (Figure 2).

Existing soils of Reaches 5 and 6 are too toxic for plant growth and development as stated earlier. Planting wells, filled with loose topsoil, other amendments, and plant

material, will be potentially erodable, especially if floodwater finds a way to hollow-out the space behind the box gabions that protect each Reno mattress gabion array. Terraced gabions along the lower Guadalupe River, suffered considerable damage during the 100-year floods of 1996-1997, and have needed repair, even after 50-year events. It is also important that plant species such as willow, poplar, and poison oak, with long aggressive root systems be planted "sparingly" on gabion slopes so as to avoid short-term damage to the gabion by their roots and rhizomes.

Holes are cut in the Reno mattress and wired in "collar shaped" funnels, such that gabion rock will not be dislodged from the Reno mattress and interfere with the growth of the plant or plants in each planting well. Planting wells are designed so that the wire-collared hole of each Reno mattress is directly positioned over the well (containing amended topsoil and drip irrigation lines) to be planted (Figure 2).

Toe-of-Slope Design

Since the gabion engineering design has been chosen for most of Reaches 5 and 6 (Maccaferri Company, 2000), the toe-of-slope design for the high flow channel will follow the SCVWD's suggestions (see Figure 3). The box gabions would be anchored using a concrete cut-off wall design along the trapezoidal walls of the high flow channel to prevent undercutting (Figure 3).

Sediment Transport Channel Design

Parsons engineers have designed the sediment transport channel to accommodate high groundwater level following excavation supplemented with average summer flows and associated urban run-off. The geotechnical engineering data when mapped on the engineered cross-sections, indicates that the entire floor of the channel, upon excavation, will become inundated by groundwater (Figures 2-3).

We recommend that the sediment transport channel retain its earthen characteristics so as to allow for the growth of obligate wetland plant species such as bulrushes, sedge, mule fat, and willows that tolerate constant inundation (Figure 3).

Rip-rap of the maintenance road bank will be bioengineered as shown conceptually in Figure 3. This will allow the installation of willow fascia (live stakes and possibly root balls), and container stock species of the more aggressive obligate wetland plants species having underground parts that are unsuitable for the toe-of slope having gabions and the concrete cut-off wall (Table 4).

Table 4

Sediment Transport Channel Design Elements

Element	Total Number of Elements [1]	Construction Specifications	Permit Requirements	Approximate Costs
Rip-rap rock		Sandstone and mudstone (**No concrete rubble or asphalt**)	Section 401, 404; CDFG 1601, SCVWD Permit	
Instream boulders	1308	200 lb. Sandstone and mudstone (**No concrete rubble or asphalt**)	Section 401, 404; CDFG 1601, SCVWD Permit	
Cobble-filled Trenches	654	Five-feet long, twelve-feet wide, and one-foot deep trenches on the invert of the sediment transport channel, backfilled with river cobbles (all excavated subsoil to be removed and trucked to an offsite landfill disposal site)	Section 401, 404; CDFG 1601, SCVWD Permit	
River cobbles			Section 401, 404; CDFG 1601, SCVWD Permit	
Auger cores		Power-augered hole (vertical) four-feet deep with a 12-inch bit, filled with swamp mud (imported from offsite in steel drums), capped with a 6-inch bentonite cap; planted with deepot or supercell of a tule	CDFG 1601, SCVWD Permit	
Live stakes (willow fascia) either/or (below)		Power-augered hole lateral, into the side of the sediment transport channel (top-of hole at chest height), filled with amended topsoil and planted with several, living bound willow cuttings (minimum of five), seven feet long (bindings are jute strips or raw, untreated burlap or coconut fiber)	CDFG 1601, SCVWD Permit	

Element	Total Number of Elements [1]	Construction Specifications	Permit Requirements	Approximate Costs
Root balls of willow either/or (above)		4-foot wide backhoe trench, excavated at the lip of the sediment transport channel, 3-feet in depth filled with one to several, transplanted root balls (to fill the trench), placed on a bed of amended topsoil and covered with amended topsoil mixture and rip-rap	CDFG 1601, SCVWD Permit	
Invert container stock		Install in hand-dug planting wells twice the size of the container, backfilled with amended topsoil mix, OR in the case of inoculated core-holes, one supercell or deepot planted through the top of each bentonite capped hole	CDFG 1601, SCVWD Permit	

[1] = Based on 6,540 lineal feet of channel: each 10-foot sediment transport channel segment may contain either 2 root balls OR 4 live stakes; one 5' x 12' x 1' cobble-filled trench; two 200-lb boulders; six augered core-holes filled with swamp mud covered with bentonite caps and planted with container stock.

We also suggest placement of boulders and gravels at key points along the sediment transport channel as one measure to create a salmonid fishery, especially in the former floor of the historic excavated channel. The purpose of planting root balls and live stakes (willow fascia) on the bio-engineered rip-rap is to create an overhanging palustrine scrub-shrub wetland fringe to shade to fish and aquatic invertebrates from the sun during the dry season.

Top of Bank Vegetation Layout

The conceptual planting layout for the top-of-bank will take into account the soils constraints (see Figure 1), and other factors such as proximity to the floodwalls and private residences, and needs for access by maintenance staff. Typical layouts, shown in plan view will appear in the 60% design plan sheets.

Soil Amendments

The relatively high pH of the soil will necessitate modifying soils for planting wells and basins. We recommend mixing of organic mulch available from BFI or from the Zanker landfill in the proportion of one-part mulch to three-parts imported topsoil for each planting location. In addition to mulch, imported topsoil, soil amendments (see below), a mycorrhizal fungal inoculant is prescribed for each planting location.

Every 1000 sq. ft of planting surface of Reach from South Babb Creek upstream to Cunningham Road will need hundreds of pounds of soil amendments to include:

- At least six-inches (two-feet is preferable) of tested, non-ultramafic (non-serpentine) topsoil;
- Zanker or BFI greenwaste (one-part mulch per three-parts imported topsoil);
- Nitrogen containing fertilizer;
- eight lbs. of treble superphosphate phosphates;
- 12 lbs. of potassium sulfate;
- 33 lbs. of sulfur; and
- 140 lbs. of gypsum.

Soil amendments as described above will be added to approved, tested topsoil (from offsite sources), mixed by portable cement mixer near the major planting activity, and installed in the planting wells (not stockpiled) within 24 hours of mixing. Planting wells will be backfilled with this topsoil mix. The same, amended topsoil mix will be used for all of reach 6. For reach 5, the amount of sulfur and gypsum will be reduced depending upon local conditions reported in the soil data.

Zanker or BFI Greenwaste will be trucked to the site from the manufacturer daily to retard decomposition of woodwaste in piles on the site. Chemicals will be stored in labeled and locked sheds on site, and kept out of the active stream channel, unless fully mixed with the topsoil mixture.

Existing soils that are graded from Reach 6 are hostile to plant growth and development. These soils must be trucked offsite to an approved soil disposal site (see discussion above) and replaced with wholly, imported and amended topsoil. Fewer amendments would be required in other areas within Reaches 5.

Irrigation Plans

Drip irrigation and/or bubblers will be required for all Reno mattress planter arrays located on the sides of the high flow channel. Drip irrigation and/or bubblers will be required for any top-of bank plantings around the floodwalls. All irrigation design drawings will be put together by licensed staff from Brookwater, Inc. and the Suzman Design, Inc. Landscape Architect, and will appear on the bid-level plan sheets in the 60% submittal.

Bioengineering Detail

Since the gabion engineering design has been chosen for most of Reaches 5 and 6 (Maccaferri Products, 2000), the toe-of-slope design for the high flow channel will follow the manufacturer's suggestions (see Figure 3, above). These block gabions would be anchored on concrete cut-off walls along the trapezoidal walls of the high flow channel, to prevent undercutting.

It will be critical to place willow fascia and root balls only on rip-rap surfaces away from areas that will be disrupted by growth by tree and shrub root systems.

SCHEDULING CONSIDERATIONS

Construction scheduling to ensure coordination between the construction and revegetation contractors will be important to the success of revegetation. The main scheduling milestones with implications toward revegetation success will be:

- Timely channel dewatering and excavation;
- Excavation and grading;
- Coring and microbial inoculation of the sediment transport channel;
- Planting of the sediment transport channel;
- Construction of the maintenance road;
- Final excavation and grading of the 100-year flow channel;
- Importation of topsoil, woodwaste organic matter, and chemicals;
- Installation of subterranean plumbing and electrical subsystems and ROW fencing;
- Excavation of holes and Reno mattress planting basin arrays with gravel-filled drain trenches for sideslope plantings;
- Installation of gabions;
- Installation of the irrigation system;
- Planting of riparian woodland;
- Planting of serpentine chaparral and grassland;
- Planting of seasonally wet meadow;
- Implementation of the maintenance and monitoring plan.

Irrigation systems (including the electrical and plumbing supply sub-systems) will be installed prior to planting of the riparian woodland trees and shrubs) but after the sediment transport channel is installed and planted, and the maintenance road construction is completed.

BEST MANAGEMENT PRACTICES

All of the regulatory agencies involved in the project (CDFG, City of San Jose, NMFS, NRCS, RWQCB, SCVWD, USACOE, and USFWS) require implementation of Best Management Practices (BMP's) both during and after reconstruction of the channel and restoration of habitat. In addition, the City has adopted specific riparian corridor guidelines that also include BMP's as does the SCVWD's own encroachment permit regulations.

Parsons suggests that incoming street runoff be detained, and then treated by a system of grassed swales before discharge into the sediment transport channel. In concept, urban runoff may be detained, and allowed to pass slowly through a series of vegetated works to follow BMP. There are a wide variety of BMPs in use for storm water management. Structural BMPs include engineered and constructed systems that are designed to provide for water quantity and/or water quality control of storm water runoff. BMPs can be grouped into several general categories as follows:

- **Infiltration Systems** capture a volume of runoff and infiltrate it into the ground. Infiltration systems include infiltration basins, porous pavement systems, and infiltration trenches or wells. An infiltration BMP is designed to capture a volume of storm water runoff, retain it and infiltrate that volume into the ground. Infiltration of storm water has a number of advantages and disadvantages. The advantages of infiltration include both water quantity control and water quality control. Water quantity control can occur by taking surface runoff and infiltrating this water into the underlying soil. This reduces the volume of water that is discharged to receiving streams; thereby reducing some of the potential impacts caused by an excess flow as well as increased pollutant concentrations in the receiving stream. Infiltration systems can be designed to capture a volume of storm water and infiltrate this water into the ground over a period of several hours or even days, thereby maximizing the infiltrative capacity of the BMP. Infiltration can have many secondary benefits such as increasing recharge of underlying aquifers and increasing baseflow levels of nearby streams. Infiltration BMPs can also provide water quality treatment. Pollutant removal can occur as water percolates through the various soil layers. As the water moves through the soil, particles can be filtered out. In addition, microorganisms in the soil can degrade organic pollutants that are contained in the infiltrated storm water.

  Although infiltration of storm water has many benefits, it also has some drawbacks. First, infiltration may not be appropriate in areas where groundwater is a primary source of drinking water due to the potential for contaminant migration. This is especially true if the runoff is from a commercial or industrial area where the potential for contamination by organics or metals is present. Also, the performance of infiltration BMPs is limited in areas with poorly permeable soils. In addition, infiltration BMPs can experience reduced infiltrative capacity and even clogging due to excessive sediment accumulation. Frequent maintenance may be required to restore the infiltrative capacity of the system. Care must also be taken during construction to limit compaction of the soil layers underlying the BMP. Excessive compaction due to construction equipment may cause a reduced infiltrative capacity of the system. Plus, excessive sediment generation during construction and site grading/stabilization may cause premature clogging of the system. Infiltration systems should not be placed into service until disturbed areas in the drainage have been stabilized by dense vegetation or grasses.

- **Detention systems** capture a volume of runoff and temporarily retain that volume for subsequent release. Detention systems do not retain a significant permanent pool of water between runoff events. Detention systems are BMPs that are designed to intercept a volume of storm water runoff and temporarily impound the water for gradual release to the receiving stream or storm sewer system. Detention systems are designed to completely empty out between runoff events, and therefore provide mainly water quantity control as opposed to water quality control. Detention basins can provide limited settling of

particulate matter, but a large portion of this material can be re-suspended by subsequent runoff events. Detention facilities should be considered mainly as practices used to reduce the peak discharge of storm water to receiving streams to limit downstream flooding and to provide some degree of channel protection. There are several types of detention facilities used to manage storm water runoff, including detention basins and underground vaults, pipes and tanks.

- **Retention Systems** capture a volume of runoff and retain that volume until it is displaced in part or in total by the next runoff event. Retention systems therefore maintain a significant permanent pool volume of water between runoff events. Retention systems include wet ponds and other retention systems such as retention ponds, tanks, tunnels, vaults and pipes. Retention systems are designed to capture a volume of runoff and retain that volume until it is displaced in part or in total by the next runoff event. Retention systems can provide both water quantity and quality control. The volume available for storage, termed the water quality volume, is provided above the permanent pool level of the system. The main pollutant removal mechanism in retention systems is sedimentation. By retaining a permanent pool of water, retention systems can benefit from the added biological and biochemical pollutant removal mechanisms provided by aquatic plants and microorganisms, mimicking a natural pond or lake ecosystem. Also, sediments that accumulate in the pond are less likely to be re-suspended and washed out due to the presence of a permanent pool of water. In addition to sedimentation, other pollutant removal mechanisms in retention systems include filtration of suspended solids by vegetation, infiltration, biological uptake of nutrients by aquatic plants and algae, volatilization of organic compounds, uptake of metals by plant tissue, and biological conversion of organic compounds.
- **Constructed Wetland Systems** are similar to retention and detention systems, except that a major portion of the BMP water surface area (in pond systems) or bottom (in meadow-type systems) contains wetland vegetation. This group also includes wetland channels. Constructed wetland systems incorporate the natural functions of wetlands to aid in pollutant removal from storm water. Constructed wetlands can also provide for quantity control of storm water by providing a significant volume of ponded water above the permanent pool elevation. Constructed wetland systems have limits to their application. A water balance must be performed to determine the availability of water to sustain the aquatic vegetation between runoff events and during dry periods. In addition, a sediment forebay or some other pretreatment provision should be incorporated into the wetland system design to allow for the removal of coarse sediments that can degrade the performance of the system. Also, construction sediment should be prevented from entering constructed wetlands, as the resulting sediment loading can severely degrade the performance of the system. Constructed wetlands are particularly

appropriate where groundwater levels are close to the surface because groundwater can supply the water necessary to sustain the wetland system.

Storm water runoff should not be intentionally routed to natural wetlands without pretreatment due to the potentially damaging effects runoff can have on natural wetland systems. In addition, natural wetlands that receive storm water runoff should be evaluated to determine if the runoff is causing degradation of the wetland, and if so measures should be taken to protect the wetland from further degradation and to repair any damage that has been done. In addition, local permitting authorities should be consulted prior to designing and maintaining constructed wetland systems in order to determine if any local regulations apply to their use or maintenance.

Pollutant removal in wetlands can occur through a number of mechanisms including sedimentation, filtration, volatilization, adsorption, absorption, microbial decomposition and plant uptake. In addition, wetlands can provide for significant water storage during runoff events, thus supplying water quantity control as well.

- **Filtration Systems** use some combination of a granular filtration media such as sand, soil, organic material, carbon or a membrane to remove constituents found in runoff. A filtration system is a device that uses a media such as sand, gravel, peat or compost to remove a fraction of the constituents found in storm water. There are a wide variety of filter types in use such as surface sand filters and underground vault sand filters. There are also a variety of proprietary designs that use specialized filter media made from materials such as leaf compost. Filters are primarily a water quality control device designed to remove particulate pollutants. Quantity control can be included by providing additional storage volume in a pond or basin, by providing vertical storage volume above the filter bed, or by allowing water to temporarily pond in parking lots or other areas before being discharged to the filter. Media filters are commonly used to treat runoff from small sites such as parking lots and small developments, in areas with high pollution potential such as industrial areas, or in highly urbanized areas where land availability or costs preclude the use of other BMP types. Filters should be placed off-line (i.e., a portion of the runoff volume, called the water quality volume, is diverted to the BMP, while any flows in excess of this volume are bypassed) and are sometimes designed to intercept and treat only the first half inch or inch of runoff and bypass larger storm water flows. A benefit of using filters in highly urbanized areas is that the filter can be placed under parking lots or in building basements, limiting or eliminating costly land requirements. However, placing filters "out of sight" may have implications for continued maintenance and performance. Media filters should use a forebay or pre-settling chamber to remove a portion of the settleable solids prior to filtration. This helps to extend the life of the filter run and prevent clogging of the filter media by removing a portion of the coarse sediment. Also, care must be taken to prevent construction site sediments and debris such as fines washed off of

newly paved areas from entering the filter, as these can cause premature clogging of the filter.

- **Biofiltration/Bioretention Systems** are designed to mimic the functions of a natural forest ecosystem for treating storm water runoff. Bioretention systems are a variation of a surface sand filter, where the sand filtration media is replaced with a planted soil bed. Storm water flows into the bioretention area, ponds on the surface, and gradually infiltrates into the soil bed. Pollutants are removed by a number of processes including adsorption, filtration, volatilization, ion exchange and decomposition. Treated water is allowed to infiltrate into the surrounding soil, or is collected by an under-drain system and discharged to the storm sewer system or directly to receiving waters. When water is allowed to infiltrate into the surrounding soil, bioretention systems can be an excellent source of groundwater recharge. The components of a bioretention system include:
  - **Grass Buffer Strips** - runoff enters the bioretention area as sheet flow through the grass buffer strips. The buffers reduce the velocity of the runoff and filter particulates from the runoff.
  - **Ponding Area** - The ponding area provides for surface storage of storm water runoff before it filters through the soil bed. The ponding area also allows for evaporation of ponded water as well as allows for settling of sediment in the runoff.
  - **Organic Mulch Layer** - The organic mulch layer has several functions. It protects the soil bed from erosion, retains moisture in the plant root zone, provides a medium for biological growth and decomposition of organic matter, and provides some filtration of pollutants.
  - **Planting Soil Bed** - The planting soil bed provides water and nutrients to support plant life in the bioretention system. Storm water filters though the planting soil bed where pollutants are removed by the mechanisms of filtration, plant uptake, adsorption and biological degradation.
  - **Sand Bed** - the sand bed underlies the planting soil bed and allows water to drain from the planting soil bed through the sand bed and into the surrounding soil. The sand bed also provides additional filtration and allows for aeration of the planting soil bed.
  - **Plants** - Plants are an important component of a bioretention system. Plants remove water though evapotranspiration and remove pollutants and nutrient through uptake. The plant species selected are designed to replicate a forested ecosystem and to survive stresses such as frequent periods of inundation during runoff events and drying during inter-event periods.

  In addition to providing for treatment of storm water, bioretention facilities, when properly maintained, can be aesthetically pleasing. Bioretention facilities can be placed in areas such as parking lot islands, in landscaped areas around buildings, the perimeter of parking lots, and in other open

spaces. Since local regulations frequently require site plans to incorporate a certain percentage of open landscaped area, additional land requirements for bioretention facilities are often not required. The layout of bioretention facilities can be very flexible, and the selection of plant species can provide for a wide variety of landscape designs. However, it is important that a landscape architect with proper experience in designing bioretention areas be consulted prior to construction to insure that the plants selected can tolerate the growing conditions present in bioretention facilities. Bioretention facilities can be adapted easily for use on individual residential lots. Prince George's County, MD has developed the concept of "rain gardens" which are small bioretention systems for use in single or multi-lot residential areas. They provide an easily maintainable, aesthetically pleasing, and effective means of controlling runoff from residential areas. By disconnecting down spouts and placing a series of bioretention areas throughout a residential area, the volume of storm water runoff produced and requiring subsequent management can be significantly reduced.

- **Vegetated Systems (biofilters)** such as vegetated swales and grass filter strips are designed to convey and treat either shallow flow (swales) or sheetflow (filter strips) runoff. Vegetated systems such as grass filter strips and vegetated swales are used for conveying and treating storm water flows. These BMPs are commonly referred to as *biofilters*, since the grasses and vegetation "filter" the storm water as it flows. Open channel vegetated systems are alternatives to traditional curb-and-gutter and storm sewer conveyance systems. By conveying storm water runoff in vegetated systems, some degree of treatment, storage and infiltration can be provided prior to discharge to the storm sewer system. This can help to reduce the overall volume of storm water runoff that is generated from a particular drainage area.

MAINTENANCE AND MONITORING PLAN

Regulatory compliance would be achieved by execution of a mitigation monitoring and maintenance plan (M & M) to be developed by qualified biologists. Specific goals would be set as a result of interagency consensus building and written agreements, before restorative measures are implemented. Monitoring of restoration success would employ techniques of vegetation and groundwater analysis, and by using fixed photodocumentation points, semi-permanent vegetation monitoring transects using the line-intercept plant ecological method, and staff gauges. Monitoring would take place for a period of five (5) years. The main elements of mitigation area monitoring and maintenance would be:

- Retain a qualified biologist to monitor restoration success;
- Install shallow staff gauges in the sediment transport channel, and survey against horizontal and vertical control;
- Monitor staff several times annually;
- Survey restored landscape against horizontal control;

- Produce as-built drawings;
- Install semi-permanent vegetation monitoring transects and collect baseline data;
- Establish permanent photodocumentation points;
- Carry out repair of faulty drip irrigation lines and replacement of failed nursery stock;
- Eradicate invasive plant species such as pampas grass (*Cortaderia jubata*), giant arundo (*Arundo donax*), and French broom (*Genista monspessulana*; etc.);
- Prepare annual, written monitoring reports to be submitted to the permitting agencies;
- Delineate the newly created wetland after four years following the 1987 USACOE Manual.

Remedial steps, if needed, are suggested to the SCVWD by the environmental monitor. Maintenance of the created habitat also entails semi-annual pick-up of refuse, control of unplanned erosion, repair of infrastructure (fencing and interpretive signs), and re-planting of failed landscape plantings.

Performance criteria

The success of mitigation would be ascertained from review of monitoring data and comparison of the data against criteria to be agreed upon, in advance, by the regulatory agencies and responsible party. The recommended criteria are:

- In the case of riparian woodland plantings, survival of three out of every five container tree and shrub stock planted at the beginning of the five-year period (= target survival criterion);
- In the case of wetlands to be created, documented presence of all three mandatory criteria (hydrophytic vegetation, wetland hydrology, and hydric soil characteristics) after five years according to methodology in the 1987 Corps Manual.

Failure to meet the above criteria will necessitate replacement plantings and could trigger another three years of monitoring if required by the permitting agencies.

Annual reporting

A qualified biologist would prepare annual monitoring reports. These reports would be reviewed by the responsible party and forwarded to the permitting regulatory agencies. Annual reports often include:

- List of persons who prepared the report;
- Copies of relevant permits;
- Maps (often vegetation maps);
- Graphic and tabular presentation of monitoring data;
- Results of seasonal photodocumentation;

- Progress reporting on the changing state of habitat functions and values, and achievement of performance criteria thresholds;
- Proposals for mid-course corrections or remedial action
- Appendix with raw data sheets.

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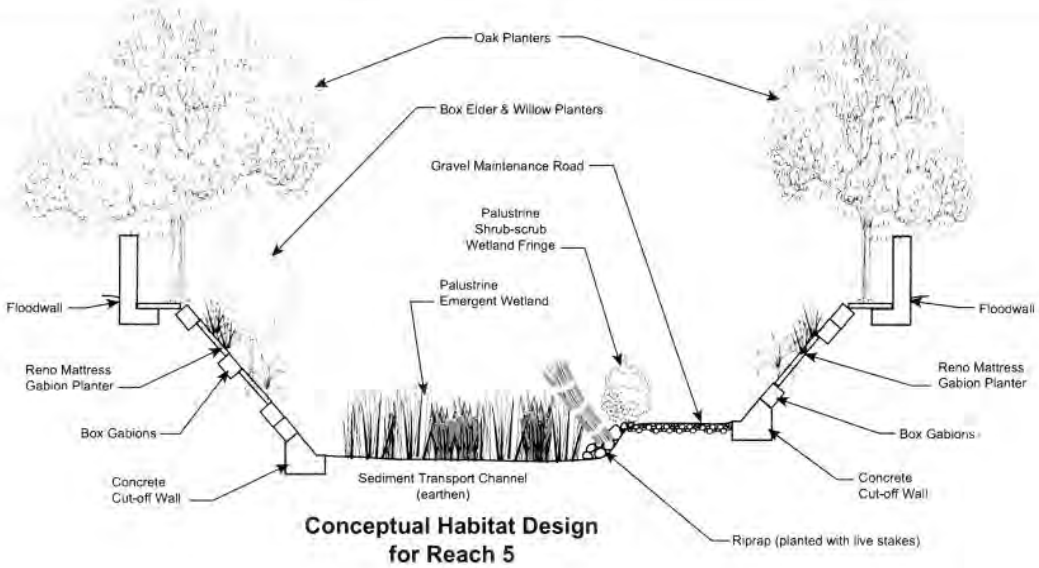
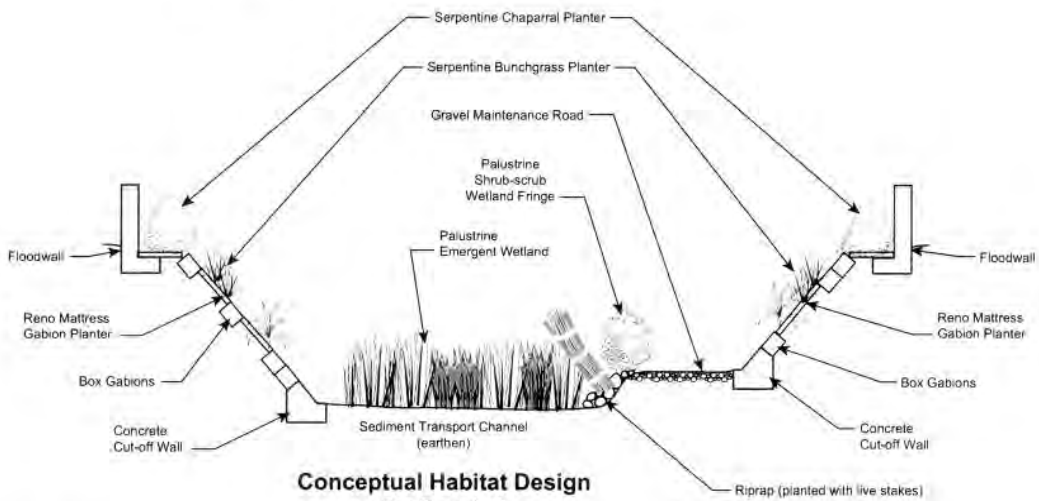
FIGURE 1



Conceptual Habitat Design for Reach 5



Conceptual Habitat Design for Reach 6

Notes: Possible habitat as a result of groundwater study by Geotechnical Consultants, Inc. and soil amendments as recommended by Parsons

CONCEPTUAL & ENGINEERED CROSS SECTIONS

Silver Creek Reaches 5 and 6

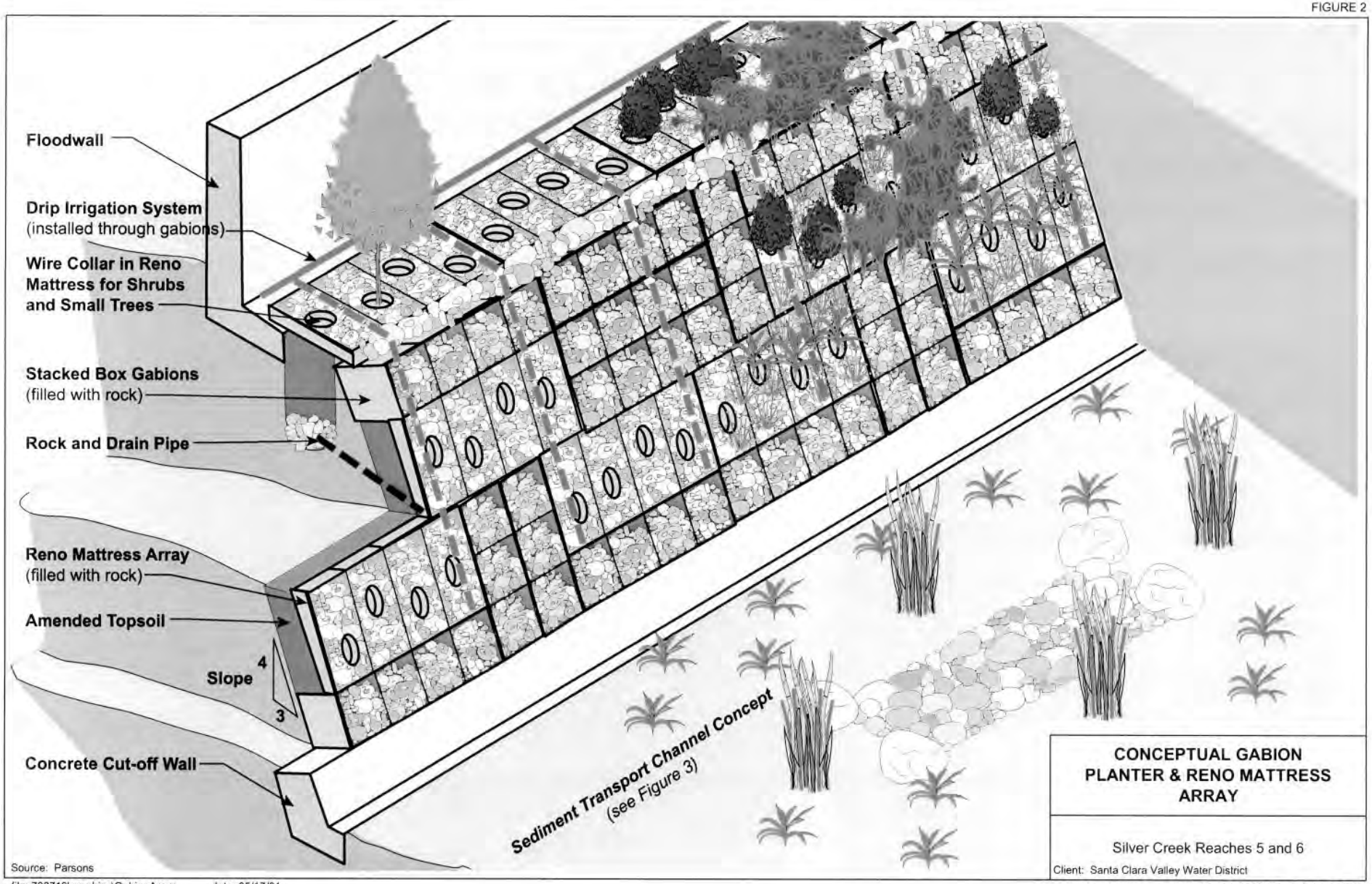
Client: Santa Clara Valley Water District

Source: Parsons

file: 738710\graphics\Sections date: 05/24/01

PARSONS ENGINEERING SCIENCE

FIGURE 2



CONCEPTUAL GABION PLANTER & RENO MATTRESS ARRAY

Silver Creek Reaches 5 and 6

Client: Santa Clara Valley Water District

Source: Parsons

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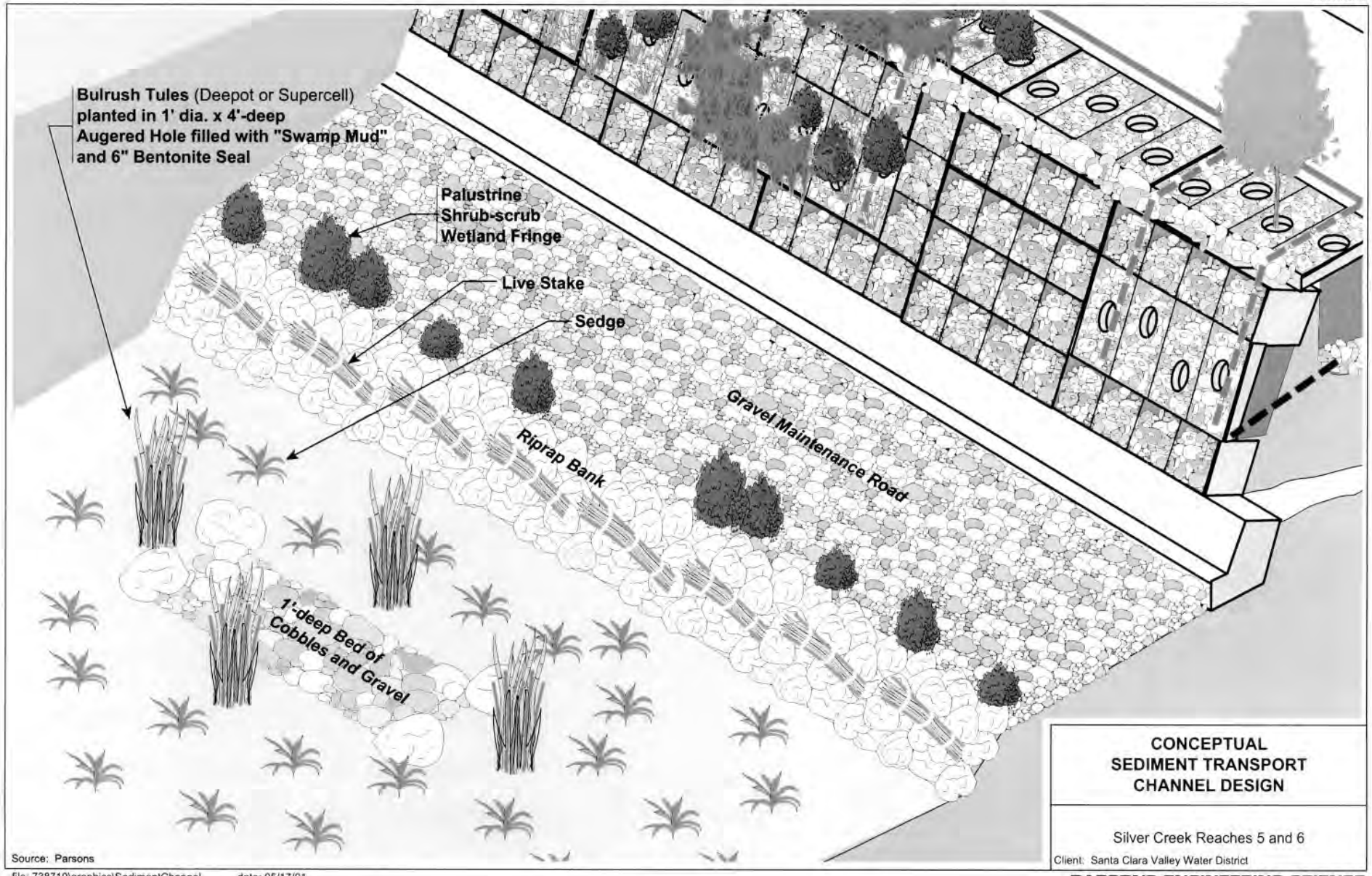
PARSONS ENGINEERING SCIENCE

FIGURE 3



CONCEPTUAL SEDIMENT TRANSPORT CHANNEL DESIGN

Silver Creek Reaches 5 and 6

Client: Santa Clara Valley Water District

Source: Parsons

file: 738710\graphics\SedimentChannel date: 05/17/01

PARSONS ENGINEERING SCIENCE

APPENDIX 3B-1

HYDRAULIC DESIGN FOR 6B

Santa Clara Valley Water District

COYOTE WATERSHED PROGRAM

LOWER SILVER CREEK REACH 6B

DRAFT BASIS OF HYDRAULIC DESIGN

February 5, 2010

Schaaf & Wheeler
Consulting Civil Engineers

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COYOTE WATERSHED PROGRAM
LOWER SILVER CREEK REACH 6B
DRAFT BASIS OF HYDRAULIC DESIGN

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COYOTE WATERSHED PROGRAM
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COYOTE WATERSHED PROGRAM
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INTRODUCTION

This Basis of Hydraulic Design has been prepared to document hydraulic and sediment transport analyses in Lower Silver Creek Reach 6B for the Coyote Watershed Program, which operates under the auspices of the Santa Clara Valley Water District. This report describes Lower Silver Creek hydraulics and sediment transport between Moss Point Drive and Cunningham Avenue in San Jose. Hydraulic modeling and engineering analyses described herein are based upon Program conceptual plans for Reach 6B and Ruggeri-Jensen-Azar's Basis of Design Plan Submittal for Reaches 4 – 6A dated January 19, 2010. It is assumed that the reader is familiar with the engineering concepts discussed herein.

Project Objectives

The basic objective of the Lower Silver Creek Improvement Project is to provide a level of flood protection along Lower Silver Creek consistent with NRCS and District policies, the policies of the Federal Emergency Management Agency (FEMA) as administered through the National Flood Insurance Program (NFIP), and with the level of flood protection afforded to those properties protected by the completed Lower Silver Creek Reaches 1 – 3.

District and NFIP regulations define the "base flood" as a flood having a one percent chance of being equaled or exceeded in any given year. Often this is referred to as a "one-percent" or "100-year" flood. This should not be confused with a flood that *will* occur once every one hundred years, but one that might occur once every one hundred years *on the average* over a very long period of time. Over the life of a 30-year mortgage, there is a 26 percent chance of experiencing a flood equal or greater in magnitude than the base flood as demonstrated by Table 1. These probability concepts may have an impact on construction staging in Reach 6B, especially the initiation and completion of work relative to the completion of work within downstream reaches, the timing of floodwall construction, and protecting the newly excavated channel prior to the establishment of protective vegetation.

Table 1
Relative Risk of Various Flood Events

	5-year	10-year	100-year
Annual risk of event	20%	10%	1%
Risk of at least one event in 5 years	67%	41%	5%
Risk of at least one event in 10 years	89%	65%	10%
Risk of at least one event in 30 years	99.88%	96%	26%
Risk of at least one event in 50 years	99.998%	99%	39%
Risk of at least one event in 100 years	really high	99.997%	63%

Although the primary project objective is to provide a level of flood protection along Lower Silver Creek meeting District, NRCS and FEMA standards, additional project objectives include:

- balancing flood reduction with environmental restoration, community beautification, and recreational opportunities.
- providing efficient and cost-effective flood control maintenance to ensure that the District is able to maintain design system performance in the future;
- allowing for more natural geomorphic processes in Lower Silver Creek; and
- engendering community support for the proposed project.

Scope of Analysis

Steady-state backwater analyses have been made to evaluate proposed channel improvements. Minimum floodwall elevations are established from station to station. Hydraulic stability and sediment transport analyses are made to assess long-term channel stability, potential sediment accumulations, and bank slope protection.

Lower Silver Creek Reach Reach 6B encompasses Lower Silver Creek from Moss Point Drive upstream to Cunningham Avenue at project Station 244+00. Reaches 4 through 6A, which will be designed under separate contract, extend from Interstate 680 upstream to Moss Point Drive at Station 217+00, which is the downstream boundary condition for Reach 6B. Reach limits are shown in Figure 1.

Figure 1: Lower Silver Creek Reach Designations (source: CH2M-Hill)

Limits of Freeboard Evaluation

The need for floodwalls is driven by providing freeboard to Santa Clara Valley Water District (District) and National Flood Insurance Program (NFIP) standards. This need is evaluated in detail for Lower Silver Creek between Moss Point Drive and Cunningam Avenue in San Jose.

Limits of Hydraulic Evaluation

To compute required freeboard and assess bed stability under a variety of channel conditions, a one-percent (base flood) water surface profile for Lower Silver Creek is calculated from the creek's confluence with Coyote Creek to Cunningham Avenue. A water surface profile downstream of the freeboard evaluation reach is necessary to establish backwater conditions, and although designed by others, the performance of the upstream Reach 6B also depends upon hydraulic conditions in Reaches 4, 5, and 6A.

Sources of Data Used in Analyses

The primary source of geometric data used in this evaluation is the channel improvement design for Reach 6B provided by the Program and preliminary channel designs for Reaches 4 through 6A prepared by Ruggeri-Jensen-Azar and transmitted to Schaaf & Wheeler on January 19, 2010. Proposed channel vegetation is taken from internal Program sketches dated September 4, 2009. Design discharges are from the *Lower Silver Creek Improvement Project Final Hydraulic Report.* (Schaaf & Wheeler, 2002) Existing channel bank elevations are taken from grading plans prepared by Mark Thomas & Company in July 2010, as provided by the Program. In addition to the data described above, HEC-RAS models used for freeboard evaluation are based on the model submitted to FEMA for Reaches 1 through 3; the model prepared by the Program for Reach 6B; and available record drawings for bridges and culverts in Reaches 4, 5, and 6.

DESIGN CRITERIA

A number of governing authorities provide design criteria applicable to Lower Silver Creek Reach 6B:

1. Santa Clara Valley Water District (District)
2. National Resources Conservation Service (NRCS)
3. National Flood Insurance Program (NFIP)

Unless otherwise discussed, where the same criterion set forth by various authorities is in conflict, the most restrictive or conservative criterion is used.

Freeboard Requirements

Freeboard provides a measure of safety that compensates for the many unknown and difficult-to-quantify parameters that affect the calculation of flood elevations. These factors include uncertainty in rainfall data, soil loss parameters, watershed urbanization, wave action, debris at bridge openings, and general uncertainties in hydrologic and hydraulic procedures. Freeboard is usually expressed in terms of feet above the design base flood elevation. To meet minimum NFIP standards, freeboard is necessary whenever a levee system, including structural floodwalls, is used to provide flood protection. Freeboard requirements are defined in 44 CFR §65.10, which mandates that riverine levees (including floodwalls) provide a minimum freeboard of three feet above the water surface level of the base (one-percent) flood. An additional foot of freeboard (i.e. 4 feet of freeboard) is required within 100 feet of either side of structures such as bridges or wherever the flow is constricted. An additional one-half foot of freeboard above the minimum is required at the upstream end of the levee (i.e. 3.5 feet freeboard), tapering to not less than the minimum at the downstream end (i.e. 3 feet freeboard).

NFIP regulations do not include a freeboard requirement where the base flood is carried without the use of a levee or floodwall system. The District and NRCS, however, have additional project freeboard requirements (SCVWD, 1994), which can be more restrictive than NFIP actuarial criteria. Table 2 provides the respective criteria, where "D" is the design depth. Previous calculations found that the channel hydraulic depth is an acceptable substitute for the design depth in composite channel sections.

Table 2
Project Freeboard Criteria

Hydraulic Situation	NFIP (feet)	District/NRCS (feet)
Water Surface Above Natural Bank Elevation	3.0	3.5
Water Surface Above Bank within 100 feet of Structure	4.0	4.0
Water Surface Below Natural Bank Elevations	N/A	$0.2(D + V^2/2g)$
Minimum Freeboard	N/A	1.0

District criteria for water surfaces below natural bank elevation are based on NRCS guidelines. In 2001 the NRCS approved the use of a slightly different formula for its freeboard criterion within incised channels; that is, where the design water surface is carried below the natural bank. The velocity head term has been omitted, leaving the required freeboard within an incised channel as the minimum of one foot or 0.2D, where D is flow depth. The NRCS also approved a

District-proposed method of weighting depth based upon flow conveyance, as stated in an October 31, 2001 memorandum from NRCS Design Staff Leader Bill Ward, P.E.:

> "[The NRCS] has determined that using a composite freeboard based on weighting the conveyance for individual channel areas within a section is a good approach for multi-staged channels and recommend[s] its use in these cases. To meet NRCS criteria you can simply use this procedure and replace the energy head with depth. Of course the minimum freeboard should not be less than one foot, and other requirements for freeboard (super-elevation, unstable range) are on top of the calculated composite freeboard."

(The effect of differing flow conveyance within multi-staged channels is accounted for by the calculation of composite roughness and velocity coefficients to produce an average water surface elevation as described in more detail in the "Hydraulic Analysis" section of this report.)

It is also recommended that the minimum freeboard be based on the hydraulic depth, which is the depth of an equivalent rectangular shaped channel (flow area divided by top width), and produces a weighted depth similar to the District's composite freeboard calculation as described fully in the 2002 *Final Hydraulics Report*. Furthermore, an additional requirement that the energy grade line shall be contained within the channel or its floodwalls is applied herein. The energy grade line essentially represents the water surface elevation at the channel boundary, where the flow velocity is zero.

Scour Protection and Channel Stability

The management of scour and sediment deposition within Lower Silver Creek may have a great impact on the future success of proposed flood protection and geomorphic improvements. While some channel scour and bank instability is inevitable in a natural system, it is particularly important that the channel bed does not significantly degrade over time, leading to unstable channel banks and potentially threaten adjacent property. At the least, excessive channel sedimentation or scour leads to excessive maintenance demands.

The NRCS criterion for scour protection is to design a channel that will be stable with a ten-year discharge in its as-built (first year) condition. The as-built condition is assumed to reflect finished channel excavation, the construction of soldier pile walls where applicable, the placement of rock slope protection and rock sills, and a completed maintenance road; but without the establishment of vegetation which when mature will provide a measure of scour protection to the channel banks.

Level of Maintenance

Regular channel maintenance is important to upholding the integrity of channel design. Proposed maintenance protocols on the part of the District are assumed to reflect the approved Lower Silver Creek Maintenance Plan of August 2000. Cross sectional areas identified for flood flow conveyance are assumed to be maintained free of woody vegetation such as brush, willows, and trees; while areas identified as habitat are assumed not to be maintained as to promote flood flow conveyance.

DESIGN PARAMETERS

Project design base flood discharges are those presented in Chapter 3 of the 2002 *Final Hydraulic Report*. Runoff at key design points along Lower Silver Creek for various storm events are summarized in Table 3, based on the Program's watershed model prepared under separate contract. Design base flood (100-year) discharges range from 2,810 cfs at Moss Point Drive to 4,160 cfs upstream of Interstate 680.

Table 3
Project Design Discharges

Location	Discharge (cfs)			
	2-year	5-year	10-year	100-year
Lake Inflow	610	2,040	3,400	5,060
Cunningham Avenue	610	2,040	2,650	2,810
S. Babb Creek	680	2,420	3,310	3,670
N. Babb Creek	780	2,630	3,640	4,160
Interstate 680	780	2,650	3,670	4,210
Alum Rock Avenue	810	2,730	3,780	4,340
Miguelita Creek	890	2,940	4,160	4,920
Highway 101	940	3,050	4,360	5,220
Coyote Creek	940	3,050	4,360	5,220

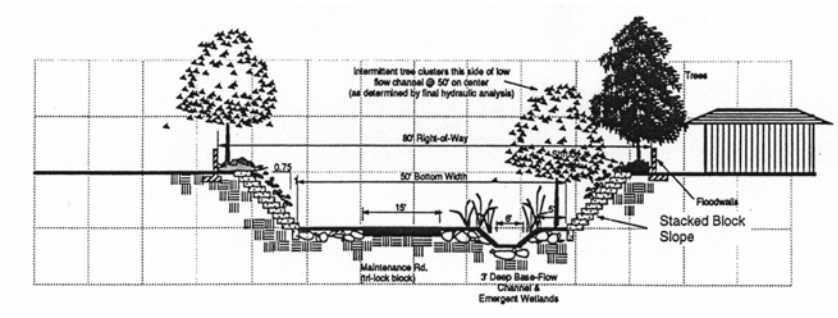
Backwater Conditions

Water surfaces elevations, particularly in the lower reaches of Lower Silver Creek, can be directly influenced by conditions in Coyote Creek at the confluence. However, this backwater influence is completely dissipated by Interstate 680, which is the downstream limit of Reach 4. Backwater conditions in Reach 3 can influence hydraulic performance in Reaches 4 - 6. The analyses presented in this report utilize the water surface profile submitted to FEMA as part of the Reaches 1 – 3 Letter of Map Revision.

PROJECT PLANS

A planning study prepared by the District in 1976 proposed to provide a concrete-lined trapezoidal channel for most of Lower Silver Creek between Highway 101 and Cunningham Avenue. This plan was abandoned in the early 1980s in favor of the NRCS (formerly SCS) plan of 1983. The original watershed plan examined five non-structural and three structural measures to provide one-percent flood protection, narrowing the alternatives to the no project alternative, non-structural floodplain protection, and channel enlargement and floodproofing.

In 1998 the NRCS developed a major update to their 1983 plan. They investigated new alternatives in an attempt to minimize the lineal feet of proposed concrete channel and incorporate more environmentally sensitive design elements. After examining eleven more non-structural and structural measures, three new alternatives were selected for further study and refinement including geomorphic stream restoration with detention basins; geomorphic stream restoration with diversion channels; and a hybrid vegetated block wall channel in Reach 6.



NRCS Plan for Reach 6

The District's 2002 work refined the NRCS plans to reduce the amount of concrete lining, utilize more natural and environmentally sensitive materials and configurations, provide for more natural channel geomorphologic processes, improve maintenance, and allow greater public access to the creek. One goal at that time was also to minimize the necessity for and height of protective floodwalls.

Figure 2 shows the most recent evolution of the design channel sections for Reach 6B. Due to the demonstrated need for horizontal tiebacks into private property for geotechnical stability, and District concerns with the long-term maintenance, the steep vegetated block walls have been eliminated in favor of banks sloped at 1.5:1 (horizontal:vertical) within Reach 6B between Moss Point Drive and Cunningham Avenue (similar to Section 1 shown from Reach 4). The south bank is dedicated to riparian habitat, including a 5-foot wide bench above the low flow channel. The north bank is dedicated to flood conveyance, with a grassed bank and 18-foot wide maintenance road above the low flow channel. Concrete floodwalls will be constructed

along the top of each bank as needed to meet the freeboard criteria outlined above. It is noted that there are generally ten additional feet of right-of-way within Reach 6B than in Reach 4 from Jackson Avenue to Capitol Expressway, which Figure 2 shows. The additional right-of-way is used to widen the sediment transport channel.

During more detailed design, the typical channel sections shown in Figure 2 will need to be connected by transition sections to conform to bridges and culverts at road crossings. Sloped ramps from the top of bank to the maintenance road will also be located near road crossings. There are no planned culvert or bridge improvements within Reach 6B.

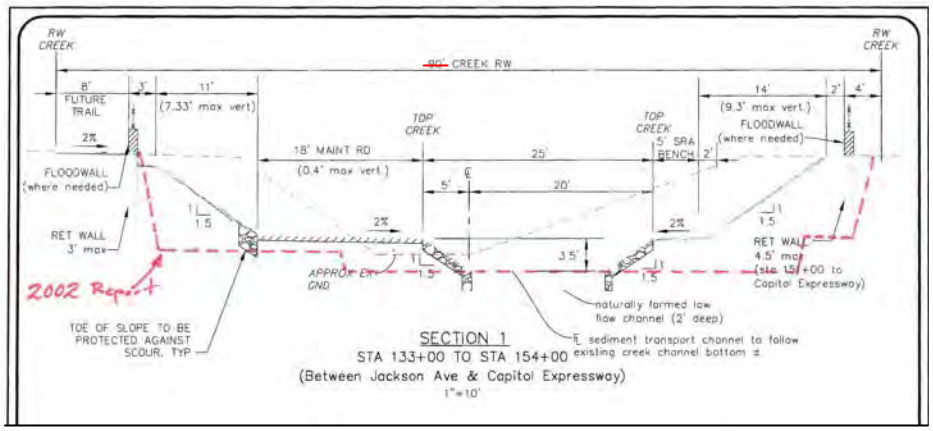


Figure 2: Proposed Typical Channel Section (2002 plan section in red)

HYDRAULIC ANALYSES

Base flood elevations within Lower Silver Creek are estimated using a one-dimensional steady state flow backwater analysis via the HEC-RAS public domain program (Version 4.0 Beta). Steady state analyses are performed with subcritical flow or mixed flow regimes (subcritical and supercritical) as appropriate. Floodwall must be certifiable to at least the base flow (i.e. 1% or 100-year discharge). Design discharges are given in Table 3.

Methodologies

To evaluate the required freeboard above the base flood elevation, an HEC-RAS model has been prepared to reflect the conformed as-built conditions within the downstream reaches of Lower Silver Creek (Reaches 1 – 3) to Coyote Creek and referenced plan sections and plantings projected at full maturity within Lower Silver Creek Reaches 4 through 6. Relevant hydraulic parameters including channel roughness, bridge modeling, transition losses and boundary conditions are based on earlier hydraulic analyses prepared for the Program and described herein.

Channel Roughness

In one-dimensional open channel flow analysis, "Manning's n" is used to represent the retarding forces to flow imposed by the channel bed and banks. Roughness elements along the wetted perimeter of Lower Silver Creek will vary across an individual cross section. For instance the channel cross section might eventually contain elements of grassed banks, mature riparian vegetation including trees, shrubs or brush, access roads, emergent wetland areas and/or open water, bare earth and concrete walls. To compute water surface elevations in a channel with variable roughness using a one-dimensional model (i.e. with a mean velocity), it is necessary to estimate an effective (composite) roughness value for each cross section.

Table 4 lists estimates of roughness used in this sensitivity analysis and the literature source for each. A range of roughness estimates is used to estimate effective cross sectional roughness coefficients. A "high" estimate is used for freeboard evaluation, while a "low" estimate is used for channel stability analyses and the examination of channel scour potential. Low roughness estimates assume unvegetated conditions with the placement of erosion control blankets.

Table 4
Channel Roughness Elements

Description	Example Photo	Manning's "n"		Source(s)
		"High"	"Low"	
Grasses and Forbs w/in Committed Flood Conveyance Area		0.040	0.018	Henderson Fig 4-5 (1966). Class B grass lining (fair stand >30" or good stand 11"-24" in height) North American Green erosion control blanket
Gravel Maintenance Road		0.030	0.022	Chow Table 5-6 C.a.3 (1959)
Dense Weeds or Aquatic Plants in Deep Channels (Emergent Wetland)		0.040	0.020	Chow Table 5-6 C.b.3 (1959) Flood stage 2-3 times height of vegetation

Description	Example Photo	Manning's "n"		Source(s)
		"High"	"Low"	
Vegetated Rock Slope Protection (light brush maintained)		0.060	0.035	Chow Table 5-6 C.c.2
Riparian Habitat		0.150	0.018	Chow Table 5-6 D.2.d.5 North American Green erosion control blanket

Flow velocities vary across the channel due to variation in both the flow depth and roughness from one channel element to the next. To calculate mean flow velocity without actually subdividing each channel section, several methods are suggested in the literature for estimating a composite roughness value within non-uniform channels.

To be consistent with previously completed reaches of Lower Silver Creek, it is assumed that the total discharge in each section is equal to the sum of the discharges of individual areas subdivided by roughness (i.e. weighted by conveyance). The equivalent roughness coefficient methodology from Appendix C of US Army Corps of Engineers EM 1110-2-1601 (July 1991) is used to calculate the composite roughness coefficient. Each cross section is divided into subsections bounded by vertical lines extending from the water surface to the wetted perimeter. The mean velocity in the vertical of the subsection is given by V_n and the subsection discharge by V_nA_n. As described by Chow (1959), a simplifying assumption that the energy grade line has the same slope across the entire cross section is made. The following proportion is used:

$$V_n \approx \left(C\,R^{1/2}\right)_n$$

where C = Chezy's coefficient
R = hydraulic radius

Chow compares the Chezy formula with the Manning formula, and gives:

$$C = \frac{1.489}{n} R^{1/6}$$

where n = Manning's roughness coefficient

As $(CR^{1/2})_n$ is proportional to V_n, then $(CR^{1/2})_n A_n$ is proportional to Q_n. From this the following equations are derived:

$$Q_n = \frac{Q_T \left(C R^{1/2}\right)_n A_n}{\sum\left[\left(C R^{1/2}\right)_i A_i\right]}$$

$$V_n = \frac{Q_n}{A_n}$$

$$\left(C R^{1/2}\right)_{mean} = \frac{\sum\left[\left(C R^{1/2}\right)_i A_i\right]}{\sum A_i}$$

$$S = \frac{\overline{V}^2}{\left[\left(C R^{1/2}\right)_{mean}\right]^2}$$

$$\overline{R} = \frac{\sum\left[R_i \left(C R^{1/2}\right)_i A_i\right]}{\left[\left(V R^{1/2}\right)_i A_i\right]}$$

where Q_n = discharge in subsection (cfs)

Q_T = total discharge (cfs)

V = flow velocity (fps)

S = energy gradient (ft/ft)

A_i = cross sectional area of element i (ft^2)

R_i = hydraulic radius of cross section element i (feet)

C_i = Chezy coefficient for cross section element i

and the subscript i assumes all values of n.

Since the distribution of velocities is not uniform across channel sections, the velocity head is generally greater than the value computed when using the mean velocity. (Chow, 1959) Therefore a velocity head correction factor is applied when calculating the energy grade line using an average water surface elevation based on a composite roughness coefficient:

$$\alpha = \frac{1}{AV^3}\int_0^A V_x^3 \, dA$$

where α = velocity head correction factor

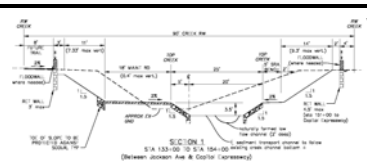
V_x = mean velocity in the vertical at location x (fps)

For computations, this integral may be represented as:

$$\alpha = \frac{A^2 \sum \left[\left(C\,R^{1/2} \right)_n^3 A_n \right]}{\left[\sum \left(C\,R^{1/2} \right)_i A_i \right]^3}$$

Table 5 presents the selection of channel roughness for each conceptual cross section. Detailed spread sheets for each section showing the breakdown of roughness elements, composite roughness calculations and the calculation of velocity head correction factors are included in Appendix A. When evaluating the minimum freeboard criterion of one foot, the energy grade line calculated using the velocity head correction factor is used in lieu of the water surface elevation computed by HEC-RAS.

Table 5
Channel Roughness Coefficients Used for Freeboard Evaluation

Reach		Vegetation	Representative Section	Composite Roughness (Manning's n)	Velocity Head Correction (α)
From	To				
Moss Point Drive	Cunningham Ave			0.040	1.6

HEC-RAS has a built in composite roughness routine wherein roughness estimates for each channel section may be input from station to station. According to the HEC-RAS Hydraulic Reference Manual (USACE 2002), a composite Manning's "n" is calculated using Chow's Equation 6-17:

$$n_c = \left[\frac{\sum_1^N \left(P_N\, n_N^{1.5} \right)}{P} \right]^{2/3}$$

This equation assumes that each part of the cross sectional area has the same mean velocity, which at the same time is equal to the mean velocity of the whole section. This is not an appropriate working assumption for a multi-stage channel with riparian vegetation on one side and dedicated flood flow conveyance on the other. It is noted that the composite roughness estimate for Reach 6B using the HEC-RAS method is about 0.075 using the same roughness elements.

Bend Losses

There are no significant channel bends within Reach 6B.

Transition Losses

An energy loss takes place just upstream and downstream from each structure as flow contracts and expands into and out of a bridge, culvert, or other channel transition. The following contraction and expansion coefficients for channel transitions are used in the hydraulic model (Table 6). Wherever turbulent conditions create the potential for energy loss, contraction and expansion coefficients are increased. Other transitions include channel bends, resting pools, and maintenance access ramps. Contraction and expansion coefficients for Reach 6B will vary depending upon the design of each ramp and transition. For gradual transitions or no transitions between channel sections, the default contraction coefficient (C_i) is 0.1 and the default expansion coefficient (C_o) is 0.3.

Table 6
Contraction and Expansion Coefficients

Transition Type	Contraction	Expansion	Source
Gradual	0.1	0.3	HEC
Warped	0.1	0.2	Chow
Wedge	0.3	0.5	Chow
Square End	0.3	0.75	Chow
Abrupt	0.6	0.80	HEC

Bridge and Culvert Modeling

In addition to the energy required to overcome channel resistance, structures such as bridges and culverts also cause energy losses, which can result in a raised water surface profile. Methods provided by HEC-RAS for analyzing bridges and culverts under low flow and pressurized conditions are employed in the backwater computations.

Several methods are available through HEC-RAS to compute energy losses through a bridge. The "energy only" or standard step method handles a bridge section without piers in the same manner as a natural river section, except that the area between the low chord of the bridge (soffit) and the top of road is subtracted from the total cross-sectional area, and the wetted perimeter is increased where water is in contact with the bridge. Increased frictional resistance due to the added wetted perimeter is included in the energy loss through the structure.

When bridge piers are present, either conservation of momentum may be applied by using a coefficient of drag, or Yarnell's method may be used for subcritical "Class A" low flow through the bridge. Table 7 lists drag coefficients used for the momentum method and pier shape coefficients for Yarnell's low flow bridge loss calculations, respectively.

Table 7
Pier Coefficients

Pier Shape	Drag Coefficient	Pier Coefficient
Semicircular Nose and Tail	1.33	0.90
Multiple Cylinders	1.33	1.00
Triangular Nose and Tail	2.00	1.05
Square Nose and Tail	2.00	1.25

When the computed water surface elevation is above the bridge soffit, a "pressure/weir" feature can compute losses through the structure for pressure (orifice) flow, weir flow over the top, or a combination of both. (For Lower Silver Creek, weir flow over bridges is not allowed.) Changes to the water surface profile resulting from the bridge are calculated based on hydraulic formulae that estimate the change in energy and water surface elevation through the bridge.

Hydraulic Stability

Flood flows can be carried within channels either as subcritical flow or supercritical flow, often referred to as "tranquil" and "rapid" flow, respectively. It is not the velocity of flow, however, that distinguishes the flow regime; rather, the flow regime is defined by how fast the water is moving relative to the velocity of the wave that results from a small disturbance in the water surface. Disturbances in subcritical flow move upstream; disturbances in supercritical flow cannot move upstream because such waves must be swept downstream. The Froude number (F_r), which is analogous to the Mach number for gas flow, is defined as the ratio of stream

$$F_r = \frac{v}{\sqrt{g\,y}}$$

velocity to wave velocity:

where v = stream velocity (feet per second)
g = gravitational acceleration (feet per second squared)
y = water depth (feet)

A Froude number greater than unity signifies supercritical flow (stream velocity greater than wave velocity), while a Froude number less than one indicates subcritical flow. When the Froude number is between 0.8 and 1.2, however, the flow can be unstable, characterized by standing waves and other disturbances that may tend to propagate upstream or downstream depending upon the state of flow. Modifying certain channel parameters such as cross sectional area and bottom slope to obtain a stable flow regime may not be possible, but insofar as practicable, Lower Silver Creek is designed to be hydraulically stable under a range of channel roughness and flow conditions. Reach 6B is heavily influenced by downstream backwater conditions and remains hydraulically stable under nearly all flow conditions.

Because the Froude number depends on channel roughness, and "n" values are expected to vary within any given reach, the specific energy freeboard criterion is maintained to insure that the channel design provides protection against unexpected changes in the flow regime. Backwater conditions from Lower Silver Creek Reach 6A and the high roughness design criterion within Reach 6B are used to establish required freeboard at the upper end of the design channel roughness range. Then normal depth starting conditions and the lower end of channel roughness are simulated to examine channel stability under mixed flow conditions; that is, with both supercritical and subcritical flow. Critical flow is assumed as the upstream boundary condition at Cunningham Avenue for the supercritical flow analysis.

Superelevation

Without a significant channel bend in Reach 6B, flow will not be superelevated.

Hydraulic Performance in Reach 6B

There is nearly one foot of energy loss through the Moss Point Drive culvert, but the energy gradient remains below natural bank elevations upstream to Ocala Avenue. Although there is relatively little energy loss through the Ocala Avenue Bridge, ground elevations at the bank drop another three feet near the upstream reach limit at Cunningham Avenue. Therefore FEMA criteria govern, and floodwall heights approach six feet.

The energy grade line is at elevation 131.2 feet NAVD on the downstream face of the Cunningham Avenue Bridge, which is intended to act as a control for the Lake Cunningham diversion. Earlier hydraulic analyses predicted an energy grade line elevation of 130.8 feet NAVD at this same location. Some changes may need to be made to previous modification plans at the Cunningham Avenue Bridge in concert with a more detailed analysis of Lake Cunningham operation and the reach of Lower Silver Creek between Cunningham Avenue and

Tully Road. Higher water surface elevations in Reach 6B would decrease the base flood discharge in Lower Silver Creek downstream of Cunningham Avenue and the hydraulic performance is somewhat self-correcting.

Profiles and tables that provide the following information for Reach 6B are included as Appendix B and Appendix C respectively:

1. Water surface profiles for the base flood (1%) discharges from Table 3.
2. Natural bank elevations.
3. Whether the design water surface elevation requires a regulatory levee (floodwall).
4. Required floodwall elevations to meet NFIP and District/NRCS freeboard criteria.
5. Preliminary floodwall profiles for design team consideration.

Bridge Headwalls

Flood protection provided by floodwalls must be contiguous wherever natural grades do not provide the required freeboard. This criterion also applies at bridge and culvert structures. If an existing solid concrete bridge headwall is neither present nor sufficiently high to provide the required freeboard, that headwall would need to be built or raised. Table 8 summarizes existing bridge headwall elevations based on Program data. It is recommended that each bridge structure be checked for the increase in uplift (buoyant force) on the bridge superstructure that results from the construction of upstream and downstream floodwalls.

Table 8
Bridge Headwalls

Bridge or Culvert Location	Minimum Existing Headwall Elevation (feet NAVD)	Required Headwall Elevation (feet NAVD)	Required Improvement
Moss Point Drive	133.37	133.40	None
Ocala Avenue	136.22	135.00	None
Cunningham Avenue	137.07	135.00	None

Risk Assessment of Floodwall Overtopping

Given the uncertainty of estimation with respect to hydraulic parameters such as base flood discharge and ultimate design channel roughness, and the goal of providing roughly equivalent levels of protection to properties along Lower Silver Creek, a rudimentary freeboard risk

assessment has been conducted. This assessment is not to the level of the risk-based levee certification procedures put forth by the Army Corps of Engineers and accepted by FEMA, but is intended to provide a level of comfort with respect to the design floodwall elevations.

Two major factors influence the reliability of any flood protection system: the base discharge estimate, and estimates of channel roughness. True risk-based analysis establishes confidence limits for each factor. However, this basis of design focuses on the accuracy of roughness estimation since the 2002 *Final Hydraulics Report* presented a discharge sensitivity analysis based on proposed improvements at Lake Cunningham and found extra available storage in the Lake Cunningham and Big Meadow complex that would essentially limit the maximum peak downstream flow to 3,000 cfs. This value is established as a maximum potential discharge for risk assessment.

The Corps of Engineers has derived a formula to account for variation of the standard deviation with the magnitude of Manning's roughness coefficient for a log-normal probability density function (HEC, 1986):

$$SD = n\sqrt{e^{(.582+.10\ln(n))^2} - 1}$$

In its risk-based procedure, the Corps essentially establishes levee elevations based on the 90 percent chance of conditional non-exceedance. In the standard normal distribution density function, plus or minus 1.65 standard deviations of the mean represents the 90 percent double-sided confidence limit. Therefore, estimates of Manning's roughness coefficient for the various channel elements described by Table 3 have been increased by 1.65 standard deviations and recomposited as described previously. The increased composite roughness estimate of 0.055 is used to regenerate a one-percent water surface profile assuming the maximum discharge of 3,000 cfs. It is noted that the velocity correction factors did not appreciably change as a result of increasing channel element roughness.

As evidenced by the risk assessment table appended to this report (Appendix C), the quasi-90 percent confidence limit water surface elevation is just contained by the proposed floodwalls in Reach 6B and the energy grade line is contained to within 0.1 foot, with the first point of spill during an extreme event at the upstream side of Moss Point Drive.

To be clear, floodwall elevations do not need to be raised for FEMA certification, but this analysis suggests that utilizing the full recommended District freeboard is beneficial to public safety.

SEDIMENT TRANSPORT ANALYSES

Sediment originates from the upland areas of the tributary catchments, and is transported down the natural and concrete-lined channels, with a portion of that transported sediment reaching the outfall at Coyote Creek. Significant volumes of sediment can be deposited within certain reaches of the existing creek channel, particularly at McKee Road, Interstate 680 and above Cunningham Avenue. If this sediment deposition is not properly managed over time, the channel will not perform as designed and could exacerbate the potential for urban flooding.

Sediment transport analyses have been made and transport models have been used to examine channel stability and scour potential, recommend short-term and long-term counter measures against scour, and estimate potential sediment deposition.

Sediment transport functions, including armoring potential, long term bed elevation changes and mass transport are analyzed to determine the required toe protection depth and the proposed locations for cross-channel grade stabilization. The focus of this analysis is to provide design input for the Lower Silver Creek project, and as such, sediment accumulation (i.e. aggradation) is largely ignored quantitatively, although its effects are included in the sediment transport modeling results.

Methodologies

Several methods are employed to estimate scour countermeasure design parameters for the project. These include analyzing armoring potential and long term bed equilibrium slopes using the equations and methodologies presented in the Federal Highway Administration Hydraulic Engineering Circular No. 20 (HEC20), *Stream Stability at Highway Structures*. Sediment transport, including scour and deposition in the channel, is modeling using the HEC-RAS 4.0 sediment transport analysis capability. Each of these methods is described in more detail below.

Both of these methods of analysis have significant limitations, and generally results should be considered relative, instead of absolute. By comparing results from both methods, however, a reasonable understanding of sediment transport and equilibrium conditions within the improved channel can be gained and employed for channel scour protection design.

Data Sources

Parikh Consultants, Inc. obtained bulk samples and prepared gradation curves for bed material from Lower Silver Creek as described in Appendix D. Since bulk samples are not available within Reach 6B, the gradation curve for the most-upstream sample point is used. If anything, upstream sediments are generally coarser, so analyses are conservative.

Low Flow Regimes

Annual sediment management is primarily concerned with sediment transport behavior for low-flow events. One of the Program's goals is to provide for naturally occurring sediment transport within significant reaches of the unlined channel. This section of the report addresses sedimentation during low-flow events and examines the potential for annual sediment loading from influent tributaries.

Sediment Transport Channel

An unlined sediment transport channel has been proposed as a mechanism for providing natural deposition and scour in Lower Silver Creek. As a natural phenomenon, the quantitative geomorphologic behavior of this channel is unpredictable, but since its size and slope will not be significantly different than the existing channel section, past geomorphology is likely to be a good predictor of future conditions, assuming that the average climate remains about the same. For the most part, the existing low-flow channel is straight with some slight meandering in certain reaches. Sediment deposits at the fringes of the open water support emergent wetland vegetation.

Table 9 provides an assessment of bed particle movement within the sediment transport channel in Reach 6B, assuming a full transport channel at 3.5 feet deep. Since the minimum estimated two-year discharge is 600 cfs, there should be some transport of sediment to downstream reaches at least every other year. At earlier Program direction, a roughness coefficient of 0.04 is assumed for the low flow channel bed. Based on the attached grain size distributions for bed sediments, the median particle sizes of bed sediments is about 12mm in the upstream reaches closer to Cunningham Avenue (fine gravel). Further downstream smaller sediment sizes are more prevalent with a median diameter of about 5mm (coarse sand). The critical velocity for incipient sediment motion is calculated as:

$$V_c = K_u \; y^{1/6} \; D^{1/3}$$

where V_c = critical velocity to transport sediment of size D and smaller

y = average depth of flow

D = particle size

K_u = 11.17 (dimensionless)

Table 9
Threshold Discharge for Sediment Transport

Reach Location	Transport Channel Width (feet)	Median Sediment Particle Size (mm)	Discharge with Full Transport Channel (cfs)	Maximum Particle Size Transported (mm)
Moss Point Dr to Ocala Ave	33.5	12	250	2 (25%)
Ocala Ave to Cunningham Ave	33.5	12	125	0.2 (2%)

Based on the bulk sample gradations, a certain percentage of material is likely to be transported when the transport channel is full. These results suggest that the bed in Reach 6B will armor itself (that is, grade so as to increase the median particle size) during low flow conditions and the meandering low flow channel will probably be deeper in more downstream reaches since a higher percentage of the bed particles can be mobilized. Relatively low quantities of fine material will be transported between Lake Cunningham and Ocala Avenue.

Long-Term Stream Stability

Channel stability and sediment modeling is approaching in two ways: via HEC20 methodology and via HEC-RAS sediment transport modeling. The purpose of the stream stability analysis is to predict long term bed degradation and locate in-stream grade control structures to provide long term bed stability. In addition, the analysis seeks to predict in-channel scour during a 100-year storm event, and provide toe protection such that in the event of both long-term bed degradation and scour during a 100-year storm, the channel toes will remain stable.

HEC20 Methodology

HEC20 provides guidelines for identifying stream instability problems at highway-stream crossings. Qualitative and quantitative geomorphic and engineering techniques useful in stream channel stability analysis are presented.

The Lower Silver Creek analysis focuses on post-project conditions, and assumes that bed gradation information in the post-project condition is similar to existing conditions. The two quantitative analyses conducted for this effort include armoring potential and equilibrium slope calculations. Parameters used in this analysis are from the HEC-RAS steady state 'scour' analysis, which assumes the two-year discharge as the effective discharge (i.e. the discharge that transports the largest proportion of the annual sediment load over the long-term; generally thought to occur on average about every one to two years) and no established channel vegetation.

Clear water is also conservatively assumed for design; that is, there is no upstream sediment supply. This is an appropriate assumption given the deposition of sediment upstream of Cunningham Avenue.

The channel bed may armor itself as non-moving coarser particles segregate from the finer from the finer material in transport. The coarser particles are gradually worked down into the bed, where they accumulate in a sublayer. Fine bed material is leached up through this coarse sublayer to augment the material in transport. As sediment movement continues and degradation progresses, an increasing number of non-moving particles accumulate in the sublayer. Eventually, enough coarse particles can accumulate to shield, or 'armor' the bed surface.

The first step in determining armoring potential is to calculate the critical diameter size. This is defined as the particle size at which a slight increase in the hydraulic forces will cause the particle to move. The following critical diameter equation is developed from the Shields diagram:

$$D_c = \frac{\tau_o}{K_s(\gamma_s - \gamma)}$$

where D_c = Diameter of sediment particle at incipient motion (ft)

τ_o = Boundary shear stress (lb/ft^2)

γ = Specific weight of water, 62.4 lb/ft^3

γ_s = Specific weight of sediment, 165.4 lb/ft^3

K_s = Dimensionless Shields parameter, 0.045 for sandy beds (Knighton)

For sand sizes, the base value of Manning's n is representative of the grain resistance and the shear stress can be computed from:

$$\tau_o = \frac{n^2 V^2 \gamma}{K_u^2 R^{(1/3)}}$$

where n = Manning's roughness coefficient

V = Average channel velocity (ft/s)

R = Hydraulic Radius

K_u = 1.686 (English units)

A different equation for shear stress is provided in HEC20 for gravel and larger grained beds. After comparing both methods, the equation based on sandy bed material is found to produce the most reasonable results.

HEC20 states that if at least five percent of the bed material is larger than the critical size (i.e. if $D_c < D_{95}$) armoring may occur. Using the bed material gradation curves described previously, it is determined that the majority of cross sections through the project reach do not have the potential to form an armoring layer.

The depth of degradation that would need to occur to form an armor layer can be calculated by:

$$Y_{sarmor} = y_a \left(\frac{1}{P_c} - 1 \right)$$

where: Y_{sarmor} = depth of degradation of scour required to form the armor layer (ft)

y_a = thickness of the armor layer

P_c = decimal fraction of material coarser than the critical particle size

An armoring layer is predicted within Reach 6B at shallow depths of scour. This layer will help counteract scour forces. The armoring layer may become unstable during extreme discharge events, however, and is therefore not relied upon when investigating event-based bed degradation.

Long Term Bed Changes

Conservatively assuming clear water conditions, combining the incipient motion equation and the Manning equation results in an estimate of the equilibrium slope where bed material movement ceases:

$$S_{eq} = \left[K_s D_c \left(\frac{\gamma_s - \gamma}{\gamma} \right) \right]^{(10/7)} \left(\frac{K_u}{qn} \right)^{(6/7)}$$

Parameters in this equation not previously defined include:

S_{eq} = Channel slope at which particles D_c will no longer move

q = Channel discharge per unit width (ft^2/s).

(This equation assumes that the channel width remains constant in future conditions.)

Using the two-year effective discharge, long-term equilibrium slopes are calculated at each cross section, and an average equilibrium slope between hard bed controls is determined. The calculated equilibrium slope is compared to the existing slope to locate new bed control structures either based on channel form (i.e. just downstream of tributary locations), or placed at relatively equal intervals in a reach subject to long term degradation. Average equilibrium slope is re-calculated based on the location of the new proposed grade control structures, and sill elevations determined based on the upstream and downstream equilibrium slopes to limit the maximum long-term degradation in the low flow invert to no more than one foot at each grade control location (District direction).

Table 10 lists all major grade control structures, additional recommended grade control structures and their station locations, recommended buried sill elevations, the depth of initial bury, and the predicted long term bed drop on the downstream side of each grade control structure.

Table 10
Grade Control Structures

Grade Control Structure	Station Location of Grade Control Structure	Top of Sill Elevation (feet NAVD)	Initial Bury Depth (foot)	Maximum Predicted Drop on Downstream Side (foot)
Moss Point Drive Culvert	217+80	116.09	0.00	0.3
Lateral Rock Sill	232+00	117.30	0.00	0.4
Lateral Rock Sill	243+58	118.10	0.70	0.0
Rock at Cunningham Avenue	244+62	121.06	0.00	0.0

Lateral rock sills may be constructed of ¼ ton rock riprap and must tie into the longitudinal rock slope protection described subsequently. The bottom elevation of each sill shall be no higher than the adjacent longitudinal rock slope protection toe-down depth. To accommodate additional local scour holes on the downstream side of each sill, it is recommended that the transverse rock depth be one to two feet deeper than the adjacent longitudinal rock slope protection.

100-year Scour Analysis

Sediment transport throughout the project reach is modeling using HEC-RAS 4.0 (Beta). Input parameters to the sediment transport modeling include:

- Bed gradation curves;
- Quasi-unsteady flow;

- Sediment load entering the modeled reach;
- Boundary condition at downstream limit of the model;
- Movable bed limits;
- Maximum scour depth;
- Transport function;
- Sorting method; and
- Fall velocity method.

Bed gradation curves are provided by Parikh Consultants as described above. Bulk Sample "C", which was taken upstream of Murtha Drive is used to represent the grain size characteristics of upstream bed sediments. It is assumed that post-project bed material will be similar in size and distribution to existing conditions.

Quasi-unsteady flow is also required to run the sediment transport model within HEC-RAS. In the quasi-unsteady flow editor, flow, duration of flow, and computation interval may be specified. For the 100-year analysis, HEC-1 results from the 2002 *Final Hydraulic Report* are utilized. The peak six hours of runoff is run in 10-minute durations identical to the HEC-1 output. The time leading up to and after the peak is input as 1-hour duration data with a 10-minute computation interval to aid in model stability and result compilation. A plot of the quasi-unsteady flow data at the most upstream cross section (Sta 245+13) is shown as Figure 3. Similar to adjustments in channel flow for the steady state model, lateral quasi-unsteady inflow hydrographs are provided at stations 202+00, 170+00, 130+00, 88+63, 41+00, and 20+75. Twenty four hour antecedent and post-event flows of 100 cfs are added to the flow data. This also adds numerical stability to the model results.

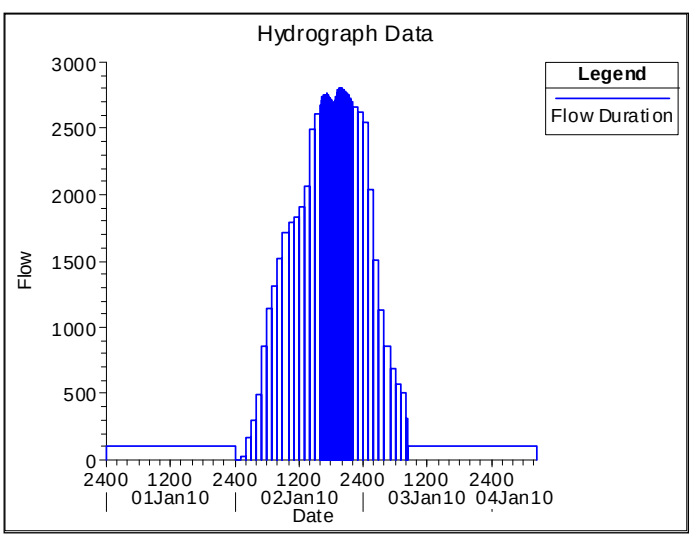


Figure 3: 100-yr Flow Hydrograph for Sediment Transport Analysis

An iterative process suggests the model is not sensitive to incoming sediment load for the 100-year event. Because of the unsteady nature of the flow data, normal depth is used as a downstream boundary condition, with a downstream hydraulic gradient of 0.004 foot per foot.

The project includes rock slope protection for the low flow channel and an engineered access road on the floodplain bench. It is assumed that the primary bed movement will occur in the low flow/sediment transport channel rather than on the upper banks above the access road elevation. As such movable bed limits throughout the project reach are set at the toes of the rock slope protection.

Setting the maximum allowable scour depth to zero where grade control (i.e. a culvert or rock rip-rap) exists produces numerical model instability and unreasonable results immediately downstream of bed control structures. Universally allowing ten feet of scour throughout the model creates a more stable model and more reasonable results. Thus scour predicted at hardened grade control locations is ignored.

Yang's sediment transport function is found to produce the most consistent and stable results among the applicable transport functions, and is also considered to be a reasonable transport function given the size of material sampled from the bed. (It is note that HEC-RAS has updated the Yang function to include the gravel range of sediment.) Default sorting method (Exner 5) and fall velocity (Ruby) functions are utilized.

The resulting bed profile through the project reach at the beginning and end of the simulation is shown in Figure 4. Figure 5 shows the bed invert change through the project reach. The maximum depth of scour experienced within the project reach is about 2.5 feet.

It should be noted that sediment modeling within HEC-RAS includes many uncertainties and assumptions. As such, model results should be seen a predictive of general trends and useful in a relative sense, but values should not pre-interpreted as literal or absolute. Some margin for safety is required and appropriate for local scour and the uncertainty of estimate.

It may also be noted that equilibrium slopes for the 100-year discharge have been calculated assuming the design locations and depths of lateral rock sills that are based on the long-term bed degradation calculations (that is, with the effective discharge). Maximum scour depths calculated using this HEC20 methodology tend to be less than maximum scour depths calculated using HEC-RAS sediment transport modeling, so the HEC-RAS results have been used to establish the maximum design scour depth.

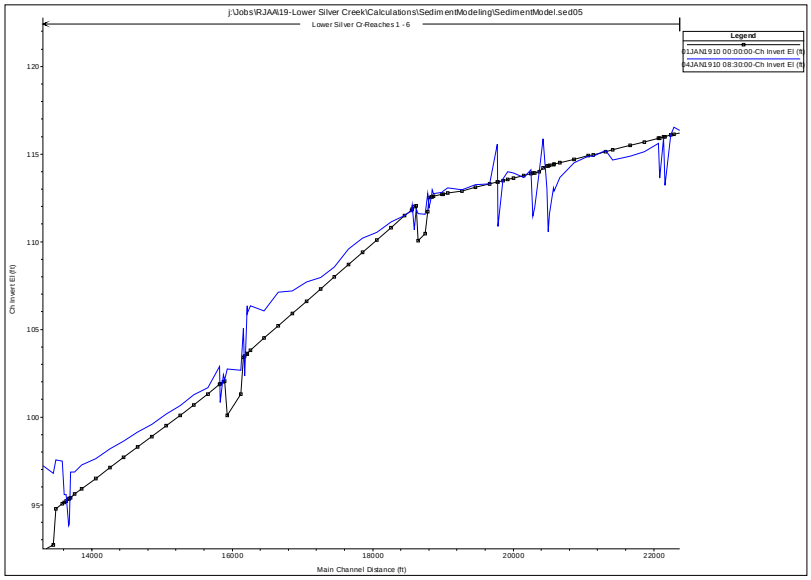


Figure 4: Channel Bed Profile after 100-Year Storm Event

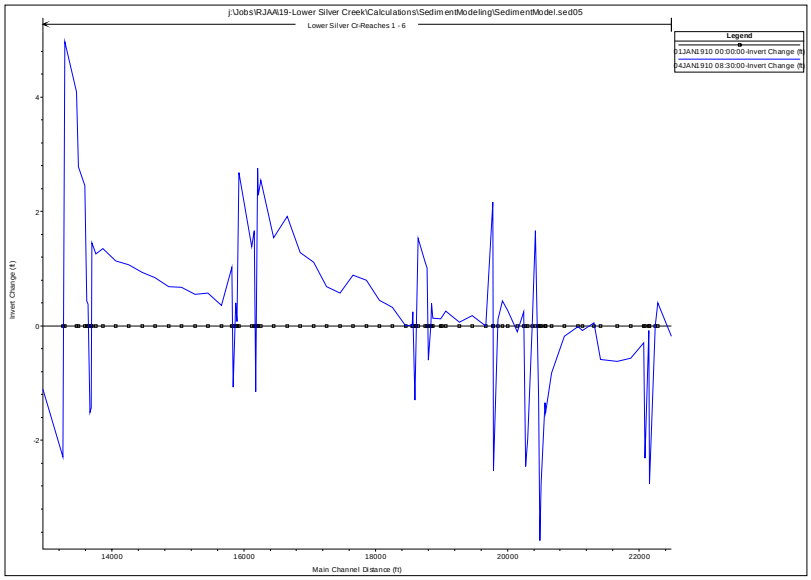


Figure 5: Channel Bed Invert Change after 100-Year Storm Event

Longitudinal Rock Slope Protection

When also considering the long-term bed degradation predicted above, the total estimated 100-year maximum scour depth is about 3.2 feet in Reach 6B and 4.2 feet within Reach 5. For design consistency with other reaches and given the previously described uncertainty with respect to sediment transport modeling, a five-foot deep rock slope protection toe down trench is recommended, as measured from the bed of the bed of the sediment transport channel.

The California Department of Transportation RSP method, as set forth in the NRCS Technical Supplement 14C, is used for rock slope protection sizing:

$$W = \frac{0.00002}{(G_S - 1)^3} \times \frac{VM \times V^6 \times G_S}{\sin^3(r - a)}$$

where	W	=	minimum rock weight (lb)
	V	=	velocity (ft/s)
	VM	=	0.67 if parallel flow
	VM	=	1.33 if impinging flow
	G_S	=	specific gravity of rock (typically 2.65)
	r	=	angle of repose (70° for randomly placed rock)
	a	=	outside slope face angle to the horizontal (typical max. of 33° for 1.5 to 1 bank slopes)

Variables are chosen to represent the worst case scenario for the entire reach. This occurs within the downstream transition from Cunningham Avenue at cross section 244+62 where the 100-year flow velocity is approximately 11.8 feet per second when the assumed Manning's n value is 0.020 (before vegetation is established). Flow is parallel to the rock slope protection which has an outside slope face angle of 33.3 degrees. The specific gravity of rock and the angle of repose are as stated as typical. This results in a minimum rock weight of 100 pounds. Therefore, the minimum quarter-ton rock size as recommended by the Program is adequate to protect the side slopes of the low-flow channel from scour under the most demanding hydraulic conditions in Reach 6B. Figure 6 excerpts a typical NRCS rock slope protection detail from the National Engineering Handbook.

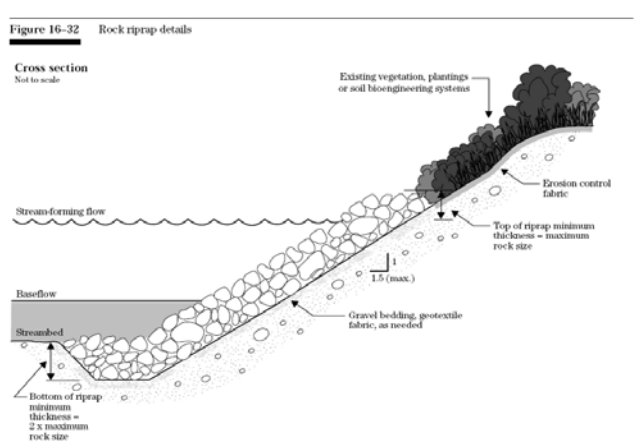


Figure 6: NRCS Rock Slope Protection Detail (NEH)

Preventing Maintenance Road Washout

Outside of the bridge and culvert transitions, where the maintenance ramps will be concrete, the highest flow velocity over the maintenance road depends on the channel section, flow conditions, and the extent of vegetation growth in both the flood conveyance area and in the riparian habitat area. As that vegetation matures and flow retardance in those channel elements increases, more and more of the channel discharge will be carried above the maintenance road with a concomitant increase in flow velocity. The USACE method of estimating a composite channel roughness is used to examine the velocity of flow over the maintenance road using a design Manning's "n" value of 0.025 for clean crushed rock, using Strickler's formula. The maximum flow velocity over the maintenance road is about 6 feet per second and the required rock size by reach to resist movement along the maintenance road is 0.5 pound, applying the Caltrans rock slope protection sizing method described previously. This is equivalent to 1-inch crushed rock.

Short Term Channel Stability

The NRCS criterion for post-construction conditions is to leave a channel that will be stable if it experiences the ten-year discharge immediately after construction. Consequently a ten-year water surface profile has also been calculated assuming as-built channel conditions.

The as-built channel condition assumes that longitudinal rock slope protection is in place to protect the channel bed from scour, the gravel maintenance road is constructed, and exposed earthen banks are hydroseeded and covered with a biodegradable erosion control blanket such as North American Green's C125 BioNet (BN) double net coconut mesh. According to the manufacturer's literature, a Manning's roughness coefficient of 0.018 may be assumed in the unvegetated condition, which is equivalent to Chow's minimum n value for clean excavated earth after weathering.

The USACE composite method for channel roughness yields a Manning's coefficient of 0.020 for the as-built condition previously described. HEC-RAS indicates that the highest velocity section for short-term stability where bare earth will be exposed is near Ocala Avenue, and the maximum channel shear stress at any location is about 0.5 psf. The depth of flow in the critical reach is approximately 11.5 feet and the flow velocity over the exposed earthen bench is 4.8 feet per second. The C125BN blanket is rated for 2.35 psf maximum shear and a maximum flow velocity of ten feet per second and if properly installed, will provide adequate protection against short-term scour before vegetation is established, in conformance with the NRCS stability criterion.

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APPENDIX A

COMPOSITE ROUGHNESS CALCULATIONS

Coyote Watershed Program
Lower Silver Creek Reaches 1 thru 6
Composite Roughness Calculations Using USACOE EM 1110-2-1601 Methodology

Reach 6B - Moss Point Drive to Cunningham Avenue
Station 217+80 to Station 244+62

Total Discharge	**2,810**	cfs
Design Depth	**14.00**	feet

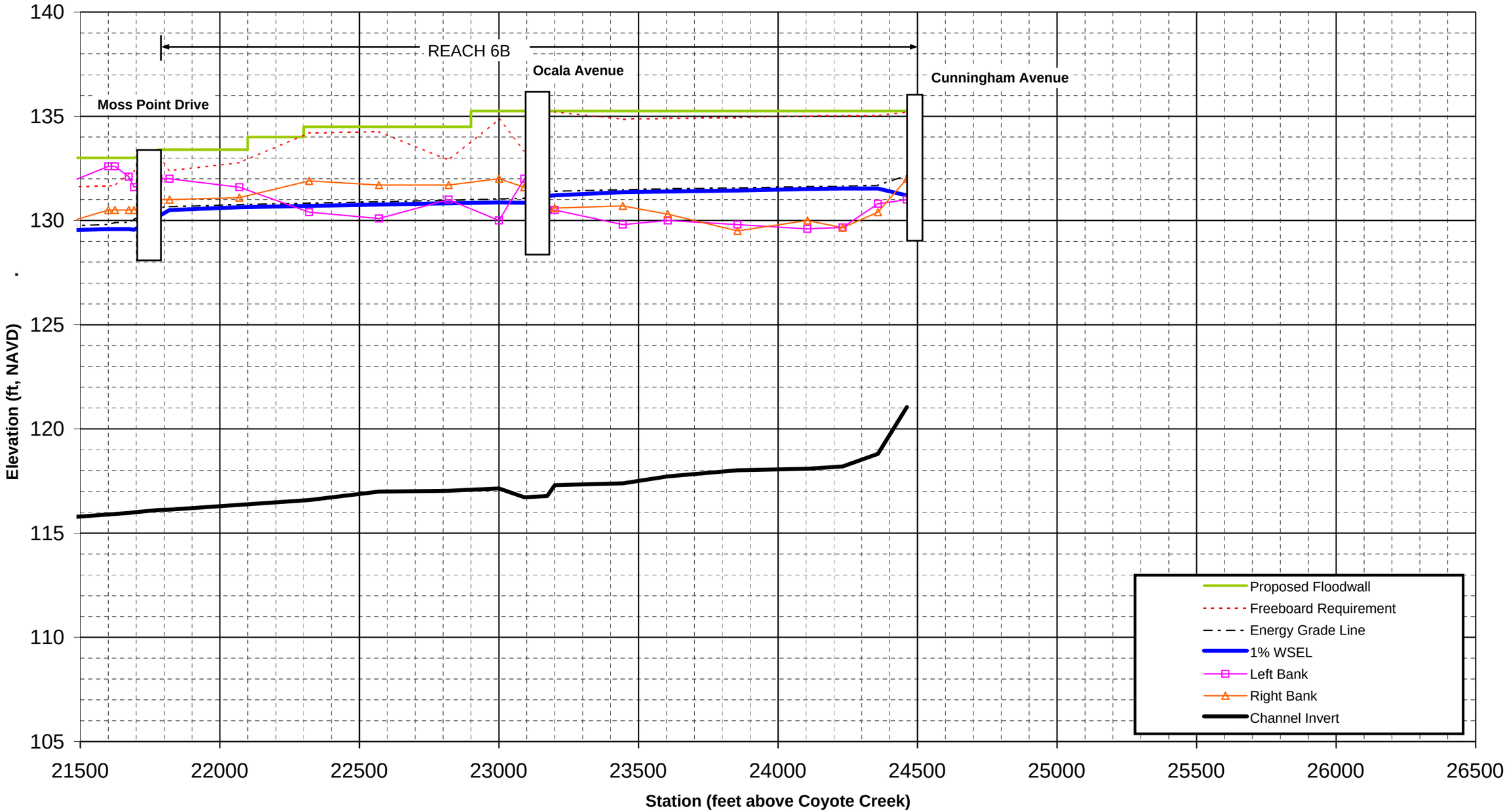
Element	n_i	A_i	P_i	R_i	C_i	$C_iR_i^{1/2}A_i$	Q_i	V_i	$C_iR_i^{3/2}A_i$	$(C_iR_i^{1/2})^3 A_i$
Left Bank	0.040	82.69	18.93	4.37	47.50	8,209	162	1.96	35,858	80,897,310
Maintenance Road	0.030	189.00	18.00	10.50	73.30	44,890	887	4.69	471,348	2,532,404,441
Wetland Bank	0.060	64.31	6.31	10.19	36.47	7,488	148	2.30	76,320	101,500,786
Low Flow Channel	0.040	322.00	23.00	14.00	57.67	69,486	1,373	4.26	972,810	3,235,850,119
Wetland Bank	0.060	64.31	6.31	10.19	36.47	7,488	148	2.30	76,320	101,500,786
Riparian Bench	0.150	52.50	5.00	10.50	14.66	2,494	49	0.94	26,186	5,627,565
Right Bank	0.150	82.69	18.93	4.37	12.67	2,189	43	0.52	9,562	1,534,053
Summation		857.50				142,244	2,810		1,668,404	6,059,315,059

Average Velocity	3.28	fps
$CR^{1/2}_{mean}$	165.88	
R_{mean}	11.73	feet
S_{mean}	0.000390	ft/ft
α	1.55	
Effective Velocity	4.08	
Effective n	0.037	

APPENDIX B

WATER SURFACE PROFILES FOR THE BASE FLOOD

Lower Silver Creek
Profiles for Reach 6B
Based on Cross Sections Provided by Program



APPENDIX C

FREEBOARD EVALUATION AND PROPOSED FLOODWALL ELEVATIONS

LOWER SILVER CREEK REACH 6B

HYDRAULIC SUMMARY FOR PROPOSED CHANNEL IMPROVEMENTS

	Channel Parameters					With Program Cross Sections					Program Freeboard Requirements				Risk Assessment					
Location	River Station	Length	Channel Invert	LOB Elev[1]	ROB Elev[1]	1% WSEL	Chan Velocity	α	E.G. Elev	Froude Number	FEMA Levee Condition?	Hydraulic Depth	$0.2(D+\alpha V^2/2g)$	Freeboard Line	90%tile 1% WSEL	Chan Velocity	E.G. Elev	Bank or Proposed Floodwall	Remaining Freeboard	Energy Containment
		(feet)	(NAVD)	(NAVD)	(NAVD)	(NAVD)	(fps)		(NAVD)			(ft)	(ft)	(NAVD)	(NAVD)	(fps)	(NAVD)	(NAVD)	(feet)	(feet)
Moss Point Drive	21780	87	116.11	132.0	131.0	130.20	5.25	1.0	130.63	0.25	NO	14.09	2.90	133.10	133.24	4.27	133.52	133.50	0.26	-0.02
Start Reach 6B	21820	40	116.13	132.0	131.0	130.50	3.20	1.0	130.66	0.18	NO	9.30	1.89	132.39	133.44	2.58	133.54	133.50	0.06	-0.04
	22070	250	116.36	131.6	131.1	130.64	2.60	1.2	130.77	0.14	NO	10.52	2.13	132.77	133.53	2.17	133.62	133.50	-0.03	-0.12
	22320	250	116.59	130.4	131.9	130.70	2.67	1.2	130.83	0.15	YES	10.37	2.10	134.20	133.56	2.23	133.65	134.50	0.94	0.85
	22570	250	116.99	130.1	131.7	130.76	2.73	1.2	130.90	0.15	YES	10.17	2.06	134.26	133.59	2.27	133.69	134.50	0.91	0.81
	22820	250	117.03	131.0	131.7	130.83	2.76	1.2	130.97	0.15	NO	10.15	2.06	132.89	133.62	2.30	133.72	134.50	0.88	0.78
	23000	180	117.14	130.0	132.0	130.87	2.97	1.2	131.03	0.16	YES	10.14	2.06	134.87	133.65	2.48	133.76	135.25	1.60	1.49
	23091	91	116.72	132.0	131.6	130.85	3.71	1.0	131.06	0.19	NO	12.27	2.50	133.35	133.63	3.19	133.79	135.25	1.62	1.46
Ocala Avenue	23173	82	116.78	130.5	130.6	131.17	3.63	1.0	131.37	0.18	YES	12.53	2.55	135.17	134.09	3.09	134.24	135.25	1.16	1.01
	23200	27	117.30	130.5	130.6	131.21	3.28	1.2	131.41	0.18	YES	10.70	2.18	135.21	134.13	2.72	134.27	135.25	1.12	0.98
	23444	244	117.39	129.8	130.7	131.36	2.48	1.2	131.47	0.13	YES	10.80	2.18	134.86	134.24	2.09	134.32	135.25	1.01	0.93
	23605	161	117.72	130.0	130.3	131.39	2.53	1.2	131.51	0.14	YES	10.61	2.15	134.89	134.27	2.12	134.35	135.25	0.98	0.90
	23855	250	118.02	129.8	129.5	131.44	2.60	1.2	131.57	0.14	YES	10.74	2.17	134.94	134.29	2.18	134.38	135.25	0.96	0.87
	24105	250	118.09	129.6	130.0	131.51	2.46	1.2	131.62	0.13	YES	10.81	2.18	135.01	134.33	2.08	134.41	135.25	0.92	0.84
	24231.5	127	118.20	129.7	129.7	131.53	2.48	1.2	131.64	0.13	YES	10.71	2.16	135.03	134.34	2.10	134.42	135.25	0.91	0.83
	24358	127	118.80	130.8	130.4	131.53	3.13	1.0	131.68	0.18	YES	9.43	1.92	135.03	134.34	2.57	134.44	135.25	0.91	0.81
	24462	104	121.05	131.0	132.0	131.20	7.91	1.0	132.17	0.44	YES	10.15	2.22	135.20	134.13	6.55	134.80	135.25	1.12	0.45
Cunningham Avenue																				

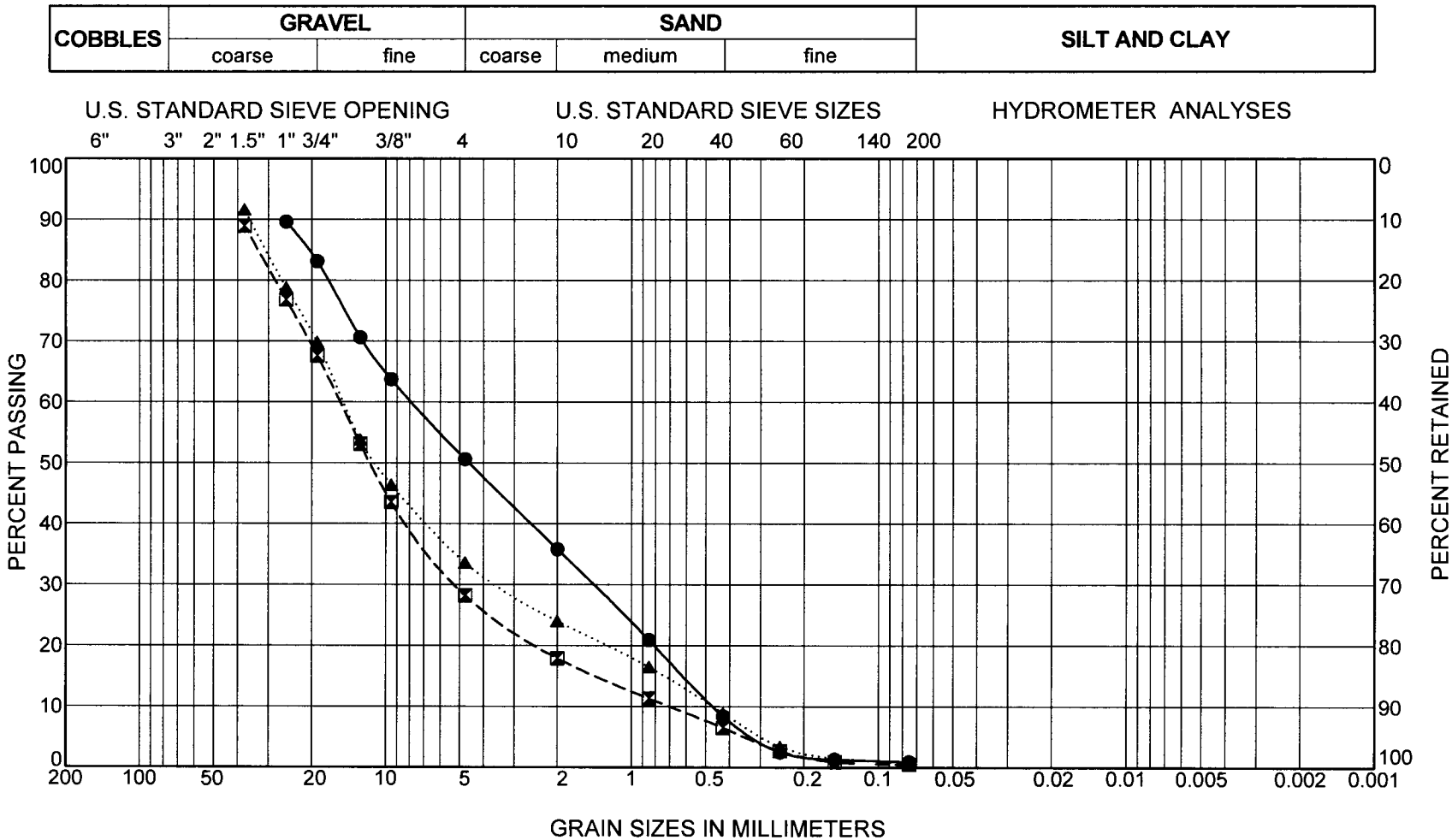
[1]Containment Elevation at Right-of-Way

LOWER SILVER CREEK REACH 6B								
PROPOSED FLOODWALL ELEVATIONS								
Location	River Station	Length (feet)	Freeboard Line (NAVD)	LOB Elev[1] (NAVD)	ROB Elev[1] (NAVD)	Proposed Top of Floodwall (NAVD)	Left Wall Height (feet)	Right Wall Height (feet)
Moss Point Drive	21780	87	133.10	131.6	130.5	133.40	1.8	2.9
Start Reach 6B	21820	40	132.39	131.8	131.0	133.40	1.6	2.4
	22070	250	132.77	131.1	131.1	133.40	2.3	2.3
	22100					133.40		
	22100					134.00		
	22300					134.00		
	22300					134.50		
	22320	250	132.80	131.6	132.2	134.50	2.9	2.3
	22570	250	132.82	131.6	132.1	134.50	2.9	2.4
	22820	250	132.89	131.5	132.1	134.50	3.1	2.4
	22900					134.50		
	22900					135.25		
	23000	180	132.93	131.0	132.0	135.25	4.3	3.3
	23091	91	133.35	131.0	131.6	135.25	4.3	3.7
Ocala Avenue	23173	82	135.17	129.6	130.6	135.25	5.6	4.6
	23200	27	135.21	130.2	130.9	135.25	5.1	4.4
	23444	244	134.86	129.2	131.5	135.25	6.0	3.7
	23605	161	134.89	129.3	132.0	135.25	6.0	3.3
	23855	250	134.94	129.3	129.3	135.25	6.0	6.0
	24105	250	135.01	129.5	129.7	135.25	5.8	5.6
	24231.5	127	135.03	129.7	129.7	135.25	5.6	5.6
	24358	127	135.03	130.8	129.9	135.25	4.4	5.3
	24462	104	135.20	131.0	132.0	135.25	4.3	3.3
Cunningham Avenue								

APPENDIX D

SEDIMENT TRANSPORT ANALYSES

GRAIN SIZE DISTRIBUTION CURVES



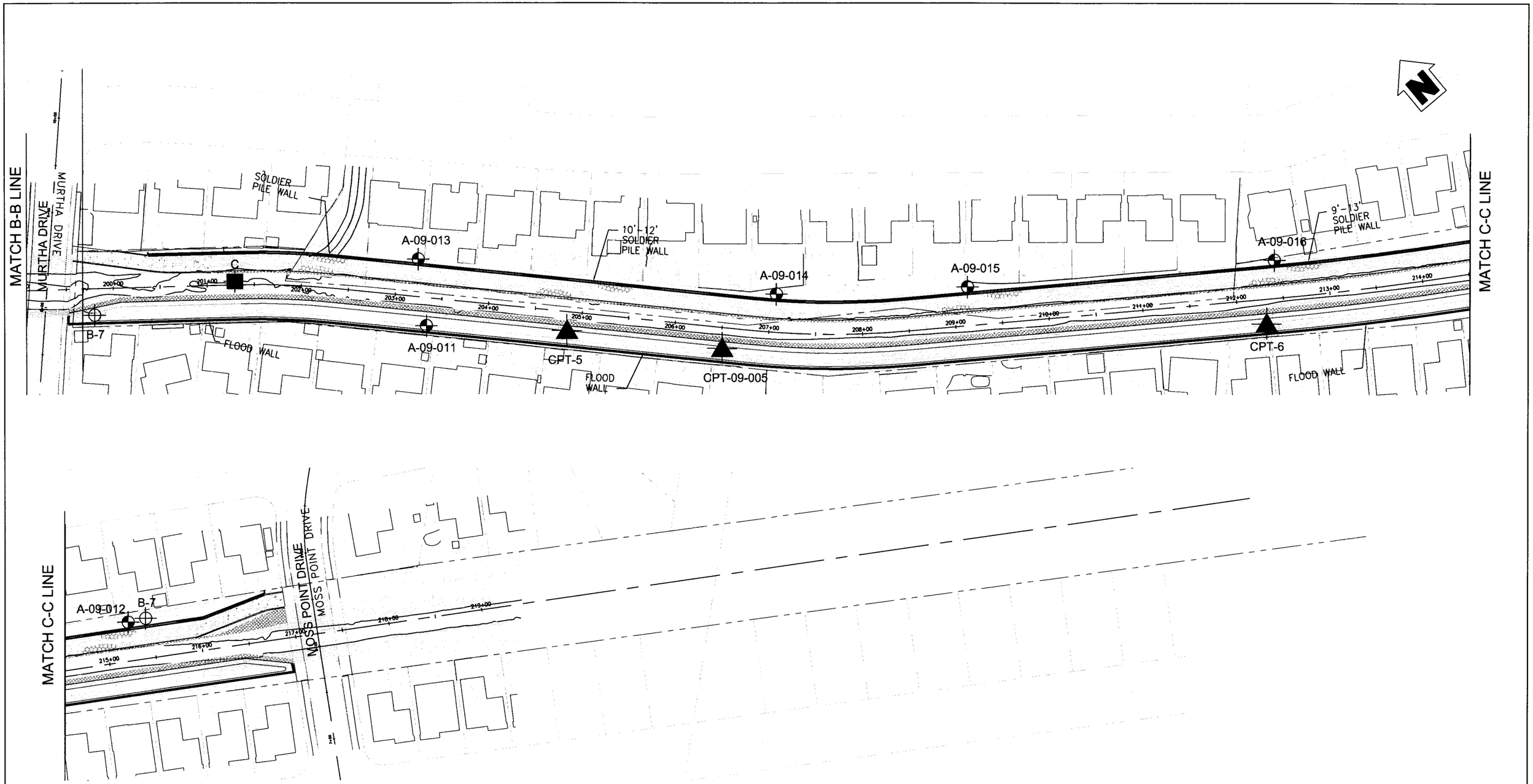
Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A	1	5.0	●			SILT (ML)
B	1	5.0	⊠			SILT (ML)
C	1	5.0	▲			SILT (ML)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

LOWER SILVER CREEK REACHES
CITY OF SAN JOSE, CALIFORNIA

JOB NO: 200116.10

PLATE NO: B-3



LEGEND

A-09-005 — Approximate boring location drilled in 2009 by Parikh.

B-2 — Approximate boring location drilled in 2000 by GTC.

CPT-09-003 — Approximate Cone Penetration Test location perfomed in 2009 by Parikh.

CPT-1 — Approximate Cone Penetration Test location perfomed in 2000 by GTC.

C — Approximate Bulk Sample location perfomed in 2010 by Parikh.

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by RJA.

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

LOWER SILVER CREEK REACHES 4, 5 & 6A
SAN JOSE, CALIFORNIA

JOB NO.:200116.PSE

PLATE NO: 2D

Equilibrium S

This Analysis Assumes Case1: No Sediment Supply From upstream

q: Channel discharge per unit width

62.4	Specific Weight of Water = Specific Density of Water, lbs/cubic Foot
2.65	Specific Gravity of Stream Bed (= Density of material / density of Water)
0.045	Ks, Shields Parameter (Knighton, p. 109)
165.36	Specific Weight of Stream Bed
1.486	Ku: Units Conversion, English

$$D_c = \frac{\tau_o}{K_s(\gamma_s - \gamma)}$$

$$\tau_o = \frac{n^2 V^2 \gamma}{K_u^2 R^{(1/3)}}$$

$$S_{eq} = \left[K_s D_c \left(\frac{\gamma_s - \gamma}{\gamma}\right)\right]^{(10/7)} \left(\frac{K_u}{qn}\right)^{(6/7)}$$

River Sta	Q Total	Invert Slope	Min Ch El	Length Chnl	q	Boundary Shear Stress (To)	Dc	Seq	Long Term Bed Direction	Grade Control Locations	
	(cfs)		(ft)	(ft)	(cfs/ft)					Ex.Control Pt	
12612	Culvert	0	0	0							
12794	778	0.0008	94.55	362	17.7	0.05	0.01	0.0002	Degredation		
12825	778	-0.071	92.34	31	9.7	0.00	0.00	0.0000	Agg		
13000	778	0.002	92.69	175	9.7	0.01	0.00	0.0000	Degredation		
13035	778	0.0597	94.78	35	11.4	0.02	0.00	0.0001	Degredation		
13081	Culvert	0	0	0					**JACKSON**		
13126	778	0.003	95.05	91	11.4	0.02	0.01	0.0001	Degredation	**93.05**	
13156	778	0.003	95.14	30	12.2	0.03	0.01	0.0002	Degredation		
13176	778	0.003	95.2	20	17.6	1.77	0.38	0.0232	Agg		ck
13212	778	0.0031	95.31	36	27.6	1.31	0.28	0.0103	Agg	Equilibrium Slope: 0.0055	0.0054
13228	778	0.0031	95.36	16	31.9	0.89	0.19	0.0052	Agg	Existing Slope: 0.0031	
13240	778	0.0033	95.4	12	16.1	0.49	0.10	0.0039	Agg		
13300	778	0.0033	95.6	60	15.8	0.38	0.08	0.0029	Degredation		
13400	778	0.003	95.9	100	15.7	0.38	0.08	0.0028	Degredation		
13600	778	0.003	96.5	200	15.8	0.38	0.08	0.0029	Degredation		
13800	778	0.003	97.1	200	15.8	0.38	0.08	0.0029	Degredation		

River Sta	Q Total	Invert Slope	Min Ch El	Length Chnl	q	Boundary Shear Stress (To)	Dc	Seq	Long Term Bed Direction	Grade Control Locations					
												LT Scour at Sill	Pk Scour	Sill Cover	
14000	778	0.003	97.7	200	15.8	0.38	0.08	0.0029	Degradation						
14200	**778**	**0.003**	**98.3**	**200**	**15.8**	**0.38**	**0.08**	**0.0029**	**Degradation**		98.9	**97.5**	-1.4	1.9	0.8
14400	778	0.003	98.9	200	15.8	0.38	0.08	0.0029	Degradation						1.4
14600	778	0.003	99.5	200	15.8	0.38	0.08	0.0029	Degradation						
14800	778	0.003	100.1	200	15.8	0.38	0.08	0.0029	Degradation					ck	
15000	778	0.003	100.7	200	15.8	0.38	0.08	0.0029	Degradation			Equilibrium Slope:	0.0020	0.0020	
15200	778	0.003	101.3	200	15.8	0.38	0.08	0.0029	Degradation			Existing Slope:	0.0030		
15365	778	0.0034	101.86	165	15.8	0.42	0.09	0.0032	Degradation						
15376	778	0.0036	101.9	11	15.5	0.25	0.05	0.0016	Degradation						
15419	778	0.0023	102	43	20.7	0.16	0.04	0.0007	Degradation						
15439	778	0.0025	102.05	20	18.3	0.11	0.02	0.0004	Degradation						
15469	778	-0.066	100.08	30	19.0	0.02	0.00	0.0001	Agg	**100.08**					
15578	Culvert	0	0	0					**CAP EX.**						
15668	778	0.0061	101.3	199	18.9	0.04	0.01	0.0001	Degradation	**101.3**					
15700	778	0.0659	103.41	32	23.0	0.54	0.12	0.0051	Degradation					ck	
15720	778	0.0035	103.48	20	25.8	1.26	0.27	0.0102	Agg			Equilibrium Slope:	0.0049	0.0049	
15754	778	0.0032	103.59	34	30.1	0.99	0.21	0.0064	Agg			Existing Slope:	0.0116		
15760	778	0.005	103.62	6	18.5	0.53	0.12	0.0040	Degradation						
15800	778	0.0045	103.8	40	17.6	0.49	0.11	0.0037	Degradation						
16000	778	0.0035	104.5	200	15.6	0.40	0.09	0.0031	Degradation						
												LT Scour at Sill	Pk Scour	Sill Cover	
16200	778	0.0035	105.2	200	16.3	0.43	0.09	0.0033	Degradation						
16400	**778**	**0.0035**	**105.9**	**200**	**16.3**	**0.44**	**0.09**	**0.0033**	**Degradation**		104.9	**104.9**	0.0	3.5	1.0
16600	778	0.0035	106.6	200	16.4	0.44	0.09	0.0033	Degradation			Equilibrium Slope:	0.0033	0.0033	
16800	778	0.0035	107.3	200	16.4	0.44	0.09	0.0033	Degradation			Existing Slope:	0.0035		
17000	**778**	**0.0035**	**108**	**200**	**16.4**	**0.44**	**0.09**	**0.0033**	**Degradation**		**107.0**	106.9	0.1	3.6	1.0
17200	684	0.0035	108.7	200	13.7	0.27	0.06	0.0020	Degradation			Equilibrium Slope:	0.0027	0.0027	
17400	684	0.0035	109.4	200	15.7	0.39	0.08	0.0029	Degradation			Existing Slope:	0.0035		
17600	**684**	**0.0035**	**110.1**	**200**	**16.9**	**0.43**	**0.09**	**0.0032**	**Degradation**		**109.1**	108.6	0.5	4.0	1.0
17800	684	0.0035	110.8	200	17.2	0.45	0.10	0.0033	Degradation			Equilibrium Slope:	0.0017	0.0017	
18000	684	0.0035	111.5	200	17.3	0.45	0.10	0.0033	Degradation			Existing Slope:	0.0037		
18087	684	0.0029	111.78	97	15.1	0.37	0.08	0.0028	Degradation						

River Sta	Q Total	Invert Slope	Min Ch El	Length Chnl	q	Boundary Shear Stress (To)	Dc	Seq	Long Term Bed Direction	Grade Control Locations					
18100	684	0.0054	111.85	13	13.7	0.25	0.05	0.0017	Degredation						
18128	684	0.0054	112	28	16.1	0.11	0.02	0.0005	Degredation						
18148	684	0.0015	112.03	20	14.6	0.07	0.02	0.0003	Degredation						
18176	684	-0.07	110.08	28	13.3	0.01	0.00	0.0000	Agg	**110.08**					
18230	Culvert	0	0	0					**STORY**						
18284	684	0.0034	110.45	108	12.9	0.02	0.00	0.0001	Degredation	**110.45**					
18315	684	0.041	111.72	31	13.3	0.02	0.00	0.0001	Degredation						
18335	684	0.041	112.54	20	13.2	0.10	0.02	0.0005	Degredation						
18374	684	0.0008	112.57	39	13.4	0.21	0.05	0.0014	Agg			Equilibrium Slope:	0.0014	0.0014	
18381	684	0.0014	112.58	7	14.3	0.26	0.06	0.0018	Agg			Existing Slope:	0.0099		
18400	684	0.0011	112.6	19	15.5	0.33	0.07	0.0023	Agg						
18516	684	0.0009	112.7	116	13.4	0.24	0.05	0.0017	Agg						
18536	684	0.001	112.72	20	12.7	0.24	0.05	0.0017	Agg						
18600	684	0.0013	112.8	64	12.6	0.22	0.05	0.0016	Agg			LT Scour at Sill	Pk Scour	Sill Cover	
18800	**684**	**0.0005**	**112.9**	**200**	**12.5**	**0.17**	**0.04**	**0.0011**	**Agg**		111.2	**111.5**	0.3	4.2	1.4
19000	684	0.001	113.1	200	12.5	0.16	0.04	0.0010	Agg			Equilibrium Slope:	0.0010	0.0010	
19200	684	0.001	113.3	200	12.5	0.16	0.03	0.0010	Agg			Existing Slope:	0.0010		
19310	684	0.0009	113.4	110	12.5	0.16	0.03	0.0010	Agg						
19320	**684**	**0.001**	**113.41**	**10**	**10.7**	**0.14**	**0.03**	**0.0009**	**Degredation**		**112.4**	112.0	0.4	3.9	1.0
19386	684	0.0012	113.49	66	10.3	0.14	0.03	0.0010	Degredation			Equilibrium Slope:	0.0009	0.0009	
19455	684	0.0009	113.55	69	10.1	0.14	0.03	0.0010	Agg			Existing Slope:	0.0010		
19533	684	0.0012	113.64	78	10.8	0.14	0.03	0.0010	Degredation						
19684	684	0.0009	113.78	151	11.4	0.15	0.03	0.0010	Agg						
19783	684	0.001	113.88	99	11.4	0.15	0.03	0.0010	Degredation			Equil Grnd El. At Murtha:	112.9		
19814	684	0.001	113.91	31	16.5	0.16	0.03	0.0008	Degredation			Scour at Murtha:	**1.1**		
19837	684	0.0009	113.93	23	15.4	0.13	0.03	0.0006	Degredation	**113.93**					
19904	684	0.0007	113.98	67	12.3	0.04	0.01	0.0001	Degredation						
19930	Bridge	0	0	0					**MURTHA**						
19955	684	0	114.2	0.5	12.0	0.04	0.01	0.0002	Agg						
20010	684	0.002	114.31	55	16.7	0.13	0.03	0.0006	Degredation						
20030	684	0.001	114.33	20	18.3	0.16	0.04	0.0008	Degredation	**114.33**					
20050	684	0.001	114.35	20	19.4	0.20	0.04	0.0009	Degredation			Equilibrium Slope:	0.0011	0.0011	

River Sta	Q Total	Invert Slope	Min Ch El	Length Chnl	q	Boundary Shear Stress (To)	Dc	Seq	Long Term Bed Direction	Grade Control Locations					
20104	684	0.0011	114.41	54	12.6	0.18	0.04	0.0012	Agg			Existing Slope:	0.0010		
20117	684	0.0008	114.42	13	12.6	0.18	0.04	0.0012	Agg			LT Scour at Sill	Pk Scour	Sill Cover	
20200	**684**	**0.001**	**114.5**	**83**	**12.6**	**0.18**	**0.04**	**0.0012**	**Agg**		**114.5**	114.8	-0.3	2.2	0.0
20400	613	0.001	114.7	200	11.2	0.13	0.03	0.0008	Degredation						0.3
20600	613	0.001	114.9	200	11.2	0.13	0.03	0.0008	Degredation						
20674	613	0.0009	114.97	74	11.2	0.13	0.03	0.0008	Degredation						
20850	613	0.001	115.15	176	10.9	0.14	0.03	0.0009	Degredation			Equilibrium Slope:	0.0008	0.0008	
20950	613	0.001	115.25	100	11.2	0.14	0.03	0.0009	Degredation			Existing Slope:	0.0010		
21200	613	0.001	115.5	250	11.2	0.14	0.03	0.0009	Degredation						
21400	613	0.001	115.7	200	10.2	0.10	0.02	0.0006	Degredation						
21600	613	0.001	115.9	200	9.9	0.10	0.02	0.0006	Degredation			Equil Grnd El. At Moss:	115.6		
21624	613	0.0008	115.92	24	14.8	0.09	0.02	0.0004	Degredation	**115.92**		Scour at Moss:	**0.3**		
21674	613	0.001	115.97	50	13.1	0.06	0.01	0.0003	Degredation						
21693	613	0.0016	116	19	16.6	0.07	0.02	0.0003	Degredation						
21723	Culvert	0	0	0					**MOSS**						
21780	613	0.0013	116.11	87	16.1	0.03	0.01	0.0001	Degredation	**116.09**					
21820	613	0.0005	116.13	40	12.1	0.06	0.01	0.0002	Degredation						
22070	613	0.0009	116.36	250	8.3	0.24	0.05	0.0013	Agg			Equilibrium Slope:	0.0006	0.0006	
22320	613	0.0009	116.59	250	8.4	0.23	0.05	0.0012	Agg			Existing Slope:	0.0019		
22570	613	0.0016	116.99	250	8.3	0.24	0.05	0.0013	Degredation						
22820	613	0.0002	117.03	250	8.3	0.20	0.04	0.0010	Agg						
23000	613	0.0006	117.14	180	10.3	0.04	0.01	0.0001	Degredation						
23091	613	-0.005	116.72	91	12.2	0.01	0.00	0.0000	Agg			LT Scour at Sill	Pk Scour	Sill Cover	
23132	Bridge	0	0						**O'CALLA**		116.9	**117.3**	0.4	2.9	0.0
23173	613	0	116.78	0.1	12.2	0.01	0.00	0.0001							
23200	**613**	**0.0193**	**117.3**	**27**	**11.2**	**0.05**	**0.01**	**0.0002**							
23444	613	0.0004	117.39	244	7.7	0.04	0.01	0.0002				Equilibrium Slope:	0.0007	0.0007	
23605	613	0.002	117.72	161	7.7	0.21	0.05	0.0012				Existing Slope:	0.0016		
23855	613	0.0012	118.02	250	7.7	0.21	0.05	0.0012							
24105	613	0.0003	118.09	250	7.2	0.16	0.03	0.0008							

River Sta	Q Total	Invert Slope	Min Ch El	Length Chnl	q	Boundary Shear Stress (To)	Dc	Seq	Long Term Bed Direction	Grade Control Locations				
												Pk Scour Depth	Sill Cover	
24232	613	0.0009	118.2	126.5	7.2	0.16	0.03	0.0008						
24358	**613**	**0.0047**	**118.8**	**126.5**	**10.7**	**0.06**	**0.01**	**0.0003**		118.8	**118.1**	3.2	0.7	
24462	613	0.0216	121.05	104	17.5	0.49	0.11	0.0037						
24488	Culvert	0	0	0					**CUNNINGHAM**					
24513	613	0	121.05	51	17.5	0.20	0.04	0.0011						

2-Year RAS OUTPUT, SCOUR SCENARIO (no vegetation)										
HEC-RAS Plan: Scour River: Lower Silver Cr Reach: Reaches 1 - 6 Profile: PF 2										
Reach	**River Sta**	**Profile**	**Q Total**	**Mann Wtd Total**	**Vel Chnl**	**Hydr Radius**	**Invert Slope**	**Min Ch El**	**Top W Act Chan**	**Length Chnl**
			(cfs)		**(ft/s)**	**(ft)**		**(ft)**	**(ft)**	**(ft)**
Reaches 1	12612		Culvert							
Reaches 1	12794	PF 2	778	0.011	4.75	3.19	0.0008	94.55	44	362
Reaches 1	12825	PF 2	778	0.011	1.53	5.48	-0.0713	92.34	80	31
Reaches 1	13000	PF 2	778	0.011	1.62	5.21	0.002	92.69	80	175
Reaches 1	13035	PF 2	778	0.011	2.98	3.45	0.0597	94.78	68	35
Reaches 1	13081		Culvert							
Reaches 1	13126	PF 2	778	0.011	3.17	3.26	0.003	95.05	68	91
Reaches 1	13156	PF 2	778	0.011	3.7	3.08	0.003	95.14	63.96	30
Reaches 1	13176	PF 2	778	0.018	14.33	1.19	0.003	95.2	44.16	20
Reaches 1	13212	PF 2	778	0.018	13.31	1.88	0.0031	95.31	28.15	36
Reaches 1	13228	PF 2	778	0.018	11.38	2.4	0.0031	95.36	24.4	16
Reaches 1	13240	PF 2	778	0.018	8.11	1.9	0.0033	95.4	48.28	12
Reaches 1	13300	PF 2	778	0.018	7.31	2.06	0.0033	95.6	49.36	60
Reaches 1	13400	PF 2	778	0.018	7.26	2.07	0.003	95.9	49.41	100
Reaches 1	13600	PF 2	778	0.018	7.31	2.06	0.003	96.5	49.37	200
Reaches 1	13800	PF 2	778	0.018	7.31	2.06	0.003	97.1	49.36	200
Reaches 1	14000	PF 2	778	0.018	7.31	2.06	0.003	97.7	49.36	200
Reaches 1	14200	PF 2	778	0.018	7.31	2.06	0.003	98.3	49.36	200
Reaches 1	14400	PF 2	778	0.018	7.31	2.06	0.003	98.9	49.36	200
Reaches 1	14600	PF 2	778	0.018	7.31	2.06	0.003	99.5	49.36	200
Reaches 1	14800	PF 2	778	0.018	7.31	2.06	0.003	100.1	49.36	200
Reaches 1	15000	PF 2	778	0.018	7.31	2.06	0.003	100.7	49.36	200
Reaches 1	15200	PF 2	778	0.018	7.31	2.06	0.003	101.3	49.36	200
Reaches 1	15365	PF 2	778	0.018	7.59	1.99	0.0034	101.86	49.12	165
Reaches 1	15376	PF 2	778	0.018	6.05	2.33	0.0036	101.9	50.15	11
Reaches 1	15419	PF 2	778	0.018	5.2	3.4	0.0023	102	37.66	43
Reaches 1	15439	PF 2	778	0.018	4.36	3.64	0.0025	102.05	42.56	20
Reaches 1	15469	PF 2	778	0.011	3.31	4.38	-0.0657	100.08	40.98	30
Reaches 1	15578		Culvert							
Reaches 1	15668	PF 2	778	0.011	4.06	3.71	0.0061	101.3	41.18	199
Reaches 1	15700	PF 2	778	0.011	13.53	1.59	0.0659	103.41	33.8	32

Reach	River Sta	Profile	Q Total	Mann Wtd Total	Vel Chnl	Hydr Radius	Invert Slope	Min Ch El	Top W Act Chan	Length Chnl
Reaches 1	15720	PF 2	778	0.018	12.96	1.83	0.0035	103.48	30.15	20
Reaches 1	15754	PF 2	778	0.018	11.87	2.22	0.0032	103.59	25.88	34
Reaches 1	15760	PF 2	778	0.018	8.6	2.04	0.005	103.62	42.04	6
Reaches 1	15800	PF 2	778	0.018	8.26	2.02	0.0045	103.8	44.21	40
Reaches 1	16000	PF 2	778	0.018	7.4	2	0.0035	104.5	49.96	200
Reaches 1	16200	PF 2	778	0.018	7.71	2	0.0035	105.2	47.83	200
Reaches 1	16400	PF 2	778	0.018	7.74	2	0.0035	105.9	47.62	200
Reaches 1	16600	PF 2	778	0.018	7.75	2	0.0035	106.6	47.54	200
Reaches 1	16800	PF 2	778	0.018	7.76	2	0.0035	107.3	47.51	200
Reaches 1	17000	PF 2	778	0.018	7.76	2	0.0035	108	47.5	200
Reaches 1	17200	PF 2	684	0.018	6.16	2.1	0.0035	108.7	50	200
Reaches 1	17400	PF 2	684	0.018	7.33	2.02	0.0035	109.4	43.67	200
Reaches 1	17600	PF 2	684	0.018	7.77	2.06	0.0035	110.1	40.54	200
Reaches 1	17800	PF 2	684	0.018	7.88	2.07	0.0035	110.8	39.77	200
Reaches 1	18000	PF 2	684	0.018	7.91	2.07	0.0035	111.5	39.6	200
Reaches 1	18087	PF 2	684	0.018	7.13	2.01	0.0029	111.78	45.17	97
Reaches 1	18100	PF 2	684	0.018	5.86	2.11	0.0054	111.85	50	13
Reaches 1	18128	PF 2	684	0.018	4.22	3.33	0.0054	112	42.5	28
Reaches 1	18148	PF 2	684	0.018	3.49	3.66	0.0015	112.03	47	20
Reaches 1	18176	PF 2	684	0.011	2.64	4.08	-0.0696	110.08	51.36	28
Reaches 1	18230		Culvert							
Reaches 1	18284	PF 2	684	0.011	2.72	3.84	0.0034	110.45	53	108
Reaches 1	18315	PF 2	684	0.011	3.2	3.72	0.041	111.72	51.5	31
Reaches 1	18335	PF 2	684	0.018	4.02	2.96	0.041	112.54	52	20
Reaches 1	18374	PF 2	684	0.018	5.47	2.25	0.0008	112.57	50.89	39
Reaches 1	18381	PF 2	684	0.018	6.13	2.23	0.0014	112.58	47.91	7
Reaches 1	18400	PF 2	684	0.018	6.8	2.18	0.0011	112.6	44.01	19
Reaches 1	18516	PF 2	684	0.018	5.84	2.2	0.0009	112.7	50.99	116
Reaches 1	18536	PF 2	684	0.018	5.76	2.11	0.001	112.72	53.88	20
Reaches 1	18600	PF 2	684	0.018	5.62	2.15	0.0013	112.8	54.1	64
Reaches 1	18800	PF 2	684	0.018	4.98	2.4	0.0005	112.9	54.54	200
Reaches 1	19000	PF 2	684	0.018	4.92	2.43	0.001	113.1	54.59	200
Reaches 1	19200	PF 2	684	0.018	4.87	2.44	0.001	113.3	54.62	200
Reaches 1	19310	PF 2	684	0.018	4.83	2.46	0.0009	113.4	54.65	110
Reaches 1	19320	PF 2	684	0.018	4.48	2.28	0.001	113.41	64.15	10

Reach	River Sta	Profile	Q Total	Mann Wtd Total	Vel Chnl	Hydr Radius	Invert Slope	Min Ch El	Top W Act Chan	Length Chnl
Reaches 1	19386	PF 2	684	0.018	4.47	2.22	0.0012	113.49	66.23	66
Reaches 1	19455	PF 2	684	0.018	4.42	2.2	0.0009	113.55	68	69
Reaches 1	19533	PF 2	684	0.018	4.54	2.28	0.0012	113.64	63.47	78
Reaches 1	19684	PF 2	684	0.018	4.61	2.37	0.0009	113.78	60.19	151
Reaches 1	19783	PF 2	684	0.018	4.61	2.37	0.001	113.88	60.18	99
Reaches 1	19814	PF 2	684	0.018	5.04	3.02	0.001	113.91	41.42	31
Reaches 1	19837	PF 2	684	0.018	4.55	3.14	0.0009	113.93	44.54	23
Reaches 1	19904	PF 2	684	0.018	2.66	4.49	0.0007	113.98	55.71	67
Reaches 1	19929.5		Bridge							
Reaches 1	19955	PF 2	684	0.018	2.7	4	0	114.2	57.1	0.5
Reaches 1	20010	PF 2	684	0.018	4.5	3.25	0.002	114.31	40.94	55
Reaches 1	20030	PF 2	684	0.018	5.12	3.1	0.001	114.33	37.34	20
Reaches 1	20050	PF 2	684	0.018	5.56	3.01	0.001	114.35	35.26	20
Reaches 1	20104	PF 2	684	0.018	5.06	2.25	0.0011	114.41	54.4	54
Reaches 1	20117	PF 2	684	0.018	5.17	2.32	0.0008	114.42	54.39	13
Reaches 1	20200	PF 2	684	0.018	5.1	2.35	0.001	114.5	54.45	83
Reaches 1	20400	PF 2	613	0.018	4.35	2.45	0.001	114.7	54.64	200
Reaches 1	20600	PF 2	613	0.018	4.41	2.42	0.001	114.9	54.58	200
Reaches 1	20674	PF 2	613	0.018	4.42	2.42	0.0009	114.97	54.57	74
Reaches 1	20850	PF 2	613	0.018	4.45	2.36	0.001	115.15	56.05	176
Reaches 1	20950	PF 2	613	0.018	4.48	2.39	0.001	115.25	54.52	100
Reaches 1	21200	PF 2	613	0.018	4.51	2.37	0.001	115.5	54.49	250
Reaches 1	21400	PF 2	613	0.018	3.91	2.51	0.001	115.7	60.09	200
Reaches 1	21600	PF 2	613	0.018	3.77	2.53	0.001	115.9	61.92	200
Reaches 1	21624	PF 2	613	0.018	3.89	3.55	0.0008	115.92	41.5	24
Reaches 1	21674	PF 2	613	0.018	3.28	3.77	0.001	115.97	46.83	50
Reaches 1	21693	PF 2	613	0.018	3.67	4.51	0.0016	116	37	19
Reaches 1	21722.5		Culvert							
Reaches 1	21780	PF 2	613	0.011	3.52	4.58	0.0013	116.11	38	87
Reaches 1	21820	PF 2	613	0.018	3.07	3.75	0.0005	116.13	50.54	40
Reaches 1	22070	PF 2	613	0.04	2.75	2.92	0.0009	116.36	73.62	250
Reaches 1	22320	PF 2	613	0.04	2.72	2.97	0.0009	116.59	72.9	250
Reaches 1	22570	PF 2	613	0.04	2.74	2.93	0.0016	116.99	73.66	250
Reaches 1	22820	PF 2	613	0.04	2.57	3.12	0.0002	117.03	73.45	250
Reaches 1	23000	PF 2	613	0.018	2.48	3.97	0.0006	117.14	59.58	180

Reach	River Sta	Profile	Q Total	Mann Wtd Total	Vel Chnl	Hydr Radius	Invert Slope	Min Ch El	Top W Act Chan	Length Chnl
Reaches 1	23091	PF 2	613	0.011	2.61	4.29	-0.0046	116.72	50.39	91
Reaches 1	23132		Bridge							
Reaches 1	23173	PF 2	613	0.011	2.64	4.25	0	116.78	50.27	0.1
Reaches 1	23200	PF 2	613	0.018	2.78	3.83	0.0193	117.3	54.79	27
Reaches 1	23444	PF 2	613	0.018	2.41	3.09	0.0004	117.39	79.8	244
Reaches 1	23605	PF 2	613	0.04	2.59	2.87	0.002	117.72	79.97	161
Reaches 1	23855	PF 2	613	0.04	2.59	2.87	0.0012	118.02	79.96	250
Reaches 1	24105	PF 2	613	0.04	2.24	3.11	0.0003	118.09	85.06	250
Reaches 1	24231.5	PF 2	613	0.04	2.25	3.11	0.0009	118.2	85.03	126.5
Reaches 1	24358	PF 2	613	0.018	3.09	3.32	0.0047	118.8	57.51	126.5
Reaches 1	24462	PF 2	613	0.018	8.27	2.12	0.0216	121.05	35	104
Reaches 1	24487.5		Culvert							
Reaches 1	24513	PF 2	613	0.018	5.7	3.08	0	121.05	35	51

Ck. 2-Year Sill Elevations for 100-Year Event

2-Year Sill Elevations	
Station	Sill Elev (ft)
24358	118.1
23200	117.3
21693 MOSS	
20200	114.5
19904 MURTHA	
19320	112.4
18800	111.5
17600	109.1
17000	107.0
16400	104.9
14200	97.5

This Analysis Assumes Case1: No Sediment Supply From upstream

q: Channel discharge per unit width

62.4	Specific Weight of Water = Specific Density of Water, lbs/cubic Foot
2.65	Specific Gravity of Stream Bed (= Density of material / density of Water)
0.045	Ks, Shields Parameter (Knighton, p. 109)
165.4	Specific Weight of Stream Bed
1.486	Ku: Units Conversion, English

$$D_c = \frac{\tau_o}{K_s(\gamma_s - \gamma)}$$

$$\tau_o = \frac{n^2 V^2 \gamma}{K_u^2 R^{(1/3)}}$$

$$S_{eq} = \left[K_s D_c \left(\frac{\gamma_s - \gamma}{\gamma}\right)\right]^{(10/7)} \left(\frac{K_u}{qn}\right)^{(6/7)}$$

River Sta	Q Total	Invert Slope	Min Ch El	Length Chnl	q	Boundary Shear Stress (To)	Dc	Seq	Long Term Bed Direction	Grade Control Locations
	(cfs)		(ft)	(ft)	(cfs/ft)					Ex.Control Pt
12612	Culvert	0	0	0						
12794	4210	0.0008	94.55	362	95.7	0.14	0.03	0.0002	Degredation	
12825	4210	-0.0713	92.34	31	52.6	0.02	0.00	0.0000	Agg	
13000	4210	0.002	92.69	175	52.6	0.02	0.00	0.0000	Degredation	
13035	4160	0.0597	94.78	35	61.2	0.05	0.01	0.0001	Degredation	
13081	Culvert	0	0	0					**JACKSON**	
13126	4160	0.003	95.05	91	61.2	0.04	0.01	0.0001	Degredation	**93.05**
13156	4160	0.003	95.14	30	49.0	0.05	0.01	0.0001	Degredation	
13176	4160	0.003	95.2	20	49.4	0.16	0.04	0.0003	Degredation	
13212	4160	0.0031	95.31	36	54.0	0.30	0.06	0.0007	Degredation	
13228	4160	0.0031	95.36	16	55.7	0.31	0.07	0.0007	Degredation	
13240	4160	0.0033	95.4	12	55.8	0.32	0.07	0.0007	Degredation	
13300	4160	0.0033	95.6	60	56.0	0.34	0.07	0.0008	Degredation	
13400	4160	0.003	95.9	100	60.7	0.37	0.08	0.0008	Degredation	

Equilibrium Slope: 0.0009
Existing Slope: 0.0031

River Sta	Q Total	Invert Slope	Min Ch El	Length Chnl	q	Boundary Shear Stress (To)	Dc	Seq	Long Term Bed Direction	Grade Control Locations				
	(cfs)		(ft)	(ft)	(cfs/ft)					Ex.Control Pt				
13600	4160	0.003	96.5	200	58.7	0.43	0.09	0.0011	Degradation					
13800	4160	0.003	97.1	200	63.6	0.51	0.11	0.0013	Degradation					
14000	4160	0.003	97.7	200	64.9	0.61	0.13	0.0016	Degradation					LT Scour
14200	**4160**	**0.003**	**98.3**	**200**	**66.2**	**0.71**	**0.15**	**0.0020**	**Degradation**			**97.5**	94.1	3.4
14400	4160	0.003	98.9	200	67.1	0.79	0.17	0.0023	Degradation					
14600	4160	0.003	99.5	200	67.7	0.86	0.19	0.0026	Degradation					
14800	4160	0.003	100.1	200	68.0	0.89	0.19	0.0027	Degradation					
15000	4160	0.003	100.7	200	69.3	1.05	0.23	0.0034	Agg			Equilibrium Slope:	0.0022	
15200	4160	0.003	101.3	200	69.0	1.01	0.22	0.0032	Agg			Existing Slope:	0.0030	
15365	4160	0.0034	101.86	165	68.3	0.92	0.20	0.0028	Degradation					
15376	4160	0.0036	101.9	11	65.5	0.62	0.13	0.0017	Degradation					
15419	4160	0.0023	102	43	96.7	1.04	0.23	0.0025	Agg					
15439	4160	0.0025	102.05	20	97.7	0.52	0.11	0.0009	Degradation			96.9	3.2	w/ no sill at all
15469	4160	-0.0657	100.08	30	101.5	0.14	0.03	0.0002	Agg	**100.08**	100.34	-0.3	Aggradation at Cap.	
15578	Culvert	0	0	0					**CAP EX.**					
15668	4160	0.0061	101.3	199	101.0	0.14	0.03	0.0002	Degradation	**101.3**				
15700	4160	0.0659	103.41	32	114.0	0.24	0.05	0.0004	Degradation					
15720	4160	0.0035	103.48	20	81.6	0.65	0.14	0.0015	Degradation			Equilibrium Slope:	0.0012	
15754	4160	0.0032	103.59	34	83.2	0.43	0.09	0.0008	Degradation			Existing Slope:	0.0116	
15760	4160	0.005	103.62	6	83.2	0.46	0.10	0.0009	Degradation					
15800	4160	0.0045	103.8	40	83.2	0.48	0.10	0.0009	Degradation					
16000	4160	0.0035	104.5	200	83.2	0.57	0.12	0.0012	Degradation					
16200	4160	0.0035	105.2	200	83.2	0.67	0.15	0.0015	Degradation					LT Scour
16400	**4160**	**0.0035**	**105.9**	**200**	**83.2**	**0.79**	**0.17**	**0.0019**	**Degradation**			**104.9**	102.1	2.7
16600	4160	0.0035	106.6	200	83.2	0.91	0.20	0.0024	Degradation			Equilibrium Slope:	0.0027	
16800	4160	0.0035	107.3	200	83.2	1.08	0.23	0.0030	Degradation			Existing Slope:	0.0035	
17000	**4160**	**0.0035**	**108**	**200**	**83.2**	**1.04**	**0.22**	**0.0029**	**Degradation**			**107.0**	106.5	0.4
17200	3670	0.0035	108.7	200	73.4	0.52	0.11	0.0012	Degradation			Equilibrium Slope:	0.0016	
17400	3670	0.0035	109.4	200	73.4	0.62	0.13	0.0015	Degradation			Existing Slope:	0.0035	

River Sta	Q Total	Invert Slope	Min Ch El	Length Chnl	q	Boundary Shear Stress (To)	Dc	Seq	Long Term Bed Direction	Grade Control Locations				
	(cfs)		(ft)	(ft)	(cfs/ft)					Ex.Control Pt				
17600	**3670**	**0.0035**	**110.1**	**200**	**73.4**	**0.74**	**0.16**	**0.0020**	**Degredation**			**109.1**	107.9	1.2
17800	3670	0.0035	110.8	200	73.4	0.86	0.19	0.0024	Degredation			Equilibrium Slope:		0.0017
18000	3670	0.0035	111.5	200	73.4	0.95	0.20	0.0028	Degredation			Existing Slope:		0.0037
18087	3670	0.0029	111.78	97	73.4	0.83	0.18	0.0023	Degredation			Note: Same as 2-year Equil Slope		
18100	3670	0.0054	111.85	13	73.4	0.67	0.15	0.0017	Degredation					
18128	3670	0.0054	112	28	62.2	0.57	0.12	0.0016	Degredation					
18148	3670	0.0015	112.03	20	78.1	0.38	0.08	0.0007	Degredation					
18176	3670	-0.0696	110.08	28	71.5	0.09	0.02	0.0001	Agg	**110.08**	110.06	0.0	NO Agg or Deg at Story	
18230	Culvert	0	0	0					**STORY**					
18284	3670	0.0034	110.45	108	69.2	0.08	0.02	0.0001	Degredation	**110.45**				
18315	3670	0.041	111.72	31	69.9	0.09	0.02	0.0001	Degredation					
18335	3670	0.041	112.54	20	54.0	0.31	0.07	0.0007	Degredation					
18374	3670	0.0008	112.57	39	60.0	0.31	0.07	0.0007	Degredation			Equilibrium Slope:		0.0007
18381	3670	0.0014	112.58	7	59.7	0.33	0.07	0.0007	Degredation			Existing Slope:		0.0099
18400	3670	0.0011	112.6	19	61.8	0.37	0.08	0.0009	Degredation					
18516	3670	0.0009	112.7	116	61.7	0.37	0.08	0.0008	Degredation					
18536	3670	0.001	112.72	20	58.6	0.33	0.07	0.0007	Degredation					
18600	3670	0.0013	112.8	64	58.7	0.33	0.07	0.0008	Degredation					LT Scour
18800	**3670**	**0.0005**	**112.9**	**200**	**58.5**	**0.32**	**0.07**	**0.0007**	**Agg**			**111.5**	110.8	0.6
19000	3670	0.001	113.1	200	58.6	0.33	0.07	0.0007	Degredation			Equilibrium Slope:		0.0007
19200	3670	0.001	113.3	200	58.7	0.33	0.07	0.0008	Degredation			Existing Slope:		0.0010
19310	3670	0.0009	113.4	110	58.6	0.33	0.07	0.0008	Degredation					
19320	**3670**	**0.001**	**113.41**	**10**	**50.6**	**0.23**	**0.05**	**0.0005**	**Degredation**			**112.4**	111.8	0.6
19386	3670	0.0012	113.49	66	49.2	0.22	0.05	0.0005	Degredation			Equilibrium Slope:		0.0007
19455	3670	0.0009	113.55	69	43.2	0.19	0.04	0.0004	Degredation			Existing Slope:		0.0010
19533	3670	0.0012	113.64	78	48.2	0.22	0.05	0.0005	Degredation					
19684	3670	0.0009	113.78	151	52.0	0.26	0.06	0.0006	Degredation					
19783	3670	0.001	113.88	99	51.3	0.26	0.06	0.0006	Degredation			Equil Grnd El. At Murtha:		112.8
19814	3670	0.001	113.91	31	56.3	0.39	0.08	0.0010	Degredation			Scour at Murtha:		**1.2**
19837	3670	0.0009	113.93	23	53.9	0.42	0.09	0.0012	Agg	**113.93**				

River Sta	Q Total	Invert Slope	Min Ch El	Length Chnl	q	Boundary Shear Stress (To)	Dc	Seq	Long Term Bed Direction	Grade Control Locations			
	(cfs)		(ft)	(ft)	(cfs/ft)					Ex.Control Pt			
19904	3670	0.0007	113.98	67	58.7	0.17	0.04	0.0003	Degredation				
19930	Bridge	0	0	0					**MURTHA**				
19955	3670	0	114.2	0.5	55.6	0.14	0.03	0.0002	Agg				
20010	3670	0.002	114.31	55	73.0	0.34	0.07	0.0007	Degredation				
20030	3670	0.001	114.33	20	58.6	0.43	0.09	0.0011	Agg	**114.33**			
20050	3670	0.001	114.35	20	57.6	0.41	0.09	0.0010	Agg		Equilibrium Slope:		0.0006
20104	3670	0.0011	114.41	54	56.9	0.23	0.05	0.0005	Degredation		Existing Slope:		0.0010
20117	3670	0.0008	114.42	13	57.0	0.23	0.05	0.0005	Degredation				LT Scour
20200	**3670**	**0.001**	**114.5**	**83**	**57.0**	**0.23**	**0.05**	**0.0005**	**Degredation**		**114.5**	114.4	0.1
20400	2810	0.001	114.7	200	43.4	0.13	0.03	0.0002	Degredation				
20600	2810	0.001	114.9	200	43.6	0.13	0.03	0.0003	Degredation				
20674	2810	0.0009	114.97	74	43.6	0.13	0.03	0.0003	Degredation				
20850	2810	0.001	115.15	176	37.1	0.12	0.03	0.0003	Degredation		Equilibrium Slope:		0.0003
20950	2810	0.001	115.25	100	43.8	0.14	0.03	0.0003	Degredation		Existing Slope:		0.0010
21200	2810	0.001	115.5	250	44.0	0.15	0.03	0.0003	Degredation				
21400	2810	0.001	115.7	200	36.6	0.11	0.02	0.0002	Degredation				
21600	2810	0.001	115.9	200	38.2	0.11	0.02	0.0002	Degredation		Equil Grnd El. At Moss:		114.9
21624	2810	0.0008	115.92	24	44.0	0.16	0.03	0.0003	Degredation	**115.92**	Scour at Moss:		**1.0**
21674	2810	0.001	115.97	50	59.8	0.16	0.03	0.0003	Degredation				
21693	2810	0.0016	116	19	75.9	0.23	0.05	0.0004	Degredation				
21723	Culvert	0	0	0					**MOSS**				
21780	2810	0.0013	116.11	87	73.9	0.07	0.02	0.0001	Degredation	**116.09**			
21820	2810	0.0005	116.13	40	39.2	0.10	0.02	0.0002	Degredation				
22070	2810	0.0009	116.36	250	29.9	0.29	0.06	0.0006	Degredation		Equilibrium Slope:		0.0003
22320	2810	0.0009	116.59	250	30.3	0.30	0.07	0.0006	Degredation		Existing Slope:		0.0019
22570	2810	0.0016	116.99	250	30.2	0.31	0.07	0.0006	Degredation				
22820	2810	0.0002	117.03	250	30.4	0.31	0.07	0.0006	Agg				
23000	2810	0.0006	117.14	180	31.7	0.08	0.02	0.0002	Degredation				
23091	2810	-0.0046	116.72	91	45.5	0.04	0.01	0.0001	Agg				LT Scour

River Sta	Q Total	Invert Slope	Min Ch El	Length Chnl	q	Boundary Shear Stress (To)	Dc	Seq	Long Term Bed Direction	Grade Control Locations	
	(cfs)		(ft)	(ft)	(cfs/ft)					Ex.Control Pt	
23132	Bridge	0	0	0					**O'CALLA**		**117.3** 116.5 0.8
23173	2810	0	116.78	0.1	45.5	0.04	0.01	0.0001	Agg		
23200	**2810**	**0.0193**	**117.3**	**27**	**38.4**	**0.09**	**0.02**	**0.0002**	**Degredation**		
23444	2810	0.0004	117.39	244	28.4	0.05	0.01	0.0001	Degredation		Equilibrium Slope: 0.0004
23605	2810	0.002	117.72	161	28.4	0.28	0.06	0.0006	Degredation		Existing Slope: 0.0016
23855	2810	0.0012	118.02	250	28.5	0.29	0.06	0.0006	Degredation		
24105	2810	0.0003	118.09	250	27.2	0.25	0.05	0.0005	Agg		
24232	2810	0.0009	118.2	126.5	27.2	0.25	0.05	0.0005	Degredation		Pk Scour Depth
24358	**2810**	**0.0047**	**118.8**	**126.5**	**30.4**	**0.10**	**0.02**	**0.0002**	**Degredation**	**118.8**	**118.1** 117.8 0.4
24462	2810	0.0216	121.05	104	80.3	0.67	0.14	0.0016	Degredation		
24488	Culvert	0	0	0					**CUNNINGHAM**		

100-Year RAS OUTPUT, SCOUR SCENARIO (no vegetation)										
HEC-RAS Plan: Scour River: Lower Silver Cr Reach: Reaches 1 - 6 Profile: Silver Peak100										
Reach	**River Sta**	**Profile**	**Q Total**	**Mann Wtd Total**	**Vel Chnl**	**Hydr Radius**	**Invert Slope**	**Min Ch El**	**Top W Act Chan**	**Length Chnl**
			(cfs)		**(ft/s)**	**(ft)**		**(ft)**	**(ft)**	**(ft)**
Reaches 1	12612		Culvert							
Reaches 1	12794	Silver Peak100	4210	0.011	8.86	7.24	0.0008	94.55	44	362
Reaches 1	12825	Silver Peak100	4210	0.011	3.67	10.55	-0.0713	92.34	80	31
Reaches 1	13000	Silver Peak100	4210	0.011	3.77	10.36	0.002	92.69	80	175
Reaches 1	13035	Silver Peak100	4160	0.011	5.21	8.73	0.0597	94.78	68	35
Reaches 1	13081		Culvert							
Reaches 1	13126	Silver Peak100	4160	0.011	5.11	8.86	0.003	95.05	68	91
Reaches 1	13156	Silver Peak100	4160	0.011	5.28	7.56	0.003	95.14	84.92	30
Reaches 1	13176	Silver Peak100	4160	0.018	5.84	6.99	0.003	95.2	84.25	20
Reaches 1	13212	Silver Peak100	4160	0.018	7.7	6.12	0.0031	95.31	77	36
Reaches 1	13228	Silver Peak100	4160	0.018	7.93	6.18	0.0031	95.36	74.64	16
Reaches 1	13240	Silver Peak100	4160	0.018	8.03	6.35	0.0033	95.4	74.57	12
Reaches 1	13300	Silver Peak100	4160	0.018	8.29	6.21	0.0033	95.6	74.26	60
Reaches 1	13400	Silver Peak100	4160	0.018	8.63	6.45	0.003	95.9	68.5	100
Reaches 1	13600	Silver Peak100	4160	0.018	9.24	5.83	0.003	96.5	70.87	200
Reaches 1	13800	Silver Peak100	4160	0.018	10.05	5.82	0.003	97.1	65.44	200
Reaches 1	14000	Silver Peak100	4160	0.018	10.83	5.53	0.003	97.7	64.06	200
Reaches 1	14200	Silver Peak100	4160	0.018	11.58	5.28	0.003	98.3	62.88	200
Reaches 1	14400	Silver Peak100	4160	0.018	12.21	5.09	0.003	98.9	61.98	200
Reaches 1	14600	Silver Peak100	4160	0.018	12.65	4.96	0.003	99.5	61.41	200
Reaches 1	14800	Silver Peak100	4160	0.018	12.87	4.9	0.003	100.1	61.14	200
Reaches 1	15000	Silver Peak100	4160	0.018	13.83	4.66	0.003	100.7	60.02	200
Reaches 1	15200	Silver Peak100	4160	0.018	13.6	4.71	0.003	101.3	60.28	200
Reaches 1	15365	Silver Peak100	4160	0.018	13.04	4.86	0.0034	101.86	60.94	165
Reaches 1	15376	Silver Peak100	4160	0.018	10.89	5.36	0.0036	101.9	63.51	11
Reaches 1	15419	Silver Peak100	4160	0.018	14.16	5.44	0.0023	102	43.03	43
Reaches 1	15439	Silver Peak100	4160	0.018	10.48	7.33	0.0025	102.05	42.56	20
Reaches 1	15469	Silver Peak100	4160	0.011	8.98	7.15	-0.0657	100.08	40.98	30
Reaches 1	15578		Culvert							
Reaches 1	15668	Silver Peak100	4160	0.011	8.91	7.18	0.0061	101.3	41.18	199
Reaches 1	15700	Silver Peak100	4160	0.011	11.53	6.65	0.0659	103.41	36.5	32
Reaches 1	15720	Silver Peak100	4160	0.018	11.2	5.41	0.0035	103.48	51	20

Reach	River Sta	Profile	Q Total	Mann Wtd Total	Vel Chnl	Hydr Radius	Invert Slope	Min Ch El	Top W Act Chan	Length Chnl
			(cfs)		(ft/s)	(ft)		(ft)	(ft)	(ft)
Reaches 1	15754	Silver Peak100	4160	0.018	9.39	6.49	0.0032	103.59	50	34
Reaches 1	15760	Silver Peak100	4160	0.018	9.68	6.55	0.005	103.62	50	6
Reaches 1	15800	Silver Peak100	4160	0.018	9.88	6.45	0.0045	103.8	50	40
Reaches 1	16000	Silver Peak100	4160	0.018	10.64	6.1	0.0035	104.5	50	200
Reaches 1	16200	Silver Peak100	4160	0.018	11.47	5.76	0.0035	105.2	50	200
Reaches 1	16400	Silver Peak100	4160	0.018	12.33	5.45	0.0035	105.9	50	200
Reaches 1	16600	Silver Peak100	4160	0.018	13.11	5.19	0.0035	106.6	50	200
Reaches 1	16800	Silver Peak100	4160	0.018	14.13	4.89	0.0035	107.3	50	200
Reaches 1	17000	Silver Peak100	4160	0.018	13.91	4.95	0.0035	108	50	200
Reaches 1	17200	Silver Peak100	3670	0.018	10.08	5.78	0.0035	108.7	50	200
Reaches 1	17400	Silver Peak100	3670	0.018	10.93	5.43	0.0035	109.4	50	200
Reaches 1	17600	Silver Peak100	3670	0.018	11.82	5.1	0.0035	110.1	50	200
Reaches 1	17800	Silver Peak100	3670	0.018	12.62	4.84	0.0035	110.8	50	200
Reaches 1	18000	Silver Peak100	3670	0.018	13.17	4.68	0.0035	111.5	50	200
Reaches 1	18087	Silver Peak100	3670	0.018	12.44	4.9	0.0029	111.78	50	97
Reaches 1	18100	Silver Peak100	3670	0.018	11.27	5.13	0.0054	111.85	50	13
Reaches 1	18128	Silver Peak100	3670	0.018	10.29	4.83	0.0054	112	59	28
Reaches 1	18148	Silver Peak100	3670	0.018	8.8	6.63	0.0015	112.03	47	20
Reaches 1	18176	Silver Peak100	3670	0.011	6.98	7.11	-0.0696	110.08	51.36	28
Reaches 1	18230		Culvert							
Reaches 1	18284	Silver Peak100	3670	0.011	6.54	7.27	0.0034	110.45	53	108
Reaches 1	18315	Silver Peak100	3670	0.011	7.07	7.45	0.041	111.72	52.5	31
Reaches 1	18335	Silver Peak100	3670	0.018	7.71	5.59	0.041	112.54	68	20
Reaches 1	18374	Silver Peak100	3670	0.018	7.91	6.3	0.0008	112.57	61.2	39
Reaches 1	18381	Silver Peak100	3670	0.018	8.16	6.31	0.0014	112.58	61.44	7
Reaches 1	18400	Silver Peak100	3670	0.018	8.64	6.16	0.0011	112.6	59.35	19
Reaches 1	18516	Silver Peak100	3670	0.018	8.61	6.17	0.0009	112.7	59.48	116
Reaches 1	18536	Silver Peak100	3670	0.018	8.13	6.24	0.001	112.72	62.59	20
Reaches 1	18600	Silver Peak100	3670	0.018	8.17	6.22	0.0013	112.8	62.53	64
Reaches 1	18800	Silver Peak100	3670	0.018	8.05	6.28	0.0005	112.9	62.71	200
Reaches 1	19000	Silver Peak100	3670	0.018	8.1	6.26	0.001	113.1	62.65	200
Reaches 1	19200	Silver Peak100	3670	0.018	8.15	6.23	0.001	113.3	62.56	200
Reaches 1	19310	Silver Peak100	3670	0.018	8.15	6.23	0.0009	113.4	62.58	110
Reaches 1	19320	Silver Peak100	3670	0.018	6.87	6.47	0.001	113.41	72.53	10

Reach	River Sta	Profile	Q Total	Mann Wtd Total	Vel Chnl	Hydr Radius	Invert Slope	Min Ch El	Top W Act Chan	Length Chnl
			(cfs)		(ft/s)	(ft)		(ft)	(ft)	(ft)
Reaches 1	19386	Silver Peak100	3670	0.018	6.71	6.46	0.0012	113.49	74.62	66
Reaches 1	19455	Silver Peak100	3670	0.018	6.25	6.46	0.0009	113.55	84.96	69
Reaches 1	19533	Silver Peak100	3670	0.018	6.73	6.44	0.0012	113.64	76.11	78
Reaches 1	19684	Silver Peak100	3670	0.018	7.2	6.36	0.0009	113.78	70.64	151
Reaches 1	19783	Silver Peak100	3670	0.018	7.18	6.34	0.001	113.88	71.59	99
Reaches 1	19814	Silver Peak100	3670	0.018	8.73	5.57	0.001	113.91	65.19	31
Reaches 1	19837	Silver Peak100	3670	0.018	8.96	5.24	0.0009	113.93	68.14	23
Reaches 1	19904	Silver Peak100	3670	0.018	6.2	8.91	0.0007	113.98	62.54	67
Reaches 1	19929.5		Bridge							
Reaches 1	19955	Silver Peak100	3670	0.018	5.6	8.09	0	114.2	66	0.5
Reaches 1	20010	Silver Peak100	3670	0.018	8.44	6.78	0.002	114.31	50.25	55
Reaches 1	20030	Silver Peak100	3670	0.018	9.06	5.31	0.001	114.33	62.58	20
Reaches 1	20050	Silver Peak100	3670	0.018	8.81	5.37	0.001	114.35	63.7	20
Reaches 1	20104	Silver Peak100	3670	0.018	6.88	6.75	0.0011	114.41	64.45	54
Reaches 1	20117	Silver Peak100	3670	0.018	6.93	6.99	0.0008	114.42	64.44	13
Reaches 1	20200	Silver Peak100	3670	0.018	6.96	6.97	0.001	114.5	64.37	83
Reaches 1	20400	Silver Peak100	2810	0.018	5.17	7.12	0.001	114.7	64.78	200
Reaches 1	20600	Silver Peak100	2810	0.018	5.27	7.03	0.001	114.9	64.52	200
Reaches 1	20674	Silver Peak100	2810	0.018	5.3	7	0.0009	114.97	64.45	74
Reaches 1	20850	Silver Peak100	2810	0.018	4.94	6.92	0.001	115.15	75.66	176
Reaches 1	20950	Silver Peak100	2810	0.018	5.43	6.88	0.001	115.25	64.16	100
Reaches 1	21200	Silver Peak100	2810	0.018	5.55	6.78	0.001	115.5	63.89	250
Reaches 1	21400	Silver Peak100	2810	0.018	4.78	6.93	0.001	115.7	76.88	200
Reaches 1	21600	Silver Peak100	2810	0.018	4.82	7.42	0.001	115.9	73.65	200
Reaches 1	21624	Silver Peak100	2810	0.018	5.79	6.93	0.0008	115.92	63.81	24
Reaches 1	21674	Silver Peak100	2810	0.018	6.04	9.36	0.001	115.97	47	50
Reaches 1	21693	Silver Peak100	2810	0.018	7.36	10.32	0.0016	116	37	19
Reaches 1	21722.5		Culvert							
Reaches 1	21780	Silver Peak100	2810	0.011	6.76	10.93	0.0013	116.11	38	87
Reaches 1	21820	Silver Peak100	2810	0.018	4.6	7.78	0.0005	116.13	71.67	40
Reaches 1	22070	Silver Peak100	2810	0.04	3.55	7.85	0.0009	116.36	94.01	250
Reaches 1	22320	Silver Peak100	2810	0.04	3.64	7.76	0.0009	116.59	92.74	250
Reaches 1	22570	Silver Peak100	2810	0.04	3.69	7.64	0.0016	116.99	93.02	250
Reaches 1	22820	Silver Peak100	2810	0.04	3.69	7.68	0.0002	117.03	92.38	250

Reach	River Sta	Profile	Q Total	Mann Wtd Total	Vel Chnl	Hydr Radius	Invert Slope	Min Ch El	Top W Act Chan	Length Chnl
			(cfs)		(ft/s)	(ft)		(ft)	(ft)	(ft)
Reaches 1	23000	Silver Peak100	2810	0.018	4.01	7.31	0.0006	117.14	88.61	180
Reaches 1	23091	Silver Peak100	2810	0.011	4.75	8.54	-0.0046	116.72	61.8	91
Reaches 1	23132		Bridge							
Reaches 1	23173	Silver Peak100	2810	0.011	4.78	8.49	0	116.78	61.8	0.1
Reaches 1	23200	Silver Peak100	2810	0.018	4.51	7.79	0.0193	117.3	73.14	27
Reaches 1	23444	Silver Peak100	2810	0.018	3.4	7.82	0.0004	117.39	98.97	244
Reaches 1	23605	Silver Peak100	2810	0.04	3.48	7.64	0.002	117.72	99.05	161
Reaches 1	23855	Silver Peak100	2810	0.04	3.55	7.54	0.0012	118.02	98.59	250
Reaches 1	24105	Silver Peak100	2810	0.04	3.31	7.73	0.0003	118.09	103.39	250
Reaches 1	24231.5	Silver Peak100	2810	0.04	3.33	7.7	0.0009	118.2	103.25	126.5
Reaches 1	24358	Silver Peak100	2810	0.018	4.45	6.38	0.0047	118.8	92.56	126.5
Reaches 1	24462	Silver Peak100	2810	0.018	11.79	6.81	0.0216	121.05	35	104
Reaches 1	24487.5		Culvert							
Reaches 1	24513	Silver Peak100	2810	0.018	9.1	8.82	0	121.05	35	51

APPENDIX 3B-2

DESIGN OPTIMIZATION

MEMORANDUM

To: Draft

From: Project Team

Subject: Lower Silver Creek Reaches 4, 5, and 6 Design Optimization Meeting Summary

Date: July 9, 2009

Introduction

A Design Optimization Workshop was held from July 6 through July 8, 2009 to review the earlier designs prepared by the CWP for Lower Silver Creek, Reaches 4 -6. The empathsis was on Reaches 5 & 6, because these reaches may be constructed sooner than Reach 4, due to permitting (Capital Expwy culvert) and utility relocation issues in Reach 4. A summary of Project review results and discussions from the workshop follows.

Design Constraints

Several existing design constraints were identified. These constraints are summarized below.

Geotechnical Issues

- Existing soils are susceptible to erosion at some locations, based upon site reconnaissance and review of previous geotechnical reports.
- Constructability issues within limited R/W
- Channel sideslopes of 1.5:1 are probably acceptable, but close to the natural angle of repose, so slope failures may be more common in the long term, vs a 2:1 slope.

Utility Conflicts

- Overhead utilities along R/W for most of Reaches 5 & 6
- Underground utilities, including storm drains and gas lines

Maintenance

- Maintenance access needed in-channel
- Width of maintenance road should be maintained at 18 ft wide

Adjacent Property Owners

- Construction noise impacts likely preclude use of driven or vibrated piling.
- Potential for soils adjacent to ROW to deform and/or settle due to construction.

Environmental Issues

- Existing Project permits
- Restoration commitments to permitting agencies

Hydraulics

Short-term –The Reach 6B Project Earthwork Project may increase volume of flooding 3%, compared to current condition.
Long-term - Reach 4 should be constructed first to avoid changing current flooding condition. If Reaches 5 and 6 need to be expedited to meet fast-track schedule, these projects will need to be developed to allow floodwaters to spill out of channel similar to current conditions.

Alternative Design Options

The identified Project design alternatives are presented in the attached Typical Cross Section figures.

EXHIBIT 1
Summary of Identified Project Alternatives for creek banks

	Alternative	Total Cost
1	Original channel design from STA 205+00 to STA 214+00	Base Line
2	Use H-Piles for tie-back of Veg-Block wall on both sides of the channel	+1-2%
3	1.5:1 slopes on both sides of the channel	-50-60%
4	H-Pile with 1.5:1 slope on opposite side of channel	-30-40%
5	Change wall type to H-Piles on both sides of the channel	-15-25%

Discussion Items for Future Action

- Schedule for Reach 4; U-Frame channel and Jackson Av culvert have no good alternatives; review VTA and Capitol Expwy culvert timing.
- Proceed with hydraulic analysis/verification of alternative channel sections.
- Development of Reach 5 & 6 Project(s) to take advantage of Federal funding, but evaluate flood risk.

Attachments:

1. Alternative Cross section Figures
2. Detailed Cost Estimate

cc:

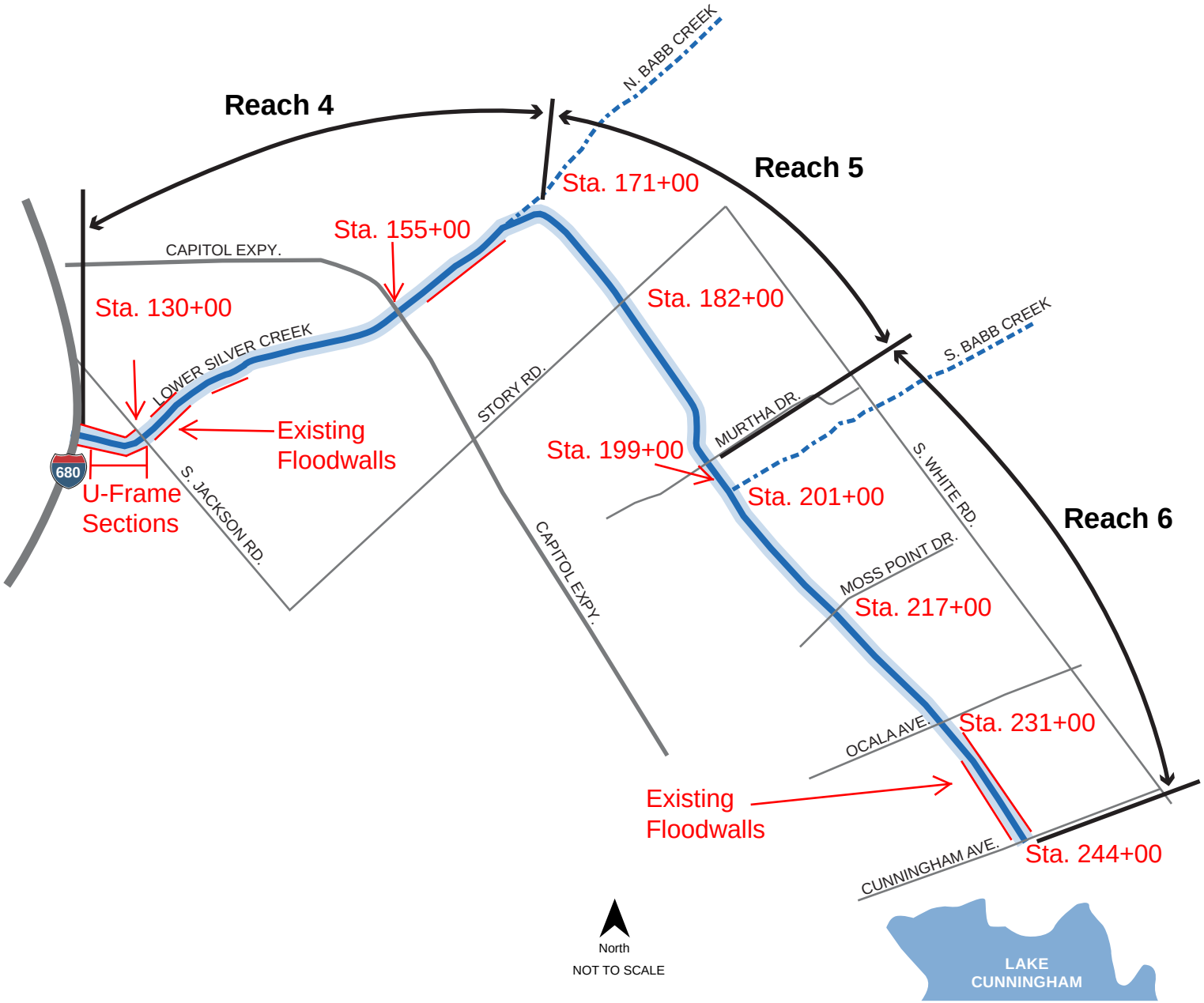


FIGURE 1
Reaches 4, 5, 6
Coyote Watershed

CH2MHILL

WB072009004BAO project_reaches.ai 07-24-09 dash

APPENDIX 3B-3

R4-6 RENDERINGS AND X-SECTIONS

Lower Silver Creek at Reach 4c

Current View

Lower Silver Creek at Reach 4c

Lower Silver Creek at Reach 5c

Current View

Lower Silver Creek at Reach 5c

Modified Design

Lower Silver Creek at Reach 6b

Lower Silver Creek at Reach 6b Modified Design

Santa Clara Valley Water District

Lower Silver Creek Watershed Project/Reaches 4, 5 and 6

Design Improvements

January 26,2010

Lower Silver Creek

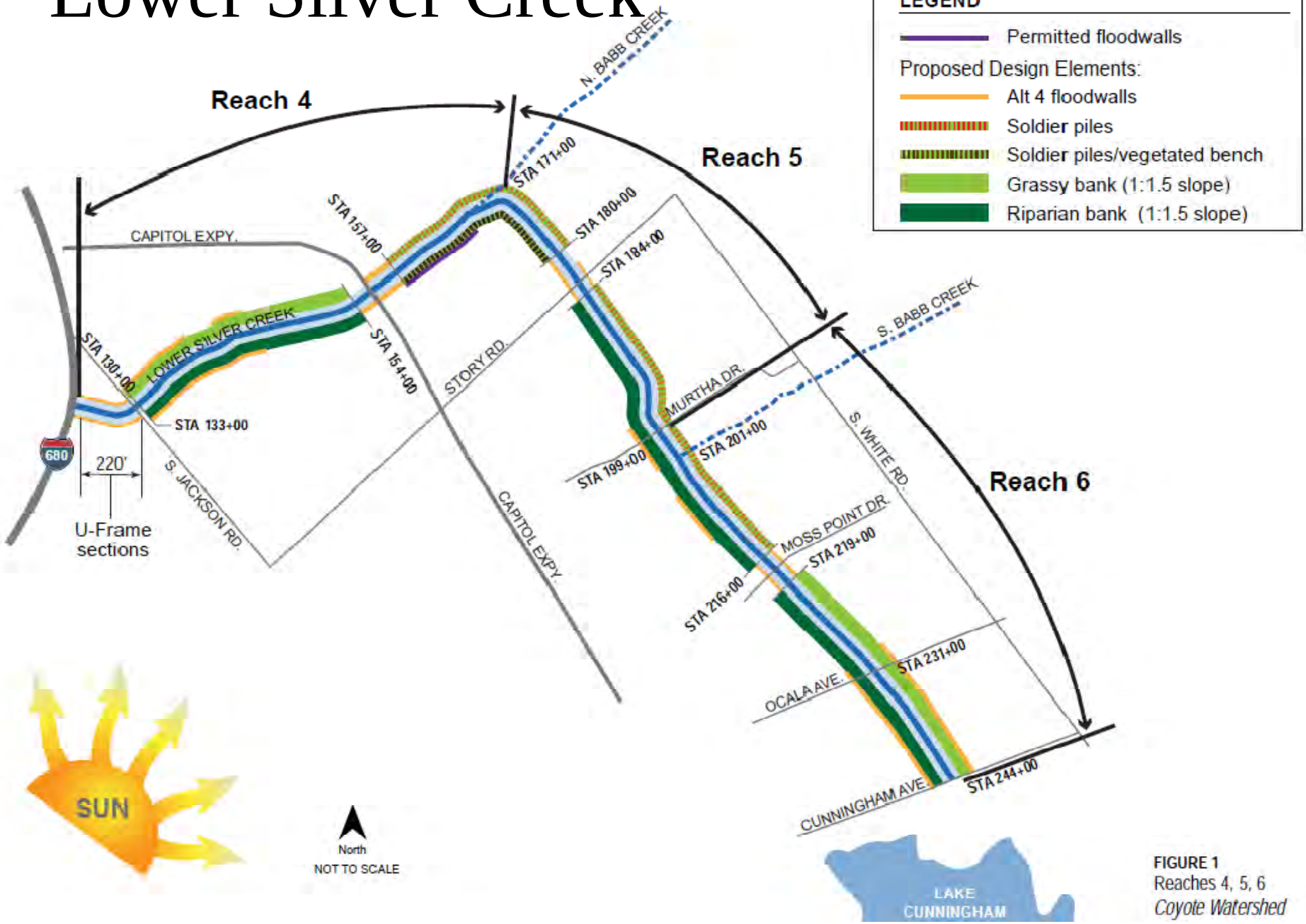
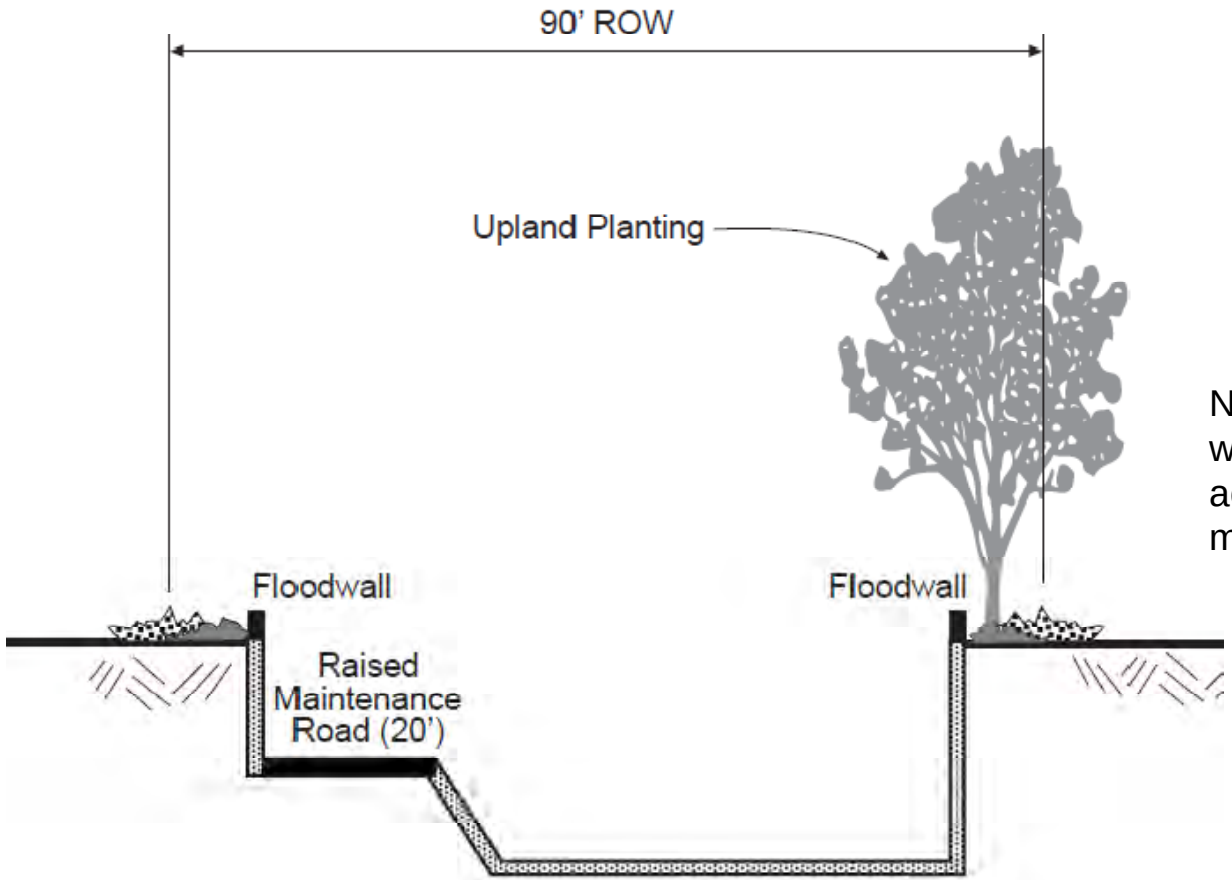


FIGURE 1
Reaches 4, 5, 6
Coyote Watershed

Lower Silver Creek at Reach 4a

(between I-680 and Jackson Ave)

No change

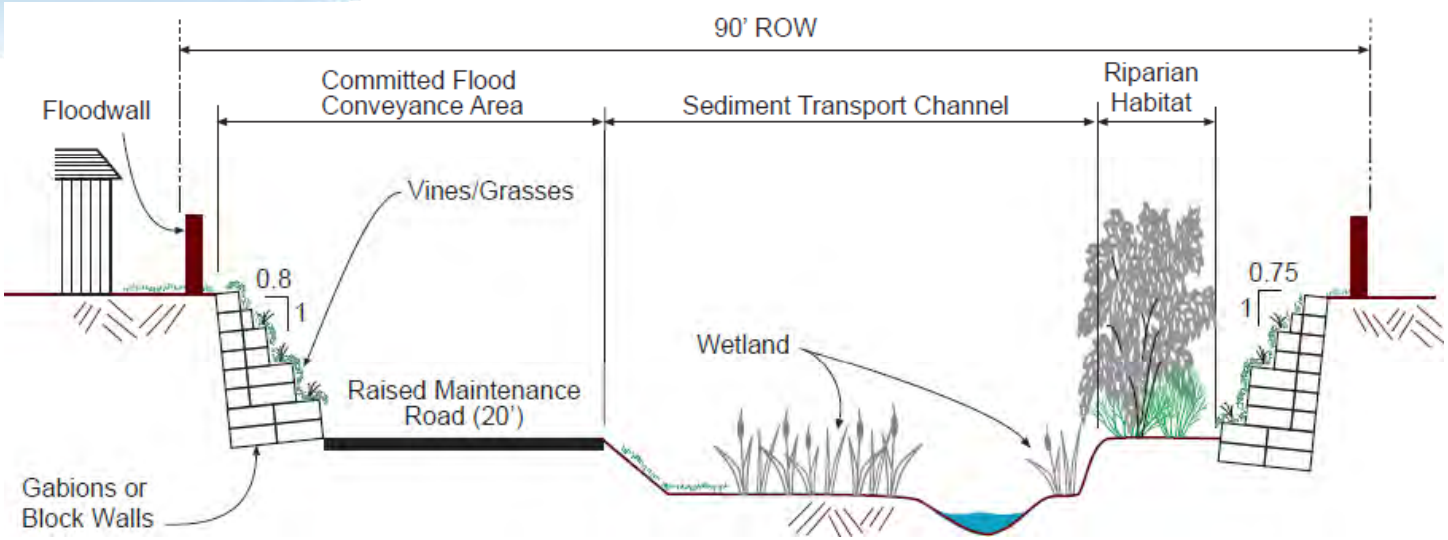


Note: Planting will depend on access for maintenance.

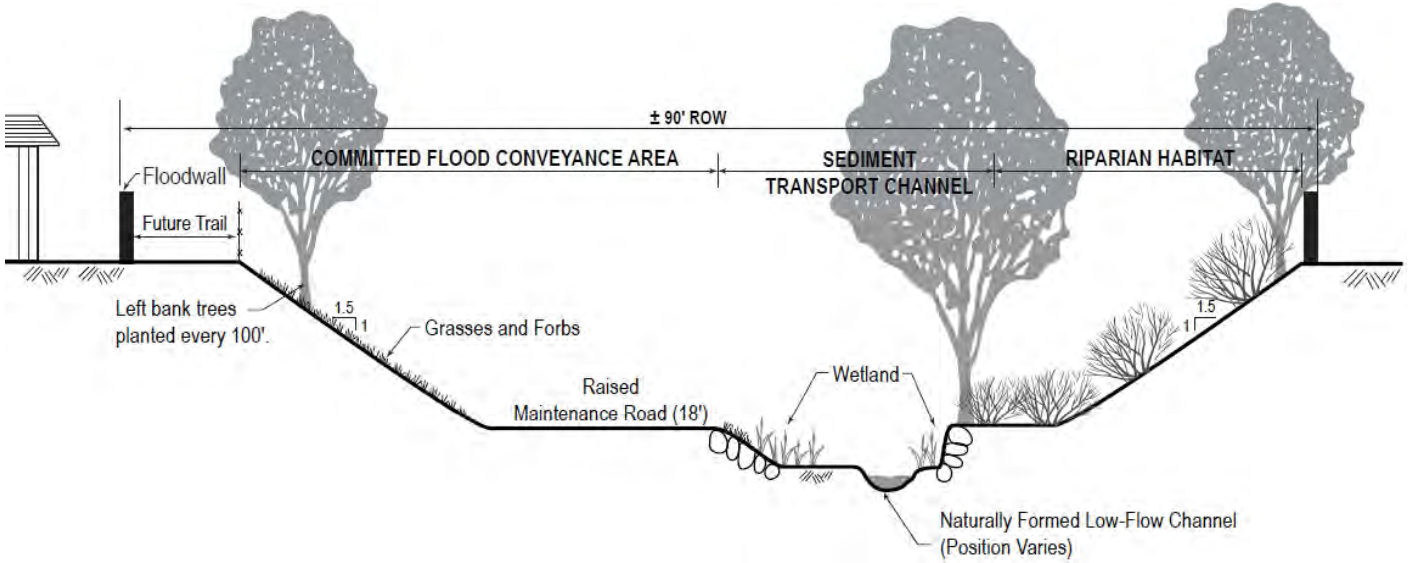
Lower Silver Creek at Reach 4b

(Jackson Ave – Capitol Expressway)

Permitted Design



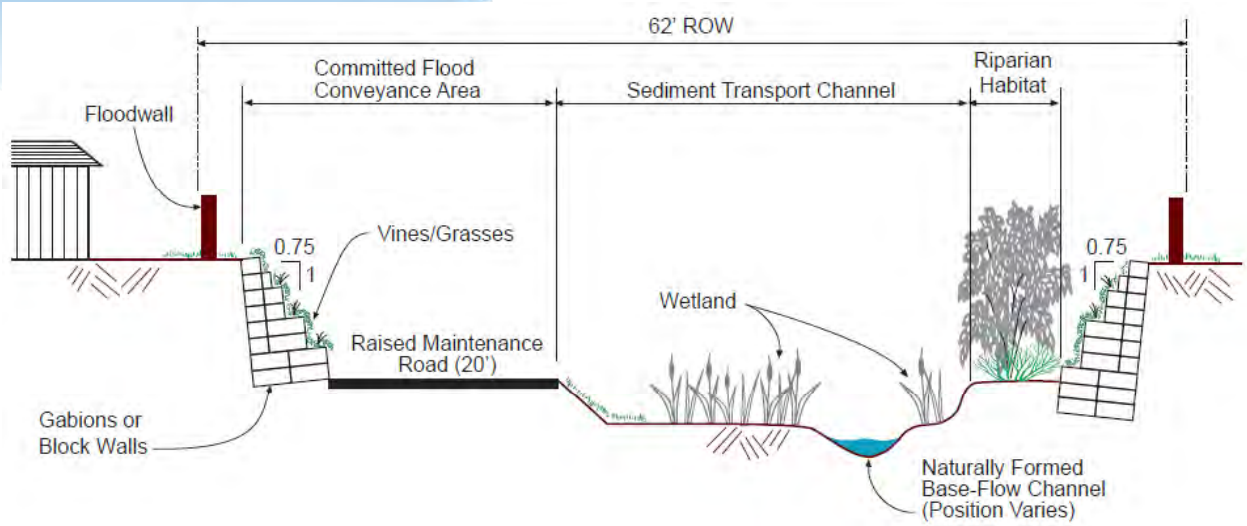
Modified Design



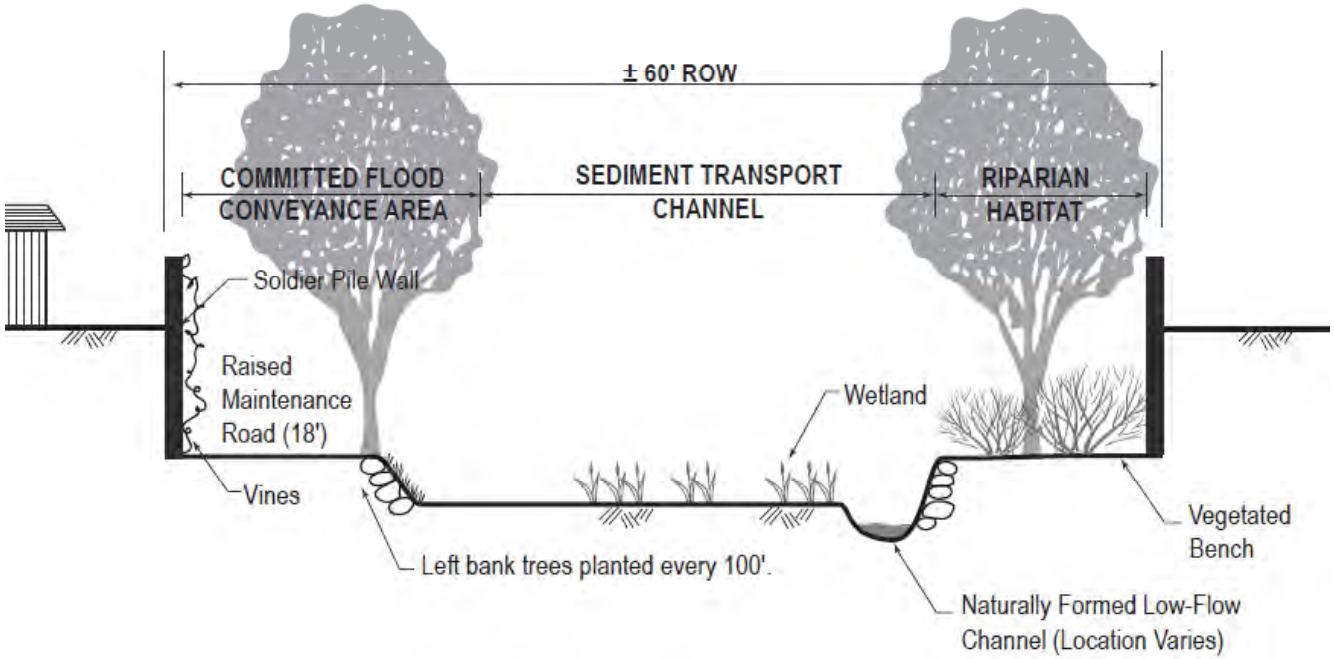
Lower Silver Creek at Reach 4c/5a/5b

(Capitol Expressway – Story Rd)

Permitted Design



Modified Design



Lower Silver Creek at Reach 4c

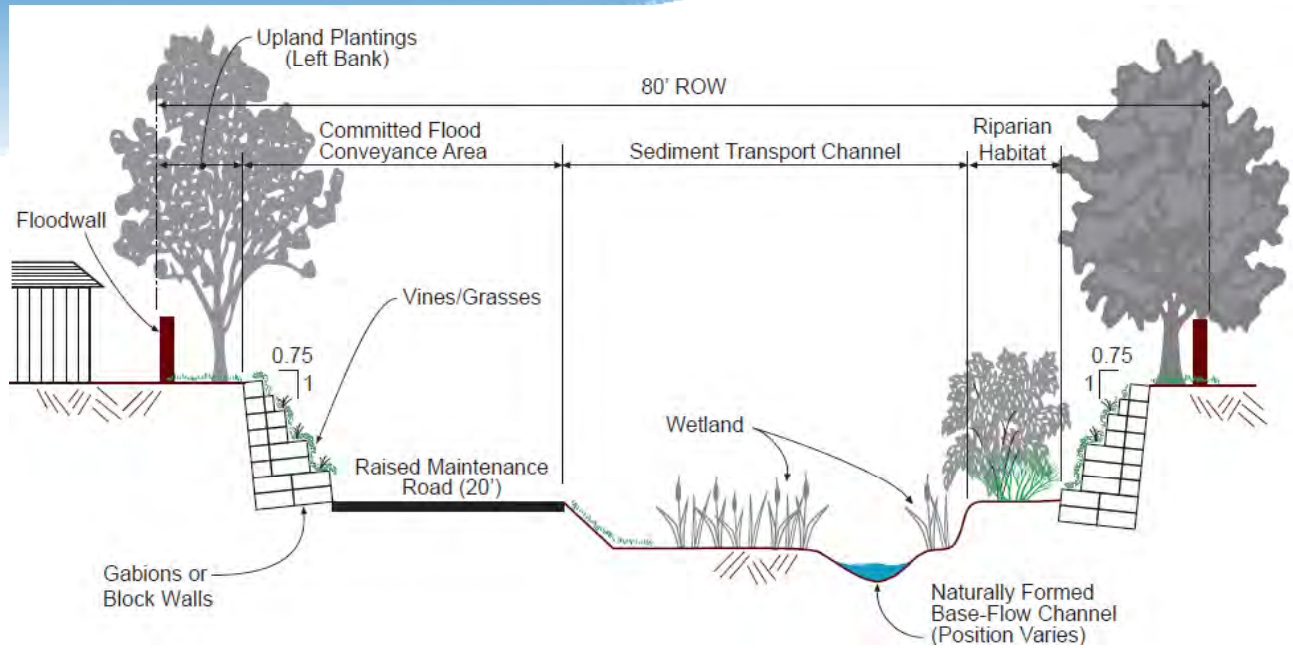
Current View

Lower Silver Creek at Reach 4c

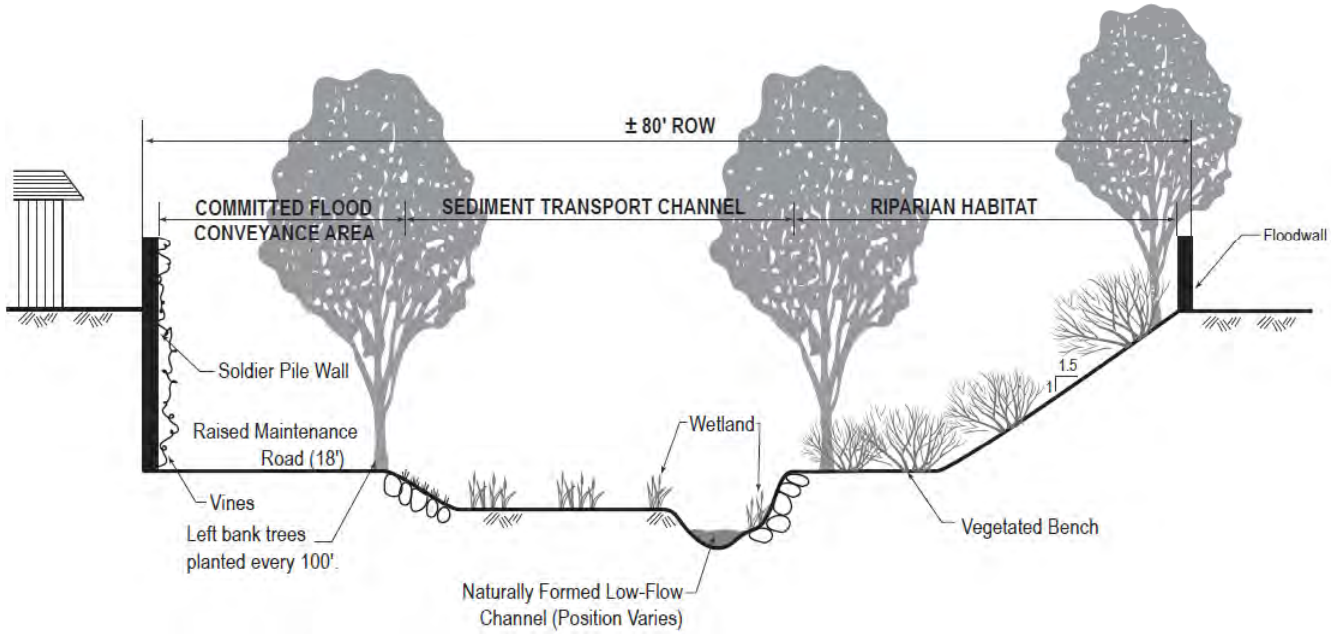
Lower Silver Creek at Reach 5c/6a

(Story Rd – Moss Point Dr)

Permitted Design



Modified Design



Lower Silver Creek at Reach 5c

Current View

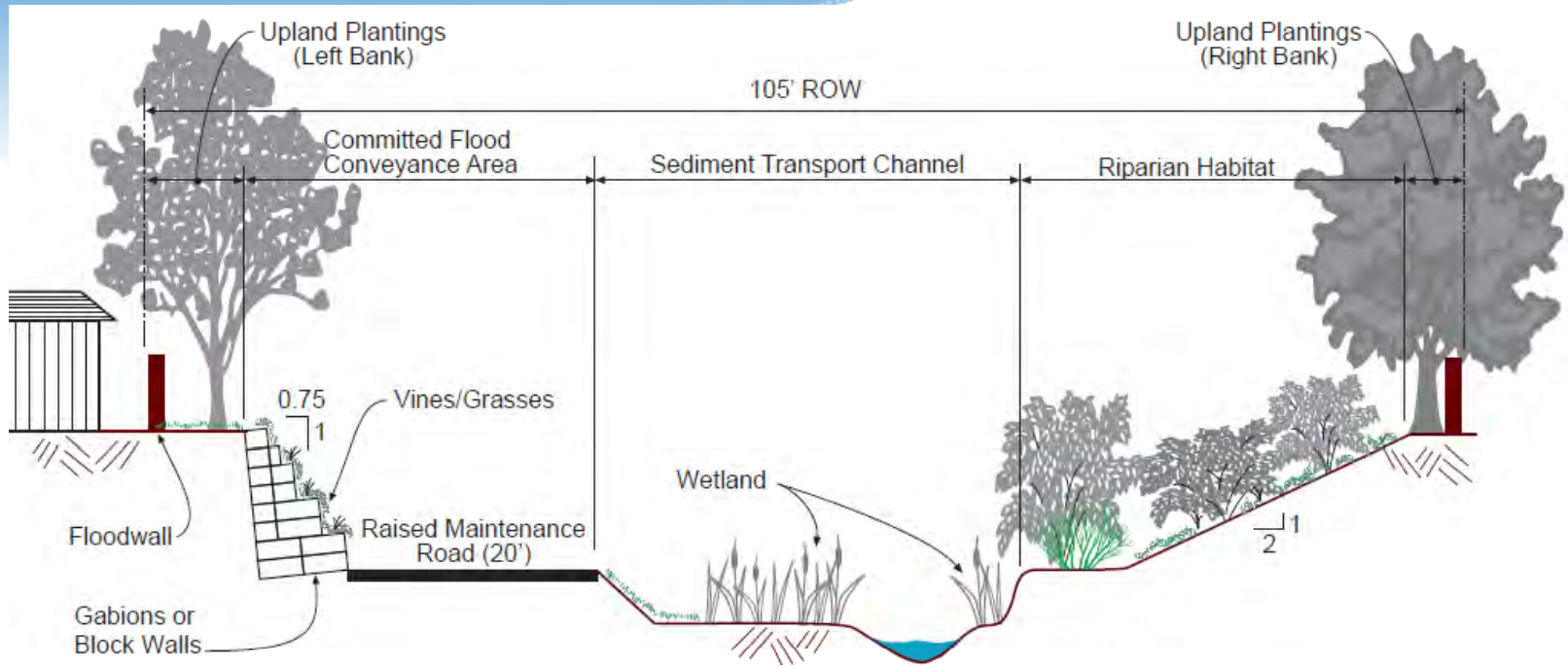
Lower Silver Creek at Reach 5c

Modified Design

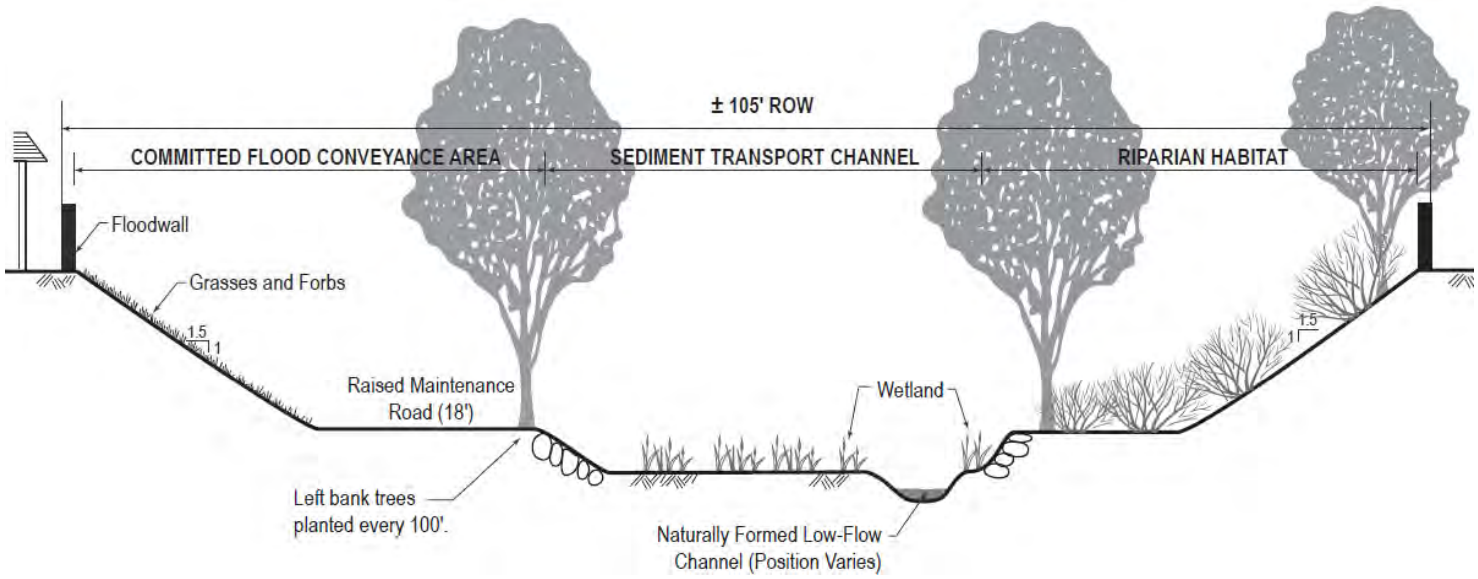
Lower Silver Creek at Reach 6b

(Moss Point Dr. – Cunningham Ave.)

Permitted Design



Modified Design



Lower Silver Creek at Reach 6b

Lower Silver Creek at Reach 6b Modified Design

APPENDIX 3B-4

UTILITY INFO

COYOTE WATERSHED PROGRAM
UTILITY RELOCATIONS
Lower Silver Creek Reaches 4-6A

Vendor	Vendor No.	Agr #	Contact	Contact Info	Location	Project	Utility Type	Amt	Amt Due (less deposits)	Status	Vendor Control #	PR #	PO #
SJWCo	3220	A2644U	Wayne Warren Mgr Water Svs	110 W. Taylor St, San Jose 95110	LSC 3-6	40264009	Potable Water [2] Relocation Deposit	$25,000		Paid 1-24-2003	NB02-455	138040	Direct Pay No PO
PGE	2869	NA	Alfred Poon Land Agent 408-282-7544 akp3@pge.com	111 Almaden Bl, Rm 814, San Jose 95113	LSC 4-6	40264012	Review Plans Cost Estimates	$50,000		Paid 11-06-2009	PM-30729809	173768	14551
SJWCo	3220	NA	Wayne Warren Mgr Water Svs	110 W. Taylor St, San Jose 95110	LSC 4-6	40264012	Evaluate relocation of SJWC water mains at Capitol/Story Rd	$40,000		Paid 11-13-2009	NB02-455	173770	Direct Pay No PO
PGE	2869	NA	Alfred Poon Land Agent 408-282-7544 akp3@pge.com	111 Almaden Bl, Rm 814, San Jose 95113	LSC 4-6	40264012	Engineering Advance Design Fee for gas transmission utility relocation	$10,000		Paid 11-30-2009	INV-6968314-2	173765	Direct Pay No PO
AT&T	9013	NA	Laura Wendover AT&T	3475B No 1st St, Rm 200, San Jose 95134	LSC 4-6	40264012	Advance fee to evaluate relocation of communication lines	$10,000		Paid 1-20-2010	INV-7674038	173797	Direct Pay No PO
PGE	2869	NA	Alfred Poon Land Agent 408-282-7544 akp3@pge.com	111 Almaden Bl, Rm 814, San Jose 95113	LSC 4-6	40264012	Add'l work on gas transmission pipeline utility relocation	$200,000		Paid 4-15-2010	PM-30729809	173818	15320
PGE	2869	NA	Alfred Poon Land Agent 408-282-7544 akp3@pge.com	111 Almaden Bl, Rm 814, San Jose 95113	LSC 4-6	40264012	Electric utility pole relocation	$43,041	$41,041	Paid 5-27-2010	PM-30729809	173821	15642
PGE	2869	PGE Contract ID# 1114730	Sharon Kennedy 408-299-1053 slkd@pge.com	PG&E CFM/PPC Dpet PO Box 997340 Sacramento, CA 95899-7340	LSC 4-6	40264012	Install 80 ft by 3" steel main, deactivate and remove 80 ft by 3" steel main	$46,744	$45,244	Pending as of 8-25-10 memo	PM-41218835	173835	TBD
PGE	2869	PGE Contract # 1114741	Sharon Kennedy 408-299-1053 slkd@pge.com	PG&E CFM/PPC Dpet PO Box 997340 Sacramento, CA 95899-7340	LSC 4-6	40264012	Relocate gas main Capital Exp & Bambi Install 58ft by 4" steel main, deactivate and remove 38ft by 4" steel main	$62,437	$60,937	Pending as of 8-25-10 memo	PM-41296976	173835	TBD
PGE	2869	PGE Contract # 1114763	Sharon Kennedy 408-299-1053 slkd@pge.com	PG&E CFM/PPC Dpet PO Box 997340 Sacramento, CA 95899-7340	LSC 4-6	40264012	Benten Ct & Mervyn's Way, Abandon service at main along creek and install new service from Betten Court	$26,529	$25,029	Pending as of 8-25-10 memo	PM-41297142	173835	TBD
PGE	2869	PGE Contract # 1114767	Sharon Kennedy 408-299-1053 slkd@pge.com	PG&E CFM/PPC Dpet PO Box 997340 Sacramento, CA 95899-7340	LSC 4-6	40264012	Story & Lyndale: cutoff and ca main, install new main when culvert is in place	$27,465	$25,965	On hold until Story Road work is approved.	PM-41297145	173835	TBD
SJWCo	3220	NA	James Bariteau 408-279-7874	San Jose Water Company Water Services Administration 1265 So. Bascom Ave. San Jose, CA 95128	LSC 4-6	40264012	Silver Creek Channel Improvements at Capitol Expressway	$375,650	$355,650	Pending as of 8-25-10 memo	NB09-041.doc Document Control No.	173834	TBD
SJWCo	3220	NA	James Bariteau 408-279-7874	San Jose Water Company Water Services Administration 1265 So. Bascom Ave. San Jose, CA 95128	LSC 4-6	40264012	Silver Creek Channel Improvements at South Jackson	$248,450	$223,450	Pending as of 8-25-10 memo	NB02-455.doc Document Control No.	173834	TBD
Comcast			Steve Morioka 408-918-3245 Steve_Morioka@cable.comcast.com	COMCAST South Bay Silicon Valley Area 1900 S. 10th St, San Jose CA 95112	LSC 4-6	40264012	Cable relocation crossing Silver Creek Channel	$5,000	$5,000	Pending as of 8-25-10 memo	2-3-2010 CableCom Memo from King to Morioka		TBD
AT&T	9013		Laura Wendover AT&T	AT&T 3475B No 1st St, Rm 200, San Jose 95134	LSC 4-6	40264012	Cable/phone relocation at Capitol Exp., Mervyn's Wy, and Betten Ct.	$22,752.33	$22,752.33	Pending as of 8-25-10 memo	139998		TBD
nt was $50K but only $25,000 was to be applied to Reaches 4-6													

COYOTE WATERSHED PROGRAM
LSC UTILITY RELOCATIONS

Project Element	Vendor	Vendor No.	Agr #	Contact	Payment Info	Location	Project	Utility Type	Amt	Amt Due (less deposits)	Status	Vendor Control #	Check #	PR #	PO #
Prelim Eng-LSC culverts@ Story, Capital, Jackson	AT&T	9013	None	Laura Wendover AT&T	AT&T 3475B No 1st St, Rm 200, San Jose 95134	LSC 4-6	40264012	Advance fee to evaluate relocation of communication lines	$10,000	$10,000	Paid 1-20-2010	INV-7674038	170225	173797	Direct Pay No PO
Cable/phone relocation at Capitol Exp., Mervyn's Wy, and Betten Ct.	AT&T	9013	None	Laura Wendover AT&T	AT&T 3475B No 1st St, Rm 200, San Jose 95134	LSC 4-6	40264012	Cable/phone relocation at Capitol Exp., Mervyn's Wy, and Betten Ct.	$22,752.33	$22,752.33	Paid 9-2-10	AT&T CR# 139998	176411	NA	Direct Pay No PO
Cable relocation	Comcast	TBD	None	Steve Morioka 408-918-3245 Steve_Morioka@cable.comcast.com	COMCAST South Bay Silicon Valley Area 1900 S. 10th St, San Jose CA 95112	LSC 4-6	40264012	Cable relocation crossing Silver Creek Channel	$5,000	$5,000	Cost Estimate received. They will bill us when and if they do any work.	2-3-2010 CableCom Memo King to Morioka	NA	NA	NA
Design deposit for Gas transmission line relocations at Dobern	PGE	2869	None	Alfred Poon Land Agent 408-282-7544 akp3@pge.com	111 Almaden Bl, Rm 814, San Jose 95113	LSC 4-6	40264012	Engineering Advance Design Fee for gas transmission utility relocation	$50,000	$50,000	Paid 11-06-2009	PM-30729809	167947	173768	14551
Deposit for gas distribution line utility relocation work (small lines)	PGE	2868	None	Sharon Kennedy 408-299-1053 slkd@pge.com	PG&E CFM/PPC Dept PO Box 997340 Sacramento, CA 95899-7340	LSC 4-6	40264012	Engineering Advance Design Fee for gas distribution utility relocation	$10,000	$10,000	Paid 11-30-2009	INV-6968314-2	169227	173765	Direct Pay No PO
Additional design deposit for Gas transmission line relocations at Dobern - deposit for pipe fittings	PGE	2869	None	Alfred Poon Land Agent 408-282-7544 akp3@pge.com	111 Almaden Bl, Rm 814, San Jose 95113	LSC 4-6	40264012	Add'l work on gas transmission pipeline utility relocation	$200,000	$200,000	Paid 4-15-2010	PM-30729809	172636	173818	15320
Capitol - Electrical utility pole relocation	PGE	2869	104091672	Alfred Poon Land Agent 408-282-7544 akp3@pge.com	111 Almaden Bl, Rm 814, San Jose 95113	LSC 4-6	40264012	Electric utility pole relocation	$43,041	$41,041	Paid 5-27-2010 Refund - add here?	PM-30764723	173963	173821	15642
Jackson Avenue - Gas line relocaton work	PGE	2869	PGE Contract ID# 1114730	Sharon Kennedy 408-299-1053 slkd@pge.com	PG&E CFM/PPC Dept PO Box 997340 Sacramento, CA 95899-7340	LSC 4-6	40264012	Install 80 ft by 3" steel main, deactivate and remove 80 ft by 3" steel main	$46,744	$45,244	Paid 9-2-10	PM-41218835	176484	NA	Direct Pay No PO
Capitol - Gas line relocation work	PGE	2869	PGE Contract # 1114741	Sharon Kennedy 408-299-1053 slkd@pge.com	PG&E CFM/PPC Dept PO Box 997340 Sacramento, CA 95899-7340	LSC 4-6	40264012	Relocate gas main Capital Exp & Bambi Install 58ft by 4" steel main, deactivate and remove 38ft by 4" steel main	$62,437	$60,937	Paid 9-2-10	PM-41296976	176486	NA	Direct Pay No PO
Betten Ct. and Mervyn's Way - Gas line and meter relocation work	PGE	2869	PGE Contract # 1114763	Sharon Kennedy 408-299-1053 slkd@pge.com	PG&E CFM/PPC Dept PO Box 997340 Sacramento, CA 95899-7340	LSC 4-6	40264012	Benten Ct & Mervyn's Way, Abandon service at main along creek and install new service from Betten Court	$26,529	$25,029	Paid 9-2-10	PM-41297142	176485	NA	Direct Pay No PO
Water line relocation designs Reaches 4-6	SJWCo	3220	A2644U	Wayne Warren Mgr Water Svs	110 W. Taylor St, San Jose 95110	LSC Reach 3	40264009	Potable Water 1 Relocation Deposit	$25,000	$25,000	Paid 1-24-2003	NB02-442	742445	138040	Direct Pay No PO
Water line relocation designs Reaches 4-6	SJWCo	3220	A2644U	Wayne Warren Mgr Water Svs	110 W. Taylor St, San Jose 95110	LSC Reach 4	40264009	Potable Water 1 Relocation Deposit	$12,500	$12,500	Paid 1-24-2003	NB02-455	742455	138040	Direct Pay No PO
Water line relocation designs Reaches 4-6	SJWCo	3220	A2644U	Wayne Warren Mgr Water Svs	110 W. Taylor St, San Jose 95110	LSC R- 5&6	40264009	Potable Water 1 Relocation Deposit	$12,500	$12,500	Paid 1-24-2003	NB02-455	742445	138040	Direct Pay No PO
Water line relocation designs for Jackson, Capitol, and Story	SJWCo	3220	None	Wayne Warren Mgr Water Svs	110 W. Taylor St, San Jose 95110	LSC 4-6	40264012	Evaluate relocation of SJWC water mains at Capitol/Story Rd	$40,000	$40,000	Paid 11-13-2009	NB02-455	168138	173770	Direct Pay No PO
Capitol Exp.- Water line relocaton work	SJWCo	3220	None	James Bariteau 408-279-7874	San Jose Water Company Water Services Administration 1265 So. Bascom Ave. San Jose, CA 95128	LSC 4-6	40264012	Silver Creek Channel Improvements at Capitol Expressway	$375,650	$355,650	Paid 9-2-10	NB09-041.doc Document Control No.	176499	NA	Direct Pay No PO
Jackson Avenue - Water line relocaton work	SJWCo	3220	None	James Bariteau 408-279-7874	San Jose Water Company Water Services Administration 1265 So. Bascom Ave.	LSC 4-6	40264012	Silver Creek Channel Improvements at South Jackson	$248,450	$223,450	Paid 9-2-10	NB02-455.doc Document Control No.	176498	NA	
Electric work at Jackson and guy anchors	PGE	2869	None	Sharon Kennedy 408-299-1053 slkd@pge.com	PG&E CFM/PPC Dept PO Box 997340 Sacramento, CA 95899-7340	LSC 4-6	40264012	Silver Creek Channel Improvements at South Jackson to Capitol	$106,681	$106,681	Paid 2-17-2011	PM-30769283	#180928	NA	Direct Pay No PO
Updated April 2011															

PROJECT	STATION	UTILITY	OWNER	MODIFICATION NEEDED FOR PROJECT	RJA ACTION ITEMS	UTILITY COORDINATOR (T. QUALLS) ACTION ITEMS	NOTES:	PLAN REFERENCE	PG&E MAP #
LSC 4	131+21 rt 47' right	Service Area Interface (SAI) (Above ground utility box on stand)	AT&T	Protect in place.			Jackson Ave. AT&T noted that this facility cannot be relocated and should not be disturbed during construction.	C2, C15, C16, S5, S5.1, S7	NA
LSC 4	131+21 rt 47' right	"LightSpeed" cable, crossing LSC at Jackson	AT&T	Protect in place.	Add this new utility to plans per plans sent by Tammy to RJA on 3/30/10.		LightSpeed cable has already been connected to the SAI box next to the creek.	C2, C15, C16, S5, S5.1, S7	NA
LSC 4	131+22 rt and lt	12-inch Water pipeline crossing creek on Jackson.	San Jose Water Company	Remove & Replace		Coordinate with SJWC. Already under design by SJWC.	Permit No. 8216 12" water on Jackson Bridge	C2, C15, C16, S5, S5.1, S7	NA
LSC 4	131+22 rt	Underground Electrical Box	PG&E	Protect in place			53' offset from center line; May be underground PG&E box from pole at 131+80 rt. May be expensive to relocate.	C2, C15, C16, S5, S5.1, S7	G1810
LSC 4	131+25	6-inch electric, single phase, primary cable	PG&E	To be built into new sidewalk of new box culvert.	Add note to plans that PG&E will install temporary poles. These lines will be temporarily moved overhead the creek during construction.	Coordinate with PG&E	Jackson Ave. SCVWD Permit 4707 (steel electrical conduit crossing) Lines are expected to remain in service.	C2, C15, C16, S5, S5.1, S7	G1810
LSC 4	131+25	4-inch electric, 12 KV, 3 phase, primary cable	PG&E	To be built into new sidewalk of new box culvert.	Add note to plans that PG&E will install temporary poles. These lines will be temporarily moved overhead the creek during construction.	Coordinate with PG&E	Jackson Ave. SCVWD Permit 4707 (steel electrical conduit crossing) Line is expected to remain in service.	C2, C15, C16, S5, S5.1, S7	G1810
LSC 4	131+25	4-inch electric, single phase, secondary cable	PG&E	To be built into new sidewalk of new box culvert.	Add note to plans that PG&E will install temporary poles. These lines will be temporarily moved overhead the creek during construction.	Coordinate with PG&E	Jackson Ave. Line is expected to remain in service.	C2, C15, C16, S5, S5.1, S7	G1810
LSC 4	131+80 rt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place			Overhead lines end at pole and probably go underground.	C2, C15, C16, S5, S5.1, S7	G1810
LSC 4	131+80 rt and lt	Overhead utility line crossing creek	PG&E, AT&T and Cable	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C2, C15, C16, S5, S5.1, S7	G1810

PROJECT	STATION	UTILITY	OWNER	MODIFICATION NEEDED FOR PROJECT	RJA ACTION ITEMS	UTILITY COORDINATOR (T. QUALLS) ACTION ITEMS	NOTES:	PLAN REFERENCE	PG&E MAP #
LSC 4	132+27 lt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C2	G1810
LSC 4	133+10 lt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C2	G1810
LSC 4	133+31 rt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C2	G1810
LSC 4	134+80 rt	Joint Pole with guy anchor, overhead utility line	PG&E, AT&T and Cable, Sunesys	Pole to remain; preserve during construction. Multiple guy anchors to be relocated.	90% Plans have note saying that guy anchors should be protected in place. Has this been field-verified? Seems like some of the guy anchors will need to move.	Submitted request to PG&E on 12/2/09. (Reference #4 in request) Tammy will do walk through with PG&E on 4/5. Also coordinating with Sunesys on their guy anchors.		C2	G1810
LSC 4	134+82 rt and lt	Overhead utility line (guy wire) crossing creek	PG&E, AT&T and Cable	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C2	G1810
LSC 4	134+83 lt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C2	G1810
LSC 4	135+66 lt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C2	G1810
LSC 4	135+88 rt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place		Tammy will confirm guy anchor during field walk.	Pole is barely in right of way. Pole has guy anchor?	C2	G1810
LSC 4	135+90 rt	21" RCP SD	City of San Jose	Construct new outfall	Need to review to make sure it is CMP in right of way and has flap gate (typ SD outfalls)			C2	NA

PROJECT	STATION	UTILITY	OWNER	MODIFICATION NEEDED FOR PROJECT	RJA ACTION ITEMS	UTILITY COORDINATOR (T. QUALLS) ACTION ITEMS	NOTES:	PLAN REFERENCE	PG&E MAP #
LSC 4	137+33 rt	Joint Pole with guy anchor, overhead utility line	PG&E, AT&T and Cable	Protect in place		Tammy will confirm guy anchor during field walk.		C3	G1810 (not shown on map)
LSC 4	137+44 lt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C3	G1810
LSC 4	137+44 rt & lt	Overhead utility line crossing creek	PG&E, AT&T and Cable	Both overhead line and joint poles to remain in place. Protect in place.			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C3	G1810 (not shown on map)
LSC 4	137+51 rt	Joint Pole with guy anchor, overhead utility line	PG&E, AT&T and Cable	Protect in place		Tammy will confirm guy anchor during field walk.	Seems like slope cut may affect guy anchor, should we request removal?	C3	G1810
LSC 4	138+08 lt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place			On private property	C3	G1810 (not shown on map)
LSC 4	138+77 rt	Joint Pole with guy anchor, overhead utility line	PG&E, AT&T and Cable	Protect in place		Tammy will confirm guy anchor during field walk.	Show guy anchor on plans.	C3	G1810 (not shown on map)
LSC 4	139+00 rt & lt	Overhead utility line crossing creek	PG&E, AT&T and Cable	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C3	G1810
LSC 4	139+26 lt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place			On private property	C3	G1810
LSC 4	140+60 rt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C3	G1810
LSC 4	142+14 lt	18-inch CMP Storm Drain Pipe	City of San Jose	Construct new outfall	Check if flapgate is needed (typ all CSJ owned SD outlets).		@90% design 18-inch pipe size shown/confirmed.	C3	NA
LSC 4	142+19	24-inch CMP Storm Drain Pipe	City of San Jose	Construct new outfall	Check if flapgate is needed (typ all CSJ owned SD outlets).			C3	NA
LSC 4	142+40 rt	Joint Pole with guy anchor, overhead utility line	PG&E, AT&T and Cable	Protect in place			Show guy anchor on plans.	C3	G1810
LSC 4	142+60 lt	Electrical Tower	PG&E	Protect in place			58' offset from center line	C3	G1810

PROJECT	STATION	UTILITY	OWNER	MODIFICATION NEEDED FOR PROJECT	RJA ACTION ITEMS	UTILITY COORDINATOR (T. QUALLS) ACTION ITEMS	NOTES:	PLAN REFERENCE	PG&E MAP #
LSC 4	142+72 rt	48-inch CMP Storm Drain Pipe	City of San Jose	Construct new outfall	Check if flapgate is needed (typ all CSJ owned SD outlets).			C3	NA
LSC 4	143+04 rt and lt	34-inch Gas line crossing creek	PG&E	Protect in place.		Confirm protect in place requirements are met.	Line 300B	C3	3414-B3
LSC 4	143+22 rt and lt	34-inch Gas line crossing creek	PG&E	Relocate	Need to add relocation requirements to plans and specifications.	Make sure phasing is okay for design and PG&E work (likely 2nd season)	Line 300A	C3	3414-B3
LSC 4	143+33 lt	Joint Pole with guy anchor, overhead utility line	PG&E, AT&T and Cable	Protect in place	RJA to determine if guy anchor needs to be relocated.		On private property. Show guy anchor on plans.	C3	G1810
LSC 4	143+35 rt and lt	20-inch Gas line crossing creek	PG&E	Relocate	Need to add relocation requirements to plans and specifications.	Make sure phasing is okay for design and PG&E work (likely 2nd season)	Line 100	C3	3414-B3
LSC 4	143+50 rt and lt	Overhead utility line crossing	PG&E, AT&T and Cable	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C3	G1810
LSC 4	143+70 rt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C3	G1810
LSC 4	143+81 lt	30-inch CMP Storm Drain Pipe	City of San Jose	Construct new outfall	Check if flapgate is needed (typ all CSJ owned SD outlets).			C3	NA
LSC 4	144+53 rt and lt	Siphon Sewer (twin 6" CIP) crossing creek and manholes	City of San Jose	Remove				c4,c22	NA
LSC 4	144+97 lt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place			On private property	C4	G1810
LSC 4	145+17 rt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C4	G1810
LSC 4	146+47 lt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C4	G1810
LSC 4	146+64 rt	24-inch RCP Storm Drain Pipe	City of San Jose	Construct new outfall	Check if flapgate is needed (typ all CSJ owned SD outlets).		@90% design 24-inch pipe size shown/confirmed.	C4	NA
LSC 4	146+71 rt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C4	G1810
LSC 4	148+00 lt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C4	G1810
LSC 4	148+15 rt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C4	G1810
LSC 4	149+50 lt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C4	G1810
LSC 4	149+68 rt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C4	G1810

PROJECT	STATION	UTILITY	OWNER	MODIFICATION NEEDED FOR PROJECT	RJA ACTION ITEMS	UTILITY COORDINATOR (T. QUALLS) ACTION ITEMS	NOTES:	PLAN REFERENCE	PG&E MAP #
LSC 4	150+98 lt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C5	G1810
LSC 4	151+18 rt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C5	G1906
LSC 4	152+68 lt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C5	G1906
LSC 4	152+68 rt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C5	G1906
LSC 4	153+66 lt	Joint Pole with guy anchor, overhead utility line	PG&E, AT&T and Cable	Protect in place	RJA to determine if guy anchor needs to be relocated.		On private property. Show guy anchor on plans.	C5	G1906
LSC 4	153+94 rt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C5	G1906
LSC 4	154+80 lt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C5	G1906
LSC 4	154+80 rt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C5	G1906
LSC 4	154+80 rt & lt	Overhead utility line crossing creek	PG&E, AT&T and Cable	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C5	G1906
LSC 4	154+80 rt to 156+60 rt	Overhead wire parallel to creek over Capitol Expressway	PG&E, AT&T and Cable	Protect in place				C5	G1906
LSC 4	154+86 rt and lt	Gas line crossing creek (2-inch line)	PG&E	Relocate		Currently under study/design by PG&E Engineering in Fresno.	Capitol Expressway	C5	3414-B4
LSC 4	156+00?	PG&E, Cable, or AT&T underground		Relocate		currently under design by AT&T	Capitol Expressway	C5,C25	G1906
LSC 4	155+45	12-inch water pipeline crossing creek in center of Capitol	San Jose Water Company	Relocate		Currently under design by SJWC.	Capitol Expressway	C5,C25	NA
LSC 4	156+00?	VTA underground	VTA	Preserve in place. RJA to confirm.	RJA to confirm it there is a VTA anchor here.		Capitol Expressway		NA
LSC 4	156+00?	Sewer Lines	City of San Jose	Relocate			Capitol Expressway	C5,C25	NA
LSC 4	156+00?	Storm Drain Outfall(s)	City of San Jose	Connect to new culvert	Check if flapgate is needed (typ all CSJ owned SD outlets).		Capitol Expressway	C5,C25	NA

PROJECT	STATION	UTILITY	OWNER	MODIFICATION NEEDED FOR PROJECT	RJA ACTION ITEMS	UTILITY COORDINATOR (T. QUALLS) ACTION ITEMS	NOTES:	PLAN REFERENCE	PG&E MAP #
LSC 4	156+00??	Power pole	PG&E				SCVWD Permit 7603. But note says that permit was voided. Was this constructed?	C5,C25	G1906 (not shown on map)
LSC 4	156+00??	600-volt electrical aerial crossing					Easterly Betten Court SCVWD Permit 16994	C5,C25	
LSC 4	156+00??	Temp. Power pole and electrical Crossing	PG&E				North of Mervyns Way SCVWD Permit 7076. Still there?	C5,C25	G1906 (not shown on map)
LSC 4	156+55 rt and lt	Gas line crossing creek (4-inch line)	PG&E	Relocate		Currently under study/design by PG&E Engineering in Fresno.	Capitol Expressway	C5,C25	3414-B4
LSC 4	156+60 rt	Joint Pole with overhead utility line	PG&E, Comcast, and/or AT&T	Relocate pole	Need to show pole relocation on plans once PG&E provides design.	Submitted request to PG&E on 12/2/09.		C5	G1901
LSC 4	157+33 rt	54-inch CMP Storm Drain pipe	City of San Jose	To be reconstructed	Check if flapgate is needed (typ all CSJ owned SD outlets).			C5	NA
LSC 4	157+30 to 159+50	4" gas- runs parallel to creek	PG&E	Remove		Currently under study/design by PG&E Engineering in Fresno.	In SCVWD ROW. Runs along south bank of creek.	C5	3414-A4
LSC 4	157+64 rt	Joint Pole with guy anchor, overhead utility line	PG&E, AT&T and Cable	Relocate pole	Need to show pole relocation on plans once PG&E provides design.	Submitted request to PG&E on 12/2/09.	Show guy anchor on plans.	C5	G1901
LSC 4	157+95 rt & lt	Overhead utility line crossing creek at a large skew	PG&E, AT&T and Cable	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C5	G1901
LSC 4	158+20 rt & lt	Overhead utility line crossing creek at a large skew	PG&E, AT&T and Cable	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C6	G1901
LSC 4	158+50	Gas, electric, and telephone service for San Jose Cambodian Buddhist Society Parcel	PG&E and AT&T	Relocate		Gas is currently under study/design by PG&E Engineering in Fresno. AT&T is following up on telephone service.	Comcast cable and water are served from Betten Ct, not from the creek side.	C6	3414-A4 G1901

PROJECT	STATION	UTILITY	OWNER	MODIFICATION NEEDED FOR PROJECT	RJA ACTION ITEMS	UTILITY COORDINATOR (T. QUALLS) ACTION ITEMS	NOTES:	PLAN REFERENCE	PG&E MAP #
LSC 4	158+54 lt	4-inch Storm Drain Pipe	Not sure - looks to be private?	Note 9 shows it to be rebuilt for new wall.			Would be nice to eliminate this storm drain outlet.	C6	NA
LSC 4	159+22 lt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place		Submitted request to PG&E on 12/2/09		C6	G1901
LSC 4	159+48 rt	Joint Pole with overhead utility line	PG&E, AT&T and Cable	Protect in place				C6	G1901
LSC 4	159+50	Gas, electric, and telephone service for home owned by Randy Illa.	PG&E and AT&T	Relocate		Gas is currently under study/design by PG&E Engineering in Fresno. AT&T is following up on telephone service.	Comcast cable and water are served to Betten Ct, not from the creek side.	C6	3414-A4 G1901
LSC 4	160+18 rt	12-inch CMP Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Private or CSJ (typ. all SD items).			C6	NA
LSC 4	160+94 rt	12-inch CMP Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Private or CSJ (typ. all SD items).			C6	NA
LSC 4	161+21 rt	30-inch CMP Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Check if flapgate is needed (typ all CSJ owned SD outlets).			C6	NA
LSC 4	161+72 lt	18-inch CMP Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Check if flapgate is needed (typ all CSJ owned SD outlets).			C6	NA
LSC 5	171+26 rt	12-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Private or CSJ (typ. all SD items).			C7	NA
LSC 5	171+54 rt	12-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Private or CSJ (typ. all SD items).			C7	NA
LSC 5	171+87 lt	12-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Private or CSJ (typ. all SD items).			C7	NA
LSC 5	173+55 lt	Electrical Box		Protect in place			Note found on Plan, to be verified at field.	C8	G1901
LSC 5	176+33 rt	6-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Private or CSJ (typ. all SD items).			C8	NA
LSC 5	179+10	Monitoring Well	Santa Clara Valley Water District	To be sealed	Need to add well to plans and note on sealing per District's standard well destruction procedures.			C8	NA
LSC 5	181+80 rt	Existing Fire Hydrant	San Jose Water Company	Protect in place, to be remained.	Hydrant was relocated with Home Depot construction. Needs to be updated on plans at new location.			C9	NA
LSC 5	182+00	12-inch Water Line along Story Road	San Jose Water Company	relocate		Currently under design by SJWC.		C9	NA
LSC 5	182+00	Electric lines for street lights and signals	City of San Jose	Protect existing lines in place.				C9	NA

PROJECT	STATION	UTILITY	OWNER	MODIFICATION NEEDED FOR PROJECT	RJA ACTION ITEMS	UTILITY COORDINATOR (T. QUALLS) ACTION ITEMS	NOTES:	PLAN REFERENCE	PG&E MAP #
LSC 5	182+00	Telephone lines-underground	AT&T	Protect existing conduits in place.		AT&T to confirm there is slack available for construction.		C9	NA
LSC 5	182+20	4-inch Gas Crossing Story Road	PG&E	Relocate		Currently under study/design by PG&E Engineering in Fresno.		C9	3414-B5
LSC 5	182+50	30-inch Storm Drain Pipeline along Story Road	City of San Jose	Move manhole per CSJ.			One map shows pipe on 2 sides and this does not make a lot of sense.	C9, C35	NA
LSC 5	182+75	Utility Line along Story Road	PG&E, Comcast and/or AT&T	Protect in place		Submitted request to PG&E on 12/2/09.	Field visit confirmed that overhead lines have been put underground.	C9	G1907
LSC 5	182+75	Electric lines for street lights and signals	City of San Jose	Protect existing lines in place.				C9	NA
LSC 5	182+75	Telephone lines-underground	AT&T	Protect existing conduits in place.		AT&T to confirm there is slack available for construction.		C9	NA
LSC 5	182+75	Gas, electric, and phone services for Fish City business.	PG&E and AT&T	Protect in place				C9	3414-B5 G1907
LSC 5	190+05 lt	15-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Check if flapgate is needed (typ all CSJ owned SD outlets).			C10	NA
LSC 5	190+07 rt	12-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Private or CSJ (typ. all SD items).			C10	NA
LSC 5	191+22 lt	24-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Check if flapgate is needed (typ all CSJ owned SD outlets).			C10	NA
LSC 5	191+19.5 lt	Storm Drain Manhole	City of San Jose	Protect in place, to be remained.				C10	NA
LSC 5	193+08 rt	8-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Private or CSJ (typ. all SD items).			C10	NA
LSC 5	195+02lt	15-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Check if flapgate is needed (typ all CSJ owned SD outlets).			C11	NA
LSC 5	195+20 lt to 195+48 rt	Overhead Utility Line Crossing Creek connected by 2 Joint Utility Poles	PG&E, Pac Bell and/or AT&T	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C11	G1907

PROJECT	STATION	UTILITY	OWNER	MODIFICATION NEEDED FOR PROJECT	RJA ACTION ITEMS	UTILITY COORDINATOR (T. QUALLS) ACTION ITEMS	NOTES:	PLAN REFERENCE	PG&E MAP #
LSC 5	196+66 rt to 196+95 lt	Overhead Utility Line Crossing Creek connected by 2 Joint Utility Poles	PG&E, Pac Bell and/or AT&T	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C11	G1907
LSC 5	197+92 lt to 198+18 rt	Overhead Utility Line Crossing Creek connected by 2 Joint Utility Poles	PG&E, Pac Bell and/or AT&T	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C11	G1907
LSC 5	198+96	12-inch Storm Drain	City of San Jose	Modify Existing Outfall	Private or CSJ (typ. all SD items).		Flow line of this outfall is not available, need to verify at field.	C11	NA
LSC 6A	199+59 rt to 199+68 lt	Overhead Utility Line Crossing Creek from Sta. 199+59 of right bank to 199+68 of left bank	PG&E, Pac Bell and/or AT&T	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C11	G1907
LSC 6A	199+95 rt to 200+55 lt	Overhead Utility Line Crossing Creek connected by 2 Joint Utility Poles	PG&E, Pac Bell and/or AT&T	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C11	G1907
LSC 6A	201+60 rt & lt	Overhead Utility Line Crossing Creek connected by 2 Joint Utility Poles	PG&E, Pac Bell and/or AT&T	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C11	G1907
LSC 6A	201+71 lt	3-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Private or CSJ (typ. all SD items).			C11	NA
LSC 6A	202+80 RT to 202+70 lt	Overhead Utility Line Crossing Creek connected by 2 Joint Utility Poles	PG&E, Pac Bell and/or AT&T	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C11	G1907
LSC 6A	203+84 lt	18-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Check if flapgate is needed (typ all CSJ owned SD outlets).		@ 90% design 18-inch pipe size shown/confirmed.	C12	NA

PROJECT	STATION	UTILITY	OWNER	MODIFICATION NEEDED FOR PROJECT	RJA ACTION ITEMS	UTILITY COORDINATOR (T. QUALLS) ACTION ITEMS	NOTES:	PLAN REFERENCE	PG&E MAP #
LSC 6A	204+03 rt to 204+40 lt	Overhead Utility Line Crossing Creek connected by 2 Joint Utility Poles	PG&E, Pac Bell and/or AT&T	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C12	G1907
LSC 6A	205+23 rt to 205+60 lt	Overhead Utility Line Crossing Creek connected by 2 Joint Utility Poles	PG&E, Pac Bell and/or AT&T	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C12	G1907
LSC 6A	206+41 rt to 206+78 lt	Overhead Utility Line Crossing Creek connected by 2 Joint Utility Poles	PG&E, Pac Bell and/or AT&T	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C12	G1907
LSC 6A	207+60 rt to 206+78 lt	Overhead Utility Line Crossing Creek connected by 2 Joint Utility Poles	PG&E, Pac Bell and/or AT&T	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C12	G1907
LSC 6A	208+80 rt to 208+58 lt	Overhead Utility Line Crossing Creek connected by 2 Joint Utility Poles	PG&E, Pac Bell and/or AT&T	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C12	G1907
LSC 6A	209+95 rt to 209+73 lt	Overhead Utility Line Crossing Creek connected by 2 Joint Utility Poles	PG&E, Pac Bell and/or AT&T	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C12	G1907
LSC 6A	210+02 rt	12-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Private or CSJ (typ. all SD items).			C12	NA
LSC 6A	211+15 rt to 211+43 lt	Overhead Utility Line Crossing Creek connected by 2 Joint Utility Poles	PG&E, Pac Bell and/or AT&T	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C13	
LSC 6A	211+74.8 lt	18-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Check if flapgate is needed (typ all CSJ owned SD outlets).		@ 90% design 18-inch pipe size shown/confirmed.	C13	NA

PROJECT	STATION	UTILITY	OWNER	MODIFICATION NEEDED FOR PROJECT	RJA ACTION ITEMS	UTILITY COORDINATOR (T. QUALLS) ACTION ITEMS	NOTES:	PLAN REFERENCE	PG&E MAP #
LSC 6A	211+83 rt	Overhead Utility Line Crossing Creek, extended from Joint Utility Pole at Sta 211+83 (right bank)	PG&E, Pac Bell and/or AT&T	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C13	
LSC 6A	211+83 rt to 209+73 lt	Overhead Utility Line Crossing Creek connected by 2 Joint Utility Poles	PG&E, Pac Bell and/or AT&T	Protect in place			Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint poles.	C13	
LSC 6A	213+95 lt	12-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Private or CSJ (typ. all SD items).		Note CSJ likes minimum 15-inch size	C13	NA
LSC 6A	216+86 lt	30-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Check if flapgate is needed (typ all CSJ owned SD outlets).		@ 90% design 30-inch pipe size shown/confirmed.	C13	NA
LSC 6B	218+30 rt to 218+40 lt	Overhead Utility Line Crossing Creek connected by one Joint Utility Pole and one power pole	PG&E, Pac Bell and/or AT&T	Relocate Joint Point/Overhead Lines	Remain as shown on Drawing.		Overhead line will not interfere with channel improvement; therefore, shall remain in place. Contractor will be directed to work around the joint pole and power pole.		
LSC 6B	221+17 lt	12-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Need to confirm status in next submittal				NA
LSC 6B	226+19 lt	12-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Need to confirm status in next submittal				NA
LSC 6B	230+41.7 lt	48-inch Strom Drain Pipe	City of San Jose	Modify Existing Outfall	Need to confirm status in next submittal				NA
LSC 6B	230+58 lt	24-inch Strom Drain Pipe	City of San Jose	Modify Existing Outfall	Need to confirm status in next submittal				NA
LSC 6B	236+13.4 lt	15-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Need to confirm status in next submittal				NA
LSC 6B	240+29.2 rt	12-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Need to confirm status in next submittal				NA
LSC 6B	244+13 rt	15-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Need to confirm status in next submittal				NA
LSC 6B	244+21 lt	18-inch Storm Drain Pipe	City of San Jose	Modify Existing Outfall	Need to confirm status in next submittal				NA

APPENDIX 3B-5

LAND ACQUISTION AND EASEMENTS

	1	2	3	4	5	6
1						
2	**Number**	**Project/APN**	**First Name**	**Last Name**	**District File #**	**Notes**
3		**Lower Silver Creek**				
4		**Reach 4**				
140	135	484-32-133	JOSEPH W SUNZERI 1997 FAI	Joseph W Sunzeri	4026-301	
172	167	488-04-140		Hong	4026-332	Partial take may be required.
212	207	488-09-031		Avalos	4026-372	Partial take may be required.
275						
276						
277						
278						
279						

PRELIMINARY
RIGHT-OF-WAY EXHIBIT

13785 STORY ROAD

SAN JOSE, CALIFORNIA

RJA
RUGGERI-JENSEN-AZAR
ENGINEERS ▪ PLANNERS ▪ SURVEYORS
8055 CAMINO ARROYO GILROY, CA 95020
PHONE: (408) 848-0300 FAX: (408) 848-0302

SCALE:	DATE:	JOB NO.:
1"=20'	03/10/2010	092051

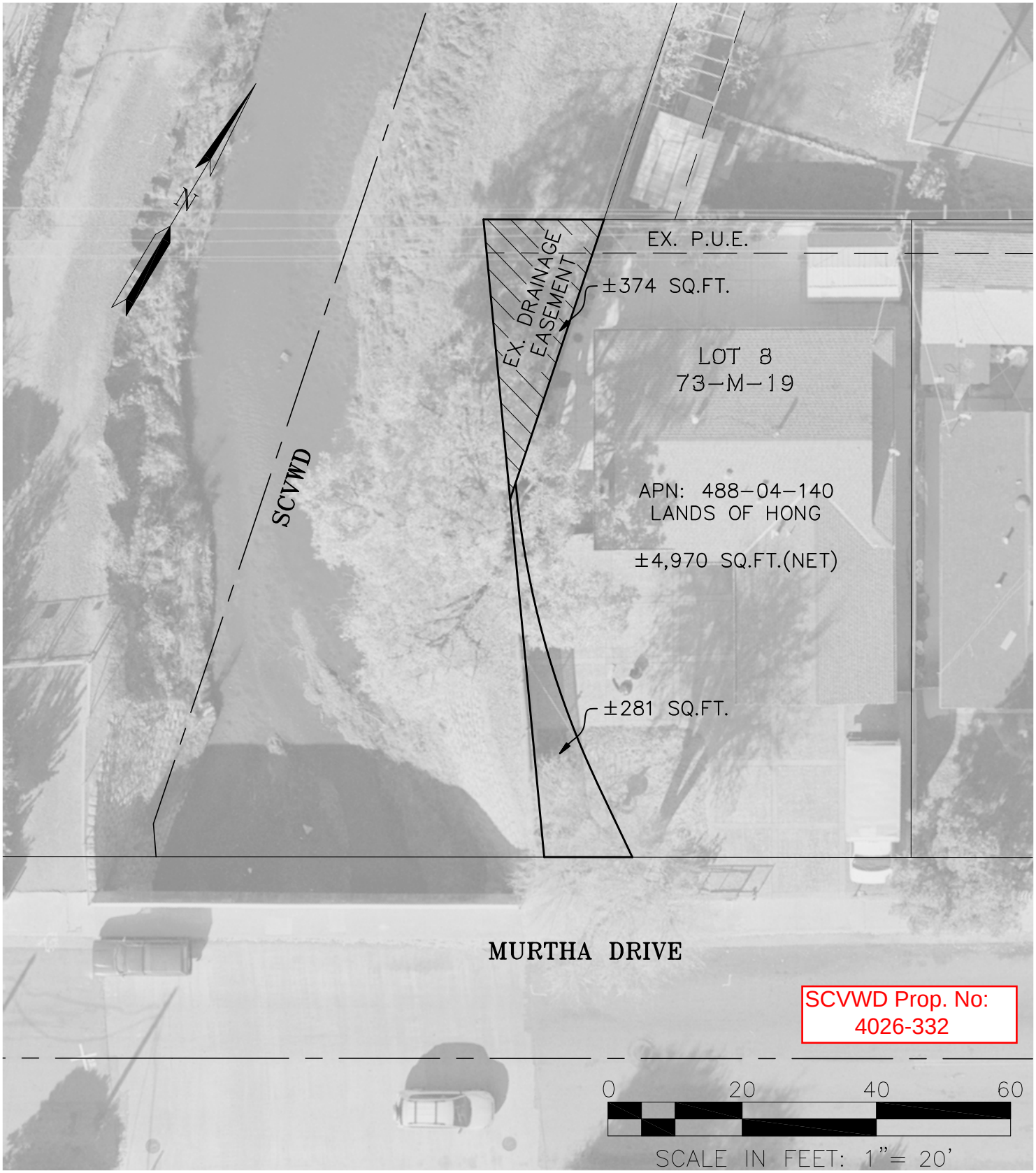
PRELIMINARY
RIGHT-OF-WAY EXHIBIT

1307 FARRINGDON DRIVE

SAN JOSE, CALIFORNIA

RJA
RUGGERI-JENSEN-AZAR
ENGINEERS • PLANNERS • SURVEYORS
8055 CAMINO ARROYO GILROY, CA 95020
PHONE: (408) 848-0300 FAX: (408) 848-0392

SCALE:	DATE:	JOB NO.:
1"=20'	01/26/2010	092051



PRELIMINARY
RIGHT-OF-WAY EXHIBIT

2885 MURTHA DRIVE

SAN JOSE, CALIFORNIA

RJA
RUGGERI-JENSEN-AZAR
ENGINEERS ▪ PLANNERS ▪ SURVEYORS
8055 CAMINO ARROYO GILROY, CA 95020
PHONE: (408) 848-0300 FAX: (408) 848-0302

SCALE:	DATE:	JOB NO.:
1"=20'	3/10/2010	092051

Update: 9/13/2010

Lower Silver Creek Flood Protection Project
Reaches 4-6 / SCVWD - RMC
APPRAISAL/ACQUISITION/ RELOCATION STATUS REPORT

CONFIDENTIAL

ARWS ASSOCIATED RIGHT OF WAY SERVICES, INC

Property Information					Appraisal			Acquisition						Relocation						
Parcel No.	Assessor Parcel No.	Owners/Tenants/Site Address	Property Interest / Fee	PTR No. & Date	N.I.A.	Inspection	Appraised Value	F.W.O.	Counter offer Amount	Settlement Amount	Owner appraised value SB 1210	C.O.E.	Last Contact Date	G.I.N.	N.O.E.	90-Day Info Notice Sent	30-Day NTV / Effective Date	Date Vacated Property	Last Contact Date	Comments
4026-372	488-09-031	Rafael G. Avalos and Jesus Avalos 1307 Farringdon Drive San Jose, CA 95127-4613 (408) 259-6690	308	10-51048321 02/19/10	04/02/10	04/08/10	$9,300.00	07/02/10					07/26/10	N/A	N/A	N/A	N/A	N/A	N/A	7/2/10: Owner behind on mortgage payments; attempting loan modification. Records show Notice of Default dated 5/17/10. AR/WS will request loan contact info to speak with lender directly. Left message 7/26. 7/28 Received email that project is on hold. 8/10 Notified Client offer should be rescinded. 9/3 Offer has not been rescinded.
4026-332	488-04-140	Tu T. and Le N. Hong Mailing: 1058 Duncan Avenue Sunnyvale, CA 94089-1505 Site: 2885 Murtha Drive San Jose, CA 95127 (408) 734-3651 Fax (408) 734-8292	659	10-51048322 02/19/10	04/02/10	04/02/10 04/08/10	$15,100.00	07/02/10	$40,000.00				09/07/10	N/A	N/A	N/A	N/A	N/A	N/A	7/2/10: Owner adament that the offer is unacceptable since it is not based of the value of the property which they paid; discussed option to retain their own appraisal and/or submit a counteroffer. 7/19, 7/20, 7/21, and 7/22 multiple discussions with Le Hong re R/W Contract questions. 7/22 Counteroffer letter received, but no total figure provided; discussed with L.Hong. 7/23 Received $40,000 counteroffer. AR/WS preparing response letter. 7/28 Received email that project is on hold. 8/10 Notified Client offer should be rescinded. 9/3 Offer has not been rescinded. AR/WS will verbally inform Hong. 9/7 Left msg. for Hong.
4026-301	484-32-133	The Joseph W. Sunzeri 1997 Family Limited Partnership Mailing: P.O. Box 3238 San Jose, CA 95156-3238 Site: 13785 Story Rd. San Jose, CA 95127 (408) 258-1000 Office (408) 529-2064 Cell	553	10-51048320 02/19/10	04/02/10	04/02/10 04/08/10	$71,300.00	05/27/10	N/A	$71,300.00	N/A		09/03/10	N/A	Pending					5/24/10: Owner concerned w/setback; asked if concrete would be allowed in the setback area; discussed personal property in the acq. area; offer will be discussed w/partners. 5/28 msg from and to Owner re fencing during construction. 6/3 Discussed riparian setback and construction limitations; confirmed any concrete surfaces must be pervious. 6/4 Riparian Guidelines sent to Owner. 6/9 Discussed setback concers with RMC. 6/14, 6/16, 6/18, and 6/23 attempted phone calls to Owner. 6/25 Spoke w/Owner; discussed floodwall height, damages, timeframe for response, etc. 6/30 Fwd construction sheets to Owner. 7/6 Confirmed receipt w/Owner. 7/14 Spoke w/Owner; discussed relocation information status; partners reviewing information. 7/21 Attempted calls to Owner. 7/23 Spoke w/Owner; he will be unavailable for one week; they do not intend to retain their own appraiser. AR/WS will follow up the week of 8/2. Received call from Sunzeri; ready to sign. 8/11:Met with Sunzeri and obtained signature; notarized deed; requested partnership documents. 8/12: Requested copy of lease. 8/24: Discussed partnership docs faxed and requested additional info. 9/1: Spoke w/Sunzeri; addtional partnership docs received. 9/3: Fwd signed offer docs and partnership docs to RMC. Quitclaim deed sent to Sunzeri regarding tenant (potential) interest. 9/7: Messages regarding quitclaim deed and notarization. 9/9: RMC will contact Sunzeri directly regarding partnership agreement and signatures from other partners.
4026-301	484-32-133	Donald and Smith Nunez dba Mundi Travel, LLC and Nunez Tax Financial 13785 Story Rd., Suite 1 San Jose, CA 95127 (408) 272-1753-Mundi Fax (408) 272-5769 iarguello@munditravel.travel www.munditravel.travel (408) 259-1044 - D. Nunez dnunez@nuneztaxfinancial.com www.nuneztaxfinancial.com	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Pending					Business owns shed within the right-of-way; entitled to relocation assistance for personal property only. Requires NOE.

Legend:
N.I.A.- Notice of Intent to Appraise
F.W.O.- First Written Offer
C.O.E.- Close of Escrow
G.I.N. - General Information Notice
N.O.E. - Notice of Eligibility
N.T.V. - Notice to Vacate
M.E. - Moving Expense
Files Completed and Closed

70 ERIC - 586-0101

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

NOTICE OF ELIGIBILITY - PERSONAL PROPERTY ONLY

(Form 11)

EXHIBIT
10-EX-46 (NEW 12/2005)
Page 1 of 2

Date _____

File Reference: _____
_____

_____
_____
_____

Dear _____:

On _____, 20___, the Department of Transportation made an offer to purchase all or a portion of the property located at _____. At the time of the offer, an inventory of personal property was taken and you were identified as the owner. As the owner of the listed personal property, you are entitled to certain relocation benefits under the Department's Relocation Assistance Program. These benefits are outlined below:

1. **RELOCATION ADVISORY ASSISTANCE:** The Department will help you find a new place to relocate your personal property and assist you in making arrangements to move your personal property from the property being required.

2. **MOVING AND RELATED EXPENSES:** You may be reimbursed the cost to relocate your personal property based on actual reasonable moving and related costs and reestablishment expenses as the Department determines to be reasonable and necessary. The following moving expenses may be considered by the Department:

   a. Transportation of personal property limited to 50 miles or less. Distances beyond 50 miles are not eligible, unless the Department determines that relocation beyond 50 miles is justified.
   b. Packing, crating, unpacking, and uncrating of the personal property.
   c. Disconnecting, dismantling, removing, reassembling, and reinstalling relocated personal property.
   d. Storage of the personal property not to exceed 12 months, unless the Department determines that a longer period is necessary.
   e. Insurance for the replacement value of the personal property in connection with the move and necessary storage.
   f. The replacement value of property lost, stolen, or damaged in the process of moving (not through the fault or negligence of your own, your agent, or your employee) where insurance covering such loss, theft, or damage is not reasonably available.
   g. Other moving related expenses as the Department determines to be reasonable and necessary.
   h. Based on the provision of "low value/high bulk," the Department may determine that the cost of moving the property would be disproportionate to its value, in which case the move payment shall not exceed the amount which would be received if the property were sold at the site.

CAUTION: In order to qualify for reimbursement of the above-described expenses, you **MUST:**

   a. Provide the Department with an updated list of the personal property to be moved at least thirty (30) days in advance of the start of your move;
   b. Notify the Department at least fifteen (15) days in advance of the date of the start of your move or disposition of your property;
   c. Permit the Department to monitor the move and make reasonable and timely inspections of the personal property at both the displacement and replacement sites. Failure to comply with any of the requirements may result in your losing part or all of your benefits.

You should also be aware that you are not entitled to payment, under the relocation regulations, for:

- The cost of moving any structure or other real property improvement in which you reserved ownership;
- Interest on a loan to cover moving expenses;
- Personal injury.

NOTICE OF ELIGIBILITY - PERSONAL PROPERTY ONLY (Cont.)

(Form #)

You may move either by commercial mover or take full responsibility for all or part of the move. If you elect a "self-move," the Department must first obtain at least two (2) acceptable bids or estimates.

If you lease or rent from the Department, failure to pay necessary rental payments to the Department may reduce the relocation payment that you will receive.

Moving and related payments are not considered as income for the purposes of personal income tax laws. Furthermore, these payments are not considered income or resources to recipients of public assistance. Relocation payments are normally made within sixty (60) days of the date that your completed claim is received by the Department.

You will be given at least 90 days' written notice before you will be required to move the personal items from the property.

It is important that you understand the matters explained above which relate to your eligibility. If at any time you want assistance, please contact your relocation agent by writing, telephoning, or visiting me at the address listed below.

The Uniform Act provides that a person may appeal to the head of the responsible department if the person believes that the department has failed to properly determine the person's eligibility or the amount of the payment authorized by the Uniform Act. You have the right to be represented by legal counsel at your own expense, but their presence is not required. If you still believe a proper determination has not been made by the Relocation Appeals Board, you may seek judicial review. You may submit an appeal in writing to: Caltrans, Right of Way Office, Relocation Appeals Board, 1120 N Street, Sacramento, California 95814.

Displacees not lawfully present in the United States are ineligible for relocation payments and assistance. Certification of legal U.S. residency status must be on file with the Department for all household members in order to receive benefits.

Sincerely,

_____

_____, Right of Way Agent

_____

Relocation Agent Address

_____

Telephone

ACKNOWLEDGEMENT

I was personally contacted by the above agent for the Department of Transportation. I have had the services and entitlements available explained to me. I was further advised that the Department of Transportation Relocation Assistance Program is available to assist me if any questions arise or as assistance is needed. I have been given a copy of this form letter.

Date _____ Displacee's signature _____

ADA Notice For individuals with disabilities, this document is available in alternate formats. For information call (916) 654-5413 Voice, CRS: 1-800-735-2929, or write Right of Way, 1120 N Street, MS-37, Sacramento, CA 95814.

10.04.02.04 Fixed Moving Schedule (Chart) [Effective May 16, 2005 (updated every three years)]

SCHEDULE A (OCCUPANT OWNS FURNITURE)	
Number of Rooms	Payments
1	$ 625
2	$ 800
3	$1,000
4	$1,175
5	$1,425
6	$1,650
7	$1,900
8	$2,150
Each additional room	$ 225
SCHEDULE B (FURNITURE PROVIDED BY LANDLORD)	
One room	$ 400
Each additional room	$ 65
Dormitory Style rooms (Includes hotel/motel rooms, caretaker facilities, assisted living rooms, and "rooms for rent.")	$ 100

"Room" for the Fixed Moving Schedule means space in a unit containing the usual quantity of personal property. Normal division includes living room, dining room, bedroom, kitchen, recreation room, library, study, laundry room, basement, garage, workshop, and patio. Other rooms, garages, or storage areas having personal property equivalent to one or more normal rooms may be counted as additional rooms. Most bathrooms do not count as a room.

Counting rooms requires judgment. A large room may have so much furniture that it can be considered two rooms. An alcove or dining area may be a separate room if it has dining room furniture. The RAP Agent must record all room equivalents and briefly explain any judgments. Generally, 1,000 pounds and/or 142 cubic feet of personal property and furniture is equivalent to a "room." Examples: 100 pounds would represent four floor-to-ceiling 3' wide bookshelves filled with books, or a well-stocked, walk-in pantry. Additionally, two small rooms with minimal items of personal property might be counted as one room.

Schedules A and B also apply to eligible moves from mobile homes.

Unusual items such as piles of junk, classic cars, or welding equipment should not be counted as an additional room. The RAP Agent should obtain an MCF in accordance with Section 10.04.02.12.

10.04.02.05 Fixed Payment Limitations and Variations

No temporary storage, utility hookups, lodging, or transportation expenses shall be paid to displacees receiving a fixed payment for moving expenses.

A multi-use property owner-occupant who elects to use Schedule A for the residential portion is still eligible for a business move from the other portion of the property.

No.	Reach	Approx. Area Needed (ft^2)	Parcel & Address	Owner/Representative Billing Address/Contact Info	District File #	UPDATES	Note
1	R4	600 +/-	**484-29-001** 10250 S. Capitol Avenue	Santa Clara County 10250 S. Capitol Avenue San Jose, CA 95127	4026-168		For Capitol Expwy Ramp. See Tab **#1** for Dwg.
2	R5	553	**484-32-133** 13785 Story Road	J. Sunzeri P O BOX 3238 San Jose, CA 95156-3238	4026-301	4/8/10 - Eric and Karen (ARWS) met with owner, took measurements and photos 4/6/10 Meeting arranged for ARWS, Eric to meet Owner Thurs 4/8/10 4/2/10 Notice of Intent to Appraise letter sent. 3/17/10. Eric met with owner at the property	For Story Road N. Ramp. See Tab **#2** for Dwg.
3	R5	2450 +/-	**484-33-114** 2855 Story Road	PO BOX 105842 Atlanta, GA 30348-5842	4026-302	3/10 Home Depot Property - John discussing with Deanna.	For Story Road N. Ramp See Tab **#2** for Dwg. District may own this piece of land already. John is checking with District.
4	R5	70+/-	**488-03-001** 2950 Story Road	Courtyard Plaza LP 3097 Willow Avenue #23A Clovis, CA 93612	4026-317		For Story Road S. Ramp. See Tab **#2** for Dwg.
5	R5	374	**488-04-140** 2885 Murtha Drive	1058 DUNCAN AV Sunnyvale, CA 94089-1505	4026-332	4/8/10 - Eric and Karen (ARWS)met with owner, took measurements and photos 4/2/10 Notice of Intent to Appraise letter sent. 4/1/10 Karen (ARWS) met with owners at the property. 3/18/10 Eric and Winola met with owners	For Murtha Drive N. Ramp. See Tab **#3** for Dwg.
6	R6	311	**488-09-031** 1307 Farringdon Drive	1307 Farringdon Drive San Jose CA 95127-4613	4026-372	4/2/10 Karen of ARWS met with owner. Took measurements and photos 4/2/10 Notice of Intent to Appraise letter sent. 3/17/10 Eric met with owner at the property.	For Murtha Drive S. Ramp. See Tab **#4** for Dwg.
7		?	Drainage Easement per Tract 1410	Easement dedicated to the SCVWD?		4/23/10: Eric will get tract map from RJA to check status of dedication	
8			Home Depot	Easements associated with Home Depot, downstream of Home Depot business parcel.		?	
9	R4	NA	Jackson Avenue	Caltrans	NA	4/6/10 Chris Benson submits encroachment application for upcoming construction needs. Long term property acquistion to be addressed at a later date.	Remove and replace culvert @ Jackson Avenue. Approx. 6,300 ft^2. Design dwg indicates that the District already has ROW crossing Jackson Avenue that covers the area of the new culvert.
10	R4	NA	South Capitol Avenue	Santa Clara County 10250 S. Capitol Avenue San Jose, CA 95127	NA	4/20/10: John and CWP staff will apply for Encroachment Permit from County	For the new culvert @ Capitol Expwy. Approx. 1,850 ft^2. Need to verify if District needs an encroachment permit from the County, or if it needs to obtain an easement. The District owns approx. 6,500 ft^2 +/- of land on Capitol Expwy (see Tab **#6**). District may consider trading the titles of some or all of these properties for County easement.
11	R5	NA	Story Road	City of San Jose	NA		For the new culvert @ Story Road. Approx. 1,300 ft^2 (Dwg on **Tab #2**). Need to verify if District needs an encroachment permit from the City of San Jose, or if it needs to obtain an easement.

APPENDIX 3B-6

DISTRICT FPS MASTER PLAN, 2010

2010

DRAFT: Flood Protection and Stream Stewardship Master Plan

PRELIMINARY REVIEW DRAFT

CHAPTERS 1 THROUGH 3

Santa Clara Valley Water District

9/30/2010

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FLOOD PROTECTION AND STREAM STEWARDSHIP MASTER PLAN

PRELIMINARY REVIEW DRAFT
JUNE 2010
(Corrected: September 2010)

The mission of the district is a healthy, safe and enhanced quality of living in Santa Clara County through watershed stewardship and comprehensive management of water resources in a practical, cost-effective and environmentally-sensitive manner for current and future generations.

BOARD OF DIRECTORS

Richard P. Santos- Chair
District 3

Larry Wilson- Vice-Chair
District 4

Joe Judge
District 2

Rosemary Kamei
District 1

Patrick Kwok
District 5

Cy Mann
At Large

Tony Estremera
At Large

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1 INTRODUCTION

The Santa Clara Valley Water District

is the primary water resource management agency for Santa Clara County, California. Its key products and services are wholesale treated water; flood protection; environmental stewardship, and open space and trails.

The district provides a reliable supply of clean, safe water for the 1.8 million people of the county. It also works to protect residents and businesses from the devastating effects of flooding; and serve as environmental stewards for the county's 800-plus miles of streams and creeks, groundwater basins and district-owned reservoirs.

The Santa Clara Valley Water District is unique in the state as an independent special district with countywide responsibility for multiple functions of water resource management.

1.1 DISTRICT MISSION

Santa Clara Valley Water District Headquarters

The mission of the Santa Clara Valley Water District (district) is a healthy, safe, and enhanced quality of living in Santa Clara County through watershed stewardship and comprehensive management of water resources in a practical, cost-effective and environmentally sensitive manner for current and future generations. The District Board has adopted Ends Policies that describe desired ends, goals, and objectives related to core missions of water supply, flood protection, and water resource stewardship.

Protecting homes, businesses and transportation networks from the devastating effects of floods is one of three core missions of the district. Through the years, as the county's population and economy have grown, the district has worked hard to keep pace with the construction of appropriate flood protection projects.

The district employs numerous flood protection technologies that help keep creeks as natural and beautiful as possible. District goals have kept pace with changing community values. New multipurpose flood protection projects protect property while preserving habitat, improving water quality and providing creekside trails. Concern for sensitive or threatened species has resulted in dramatic changes in the ways the district constructs flood protection projects.

The field of flood protection and stream stewardship has undergone a number of significant changes over the past 35 years. These changes have included greater oversight and more stringent regulatory requirements, changes in environmental laws, changes in the public's values regarding creek and habitat protection, and changes in the ability of public agencies to fund flood protection and stream stewardship projects.

In response to changing environmental values and laws, the district modified its official mission statement in 2002 to include watershed stewardship as a key component of its charter, in addition to flood protection and water supply core missions. Another important milestone occurred in November 2000 when over two thirds of the county voters approved the Clean, Safe Creeks and Natural Flood Protection special parcel tax (Clean, Safe Creeks special tax). The special parcel tax provides critical funding to continue flood protection projects and to fund water quality, environmental enhancement, and trails and open space projects.

In December 2009, the Board approved revised policies to clarify its Policy Governance framework; which includes policies in a hierarchical framework from the broadest, to more defined levels of specificity. The framework is organized in the following order: general principles, ends, goals, objectives, strategies, and implementing measures.

In doing so, the Board revised policies and clarified desired outcomes related to two of the core missions of the district - flood protection, and water resource stewardship:

- Natural flood protection for residents, businesses, and visitors
- Reduced potential for flood damages

- Healthy creek and bay ecosystems,
- Clean, safe water in creeks and bays
- Trails, open space and water resources management

The End Policies and Policy Governance are discussed in more detail in Chapter 2. Copies of the most recent Board Policies can be obtained at: http://www.valleywater.org.

In recognition of these changes, as well as future challenges looming in the horizon, particularly in the funding arena with the approaching sunset of Clean, Safe Creeks special tax funding in 2016, the district has decided to develop this Flood Protection and Stream Stewardship Master Plan (master plan).

1.2 MASTER PLAN OBJECTIVE

The objective of the master plan is to guide the strategic investment of public funds in Santa Clara County over the next 25 years. Specifically, the master plan will serve as a tool for strategic long term planning to achieve the district's goals and objectives. It will identify project and program priorities, establish guidance and project selection criteria, identify challenges and future funding considerations.

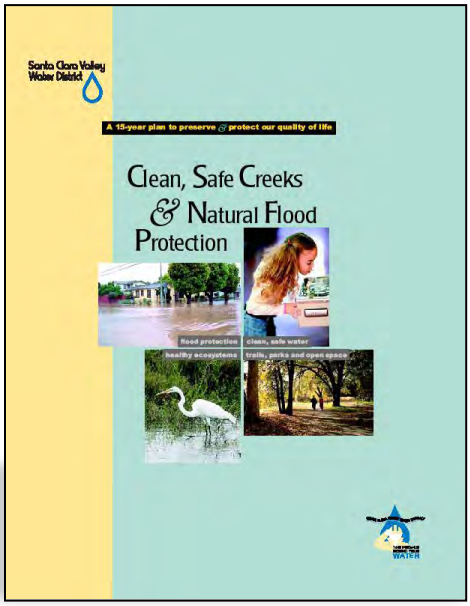
The master plan objectives apply to the following areas:

- Natural flood protection for residents, businesses, and visitors
- Reduced potential for flood damages
- Healthy creek and bay ecosystems,
- Clean, safe water in creeks and bays
- Trails, open space and water resources management

1.3 BUILDING ON A STRONG FOUNDATION

The master plan considers two distinct planning horizons: FY 2010 to FY 2016 and FY 2017 to FY 2035. The district's comprehensive Flood Protection and Stream Stewardship Program will no longer receive funding from the Clean, Safe Creeks special tax in 2016. Therefore, the master plan is divided into the two planning horizons to reflect changes in the funding outlook after 2016. Planning past 2016 allows the district to strategically build upon the Clean, Safe Creeks Plan achievements, and re-evaluate the community's values and needs. This master plan is built upon the strong foundation of the existing Clean, Safe Creeks Plan and the comprehensive Flood Protection and Stream Stewardship Program. The Clean, Safe Creeks Plan is summarized below.

Clean, Safe Creeks and Natural Flood Protection 15-year Plan



The Clean, Safe Creeks Plan is an integral part of the comprehensive Flood Protection and Stream Stewardship Program. The Clean, Safe Creeks Plan, which will sunset in 2016, was approved by Santa Clara County Voters in November 2000 and provides a significant source of funding for the overall Flood Protection and Stream Stewardship Program.

The Clean, Safe Creeks Plan was structured into the following four key outcomes to better respond to the needs and desires of the Santa Clara County community:

Outcome 1: Homes, schools, businesses and highways are protected from flooding and erosion includes six ongoing and nine new capital projects to protect homes, schools, businesses and roadways from flooding. The flood protection projects also include stream habitat restoration, removal of invasive plants, replanting of native species, improvement in water quality, and new recreational opportunities. In addition, the program also includes higher level of service for emergency response, land development review and creek maintenance to preserve the flood conveyance capacity of creeks.

Outcome 2: Clean, safe water in our creeks and bays focuses on reducing pollutants such as mercury and diazinon from local waterways. The outcome also includes an increase in the "No Dumping Flows to Bay" programs, as well as cleaning creeks of illegally dumped chemicals. The Good Neighbor Maintenance program provides staff to clean up trash and graffiti and patrol creeks for illegal dumping. In addition, this outcome includes new pollution prevention programs to detect and manage toxic materials and sediments that pollute creeks and the San Francisco and Monterey bays.

Outcome 3: Creeks and bay ecosystems protected, enhanced or restored provides for the restoration or construction of 100 acres of tidal and/or riparian habitat. The outcome also includes the removal of nonnative, invasive plants and the revegetation of riparian areas with native plant species. Furthermore, the program includes the removal of fish migration barriers, installation of fish ladders, repair of streambed erosion to decrease sedimentation and turbidity, and the improvement of water quality.

Outcome 4: Additional open spaces, trails and parks along creeks and in the watersheds provides for partnerships between the district and local jurisdictions to allow access to creekside trails and parks. The outcome also provides for access to bicycle paths for alternative transportation and increases community recreation opportunities countywide.

1.4 STUDY AREA

The master plan study area encompasses all of Santa Clara County's 1,300 square miles including the county's 15 local jurisdictions: Campbell, Cupertino, Gilroy, Los Altos, Los Altos Hills, Los Gatos, Milpitas, Monte Sereno, Morgan Hill, Mountain View, Palo Alto, San Jose, Santa Clara, Saratoga, and Sunnyvale.

Watersheds of the Study Area

Santa Clara County is home to five watershed areas as shown in Figure 1.1. The Coyote, Guadalupe, Lower Peninsula and West Valley watershed areas drain north into the southern part of San Francisco Bay while the Uvas-Llagas watershed flows south into the Pajaro River and on to Monterey Bay.

Watershed Definition
A watershed is the land area from which water drains into a major body of water. Local watersheds are typically part of larger, regional basins. The point where a watershed drains to another body of water (e.g., a creek or bay) is affected by every activity that occurs within the watershed.

Our creeks and rivers carry rainfall runoff from land masses north to San Francisco Bay or south to Monterey Bay. Before rainfall is collected in creeks and rivers in the county, some of the water is used to fill reservoirs for drinking water, replenish the underground aquifer and create better habitat for fish and wildlife. In doing so, our watersheds are critical to supporting water supply for human health and welfare and the environment.

Watershed Descriptions

Lower Peninsula Watershed:
The Lower Peninsula Watershed is defined by geographic boundaries encompassing the tributaries and watersheds of San Francisquito Creek, Matadero Creek, Barron Creek, Adobe Creek, Stevens Creek, and Permanente Creek. The geographic area includes the Town of Los Altos Hills and the cities of Palo Alto, Los Altos, Mountain View, and portions of Cupertino. The watershed encompasses a 98-square-mile area whose many small-creek watersheds feed the tidal wetlands along the San Francisco Bay's southwest shoreline.

West Valley Watershed:
The West Valley Watersheds is defined by geographic boundaries encompassing the tributaries and watersheds of the Guadalupe Slough, Sunnyvale West Channel, Sunnyvale East Channel, Calabazas Creek, San Tomas Aquino Creek, and Saratoga Creek. The geographic area includes portions of the cities of Sunnyvale, Cupertino, Monte Sereno, San Jose, Santa Clara, Campbell, Saratoga and the Town of Los Gatos. The watershed encompasses an 85-square-mile area of multiple small-creek watersheds. Characterized by the contrast between its channelized creeks on the valley floor and its more natural streams in the hillsides, this watershed is the county's smallest.

Guadalupe Watershed
The Guadalupe Watershed is defined by geographic boundaries encompassing the tributaries and watersheds of the Guadalupe River. The major tributaries are Los Gatos Creek, Canoas Creek, Ross Creek, Guadalupe Creek, and Alamitos Creek. The geographic area includes portions of the cities of Santa Clara, San Jose, Campbell, Monte Sereno, and the Town of Los Gatos. This 170 square-mile area drains the Guadalupe River and its tributaries through downtown San Jose. Lexington Reservoir, one of the area's best-known landmarks, is located along the western border of this watershed.

Coyote Watershed:

The Coyote Watershed is defined by geographic boundaries encompassing the tributaries and watersheds of Coyote Creek. The major tributaries are Lower Penitencia Creek, Scott Creek, Berryessa Creek, Upper Penitencia Creek, Silver Creek, Thompson Creek, Fisher Creek, and Packwood Creek. The geographic area includes the city of Milpitas and portions of the cities of San Jose and Morgan Hill. Sixteen major creeks drain this 322 square-mile area. The north county's largest watershed, it extends from the urbanized valley floor upward to the vast natural areas of the Mt. Hamilton range. Coyote Creek, its main waterway, is the longest creek in the county.

Figure 1.1: Santa Clara County Watersheds

Uvas-Llagas Watershed:

The Uvas-Llagas Watershed is defined by geographic boundaries encompassing the tributaries and watersheds of the Pajaro River in Santa Clara County. The major tributaries are East and West Little Llagas Creeks, Llagas Creek, West Branch of Llagas Creek, Uvas-Carnadero Creek, Pescadero Creek, and Pacheco Creek. The Uvas/Llagas Watershed is comprised of mostly unincorporated area and includes the City of Gilroy and portions of the Cities of San Jose and Morgan Hill. The watershed encompasses a 369 square-mile region which is distinguished by its agricultural lands and natural areas. Part of the larger Pajaro River Watershed, the creeks in this watershed are the only waterways in Santa Clara County that flow southward to Monterey Bay.

Watershed Based Planning

A watershed-based approach to planning supports and guides protection and enhancement of the county's significant natural resources and flood protection efforts. Taking a watershed-wide view of problems and potential solutions by identifying and prioritizing stream reaches helps to direct efforts to achieve the highest possible total system function with limited resources. Since our flood protection and environmental stewardship capital improvement projects are often conducted and focused on specific watersheds, a watershed based approach supports coordinated and integrated planning.

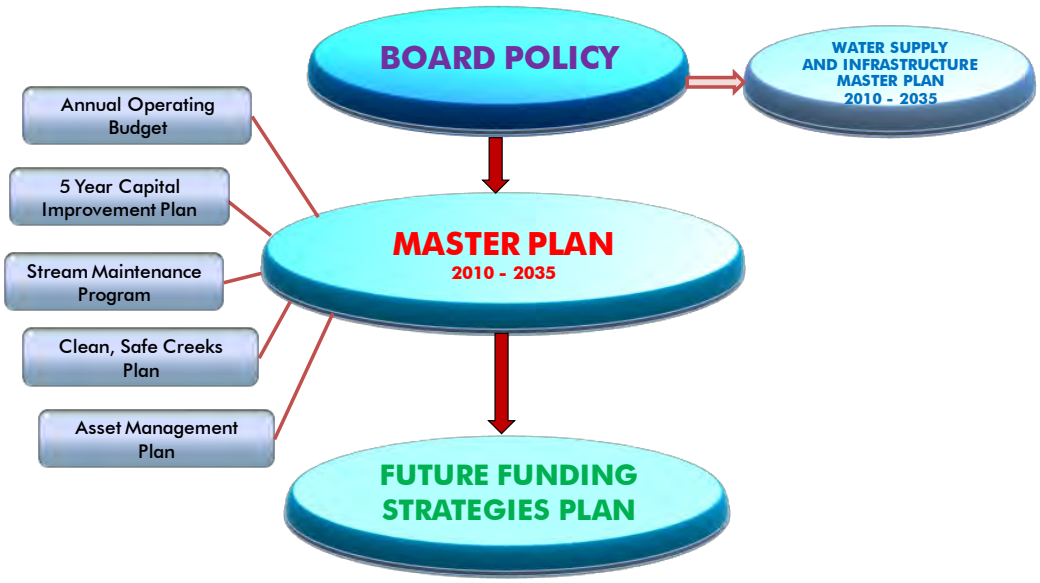
1.5 PLANNING HORIZON AND RELATIONSHIP TO OTHER DISTRICT PLANS

The 25-year planning horizon for the master plan was determined by examining its purpose and aligning it against the planning horizons of other related district plans. Another important consideration in assigning a 25-year time horizon to the master plan was to provide a sufficiently long timeline beyond the current 5-year horizon for the district's Capital Improvement Plan, while maintaining a longer term perspective that is still meaningful in the context of long range planning.

In addition, the 25-year planning horizon of the master plan facilitates the evaluation and assessment of future funding needs for the comprehensive Flood Protection and Stream Stewardship Program. It accomplishes that by incorporating the time period associated with the sunset of Clean, Safe Creeks special tax funding, as well as a longer time period following the special tax sunset to anticipate impacts to the program's future levels of service. Figure 1.2 shows the relationship between the master plan and other related planning efforts. The boxes in blue in Figure 1.2 represent significant planning processes and plans that have a connection to the master plan.

Figure 1.2 also shows the relationship of planning horizons between the master plan and the Water Supply and Infrastructure Master Plan being developed in the district's Water Utility Planning Unit. The Water Supply and Infrastructure Master Plan effort is a separate and distinct effort from the master plan process discussed in this plan. However, there will be coordination between the two planning efforts in order to find synergies and avoid conflicts between the two plans, wherever possible.

Figure 1.2 Long Term Planning Efforts in Relationship to Other Plans



In addition, Figure 1.2 shows that the highest level policy originates with district Board of Directors. The Board provides general policy direction in the form of Ends, Goals, and Objectives (Chapter 2). That policy direction is then received and interpreted by the district's Chief Executive Officer (CEO). Based on the Board's direction, the CEO generally determines strategies and implementing measures to achieve the goals and objectives in the Board's policy. The master plan embodies these as implementing strategies, as it relates to the district's overall Flood Protection and Stream Stewardship Program.

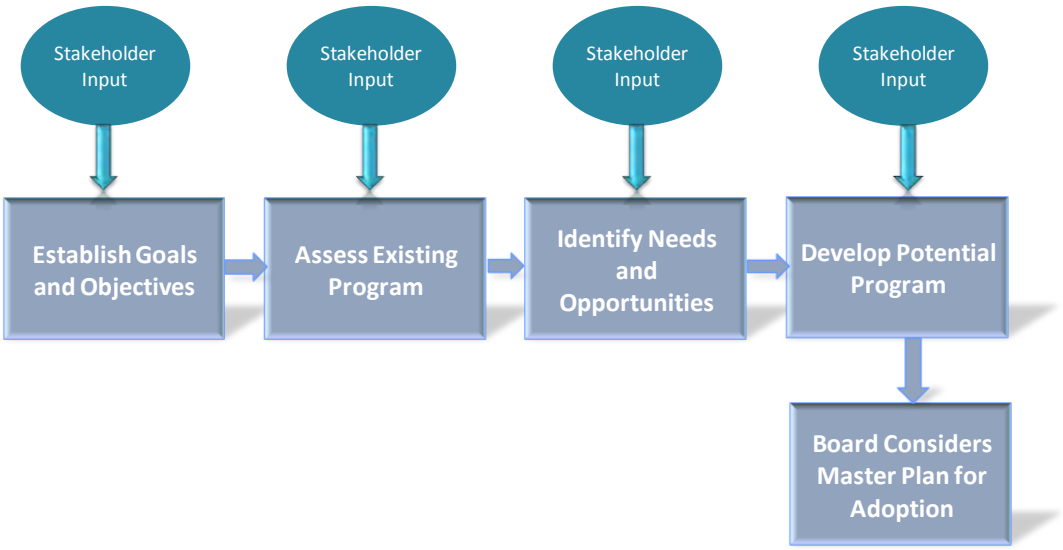
1.6 REPORT METHODOLOGY AND ORGANIZATION

At the most basic level, the methodology used to develop the master plan is based on the following four planning elements are the basis for the main chapters of the master plan.

1) Establish Goals and Objectives
2) Conduct Assessment of Existing Program Over 25-Year Planning Horizon
3) Identify Needs and Opportunities
4) Develop Potential Program

The master plan update process, including stakeholder input opportunities is illustrated in Figure 1.3 below.

Figure 1.3: Proposed Master Plan Update Process



The methodology described above resulted in the definition of the following five chapters that comprise the master plan.

Chapter 1 – INTRODUCTION provides information on: the district mission; master plan objectives; building on strong foundation of the Clean, Safe Creeks plan; study area and watersheds; planning horizons and relationships to other plans; report methodology and organization, and stakeholder engagement. In summary, the first chapter provides background on the development of the report and describes the organization of the report and the master plan development process.

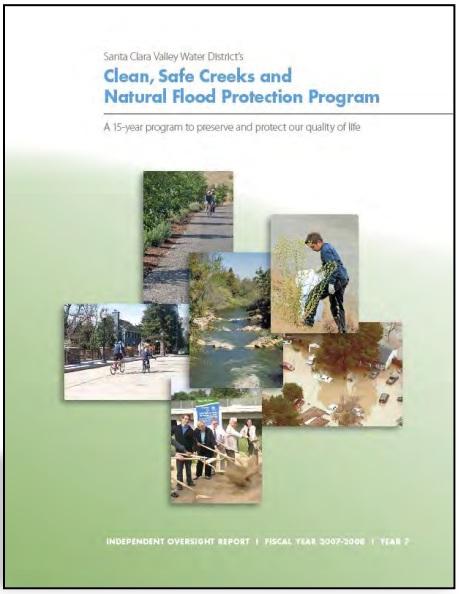
Chapter 2 – GOALS AND OBJECTIVES describes the framework for the development of the master plan. This Chapter articulates the goals and objectives for the master plan as expressed in the proposed Board Ends Policies in the areas of natural flood protection, healthy creek and bay ecosystems, clean safe water in our creeks and bays, and trails and open space.

Chapter 3 – FLOOD PROTECTION AND STREAM STEWARDSHIP PROGRAM describes the various projects and programs conducted by the district to achieve policy outcomes. The programs are presented along with the associated policies and outcomes they support. This chapter also illustrates the nature of the district's comprehensive Flood Protection and Stream Stewardship Program after the sunset of the Clean, Safe Creeks Plan.

Chapter 4 - NEEDS AND OPPORTUNITIES identifies and describes the needs and opportunities relative to the Flood Protection and Stream Stewardship Master Plan goals and objectives described in Chapter 2. Existing programs, projects and activities described in Chapter 3 were reviewed in relationship to meeting the goals and objectives. Program needs are defined as areas where master plan goals and objectives are at risk of not being met in the future planning horizon. Where needs were identified, opportunities for program improvements or new programs and projects were also identified.

Chapter 5 – POTENTIAL PROGRAM includes criteria for selecting projects in the areas of: natural flood protection; healthy creek and bay ecosystems; clean safe water in our creeks and bays; and trails and open space.

1.7 STAKEHOLDER ENGAGEMENT



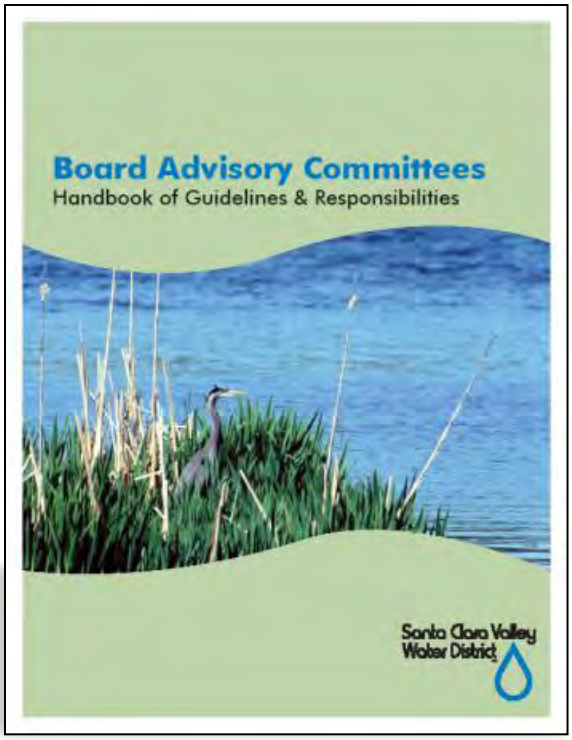
Working with the community and interested individuals is a key component in developing the master plan. An important objective of stakeholder engagement is to receive feedback throughout the master plan development process, particularly on the development of the proposed program.

Outreach efforts will focus on city representatives, environmental and other community stakeholders as represented on the Board's Flood Control and Watershed Advisory Committees and the Environmental Advisory Committee. Outreach efforts will also focus on community meetings in key geographic areas to allow for community input into the master plan. The Board of Directors relies on nine advisory committees, which primarily provide policy alternatives and implications for their deliberation, but also serve as a link with the community. The committees related to the Flood Protection and Stream Stewardship Program are comprised of knowledgeable members of the public, public employees and elected officials and will provide input on the master plan as it relates to supporting Board policy.

Broad community outreach is also planned beyond the district's Board Advisory Committees. Examples of groups and agencies that are expected to be included in outreach and engagement beyond the community stakeholders may include, but are not limited to, the following:

- Board Environmental Advisory Committee
- Coyote Flood Control and Watershed Advisory Committee
- Guadalupe and West Valley Flood Control and Watershed Advisory Committee
- Lower Peninsula Flood Control and Watershed Advisory Committee
- Uvas/Llagas Flood Control and Watershed Advisory Committee
- Bay Area Flood Protection Agencies Association
- City of Campbell
- City of Cupertino

- City of Gilroy
- City of Los Altos
- Town of Los Altos Hills
- Town of Los Gatos
- City of Milpitas
- City of Monte Sereno
- City of Morgan Hill
- City of Mountain View
- City of Palo Alto
- City of San Jose
- City of Santa Clara
- City of Saratoga
- County of Santa Clara



2 GOALS AND OBJECTIVES

INTRODUCTION

The purpose of this chapter is to describe the goals and objectives of the Flood Protection and Stream Stewardship Master Plan (hereafter referred to as Master Plan Goals and Objectives). This chapter initially describes the district's Board Policy Framework to provide perspective into the relationship between the Board's policies and the Master Plan's goals and objectives. The Master Plan goals and objectives are taken directly from the Board's Policies. This chapter then describes the Master Plan goals and objectives to provide specific focus and purpose by offering a clear vision for what the Master Plan is to accomplish. Strategies to support the Master Plan goals and objectives are described in the remainder of this chapter. Identifying strategies early in the planning process provides a foundation for development and implementation of the Master Plan. Chapter 3 provides more detail on strategic implementation by describing the district's current programs and projects that support these strategies.

The Board Policy and Master Plan Goals presented in this chapter include:

- ***Natural flood protection***
- ***Reduced potential for flood damages***
- ***Healthy creek and bay ecosystems***
- ***Clean safe water in creeks and bays***
- ***Trails, open space and water resources management.***

2.1 BOARD POLICY FRAMEWORK - DEFINITIONS AND OVERVIEW

The Board's policy framework and definitions are described in this section. The district's mission, general principles and Board Ends policies form the basis for Master Plan development.

The Board sets policy direction using a governance framework that establishes the district's mission and general principles, followed by ends policy goals and objectives. The CEO interprets this policy direction in the form of strategies and implementing measures.

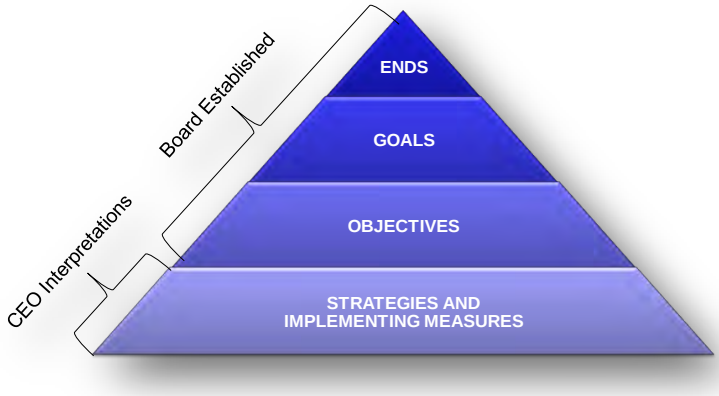
2.1.1 Board Policy Framework Definitions

- **Governance Process**- how the Board conducts its business
- **General Principles**- a statement that reflect Board's directions to guide more than one functional area or element
- **Ends Policy-** The effects the district seeks to have on the community it serves
- **Goal-** a general direction-setter provided by the Board and expressed as an ideal future related to the end
- **Objective**- a specified action either adopted by the Board or provided by the CEO that is an intermediate step toward attaining a goal
- **CEO Interpretations**- the CEO's reasonable interpretation regarding accomplishing the Board's Ends in the form of *strategies and implementing measures*
    - *Strategies* are particular courses of action that describe the means to support objectives.
    - *Implementing measures* are indicators that establish a level of quality or quantity to be satisfied when achieving the objective.

2.1.2 Board Policy Framework Overview

This section discusses the overall Board Policy Framework down to the Ends Policies level. The Board's policy framework is established from the broadest to the more defined levels. The CEO interprets the policies for implementation in form of strategies and implementing measures. Figure 2.1 illustrates the Board's policy framework hierarchy.

Figure 2.1: District Board Policy Framework



2.1.2.1 District Mission and General Principles

The *mission* of the District as established by the Board (Board Policy E-1) is as follows:

> *A healthy, safe, and enhanced quality of living in Santa Clara County through watershed stewardship and comprehensive management of water resources in a practical, cost-effective, and environmentally-sensitive manner for current and future generations.*

The Board has established the following *general principles* for implementing the district's mission,

1. An integrated approach in managing a sustainable water supply, effective natural flood protection and healthy watersheds is essential to prepare for the future.
2. Engagement with federal, state, regional and local agencies, water retailers and the community is necessary.
3. A net positive impact on the environment is important in support of the District mission and is reflected in all that we do.
4. A positive image of the District is supported in carrying out the District's mission.

2.1.2.2 District Board Ends Policies

Ends policies prescribe what the Board has directed the CEO to accomplish in order to implement the district's mission. The Board's Ends are summarized as follows:

E-2: There is a reliable, clean water supply for current and future generations.

E-3: There is a healthy and safe environment for residents, businesses and visitors, as well as for future generations.

E-4: There is water resources stewardship to protect and enhance watersheds and natural resources and to improve the quality of life in Santa Clara County.

2.2 MASTER PLAN GOALS AND OBJECTIVES

This section summarizes the Master Plan goals and objectives (as established by Board Policy) that support the development of the Master Plan. The goals and objectives provide specific focus and purpose to the Master Plan by offering a clear vision for what the Master Plan is to accomplish.

Table 2.1 identifies the Master Plan goals and objectives as they relate to the following Board Ends Policies:

E-3: There is a healthy and safe environment for residents, businesses and visitors, as well as for future generations, and

E-4: There is water resources stewardship to protect and enhance watersheds and natural resources and to improve the quality of life in Santa Clara County.

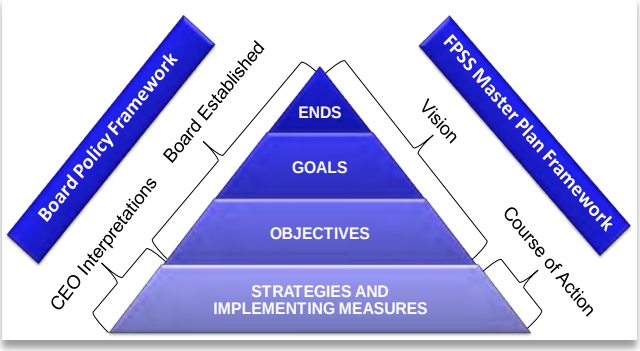
Table 2.1 Board's Ends and Master Plan Goals and Objectives

Ends	Goals	Objectives
E-3: HEALTHY AND SAFE ENVIRONMENT	3.1 Natural Flood Protection for residents, businesses, and visitors	3.1.1 Balance environmental quality and protection from flooding in a cost effective manner 3.1.2 Preserve flood conveyance capacity
	3.2 Reduced potential for flood damages	3.2.1 Reduce flood risk in flood prone areas 3.2.2 Avoid the creation of expanded flood prone areas
E-4: WATER RESOURCES STEWARDSHIP	4.1 Healthy creek and bay ecosystems	4.1.1 Balance water supply, flood protection and environmental stewardship functions 4.1.2 Improve watersheds, streams, and natural resources 4.1.3 Promote awareness of creek and bay ecosystem functions
	4.2 Clean, safe water in creeks and bay	4.2.1 Preserve or improve surface and groundwater for beneficial uses 4.2.2 Promote awareness of water quality and stream stewardship
	4.3 Improved quality of life in Santa Clara County through trails, open space and water resources management	4.3.1 Support additional trails, parks and open space along creeks and in the watersheds when reasonable and appropriate 4.3.2 Reduce greenhouse emissions when reasonable and appropriate

2.3 MASTER PLAN STRATEGIES

This section summarizes the Master Plan strategies that support the development and implementation of the Master Plan. The CEO provides policy interpretations in the form of strategies and implementing measures to direct the work of staff in reaching the Board's goals and objectives. The CEO developed strategies and implementing measures also support the Master Plan goals and objectives. The relationship between the District Board policy framework, CEO Interpretations and Master Plan development is illustrated in Figure 2.2. Strategies are outlined in Tables 2.2, 2.3, 2.4 and 2.5.

Figure 2.2: Relationship between Board Policy and Master Plan Development



Chapter 3 provides more detailed information on strategic implementation by describing the district's programs and projects that support individual strategies.

2.3.1 Strategies Related To the Goal of Natural Flood Protection for Residents, Businesses, and Visitors

This section summarizes the district's goal of natural flood protection, and lists the associated Master Plan objectives and strategies in Table 2.2.

Natural Flood Protection Overview

Protecting homes, businesses and transportation networks from the devastating effects of floods is one of the main jobs of the district. The district provides increased protection from flood damages through floodwater management activities with the general goal of "keeping the water away from the people." In response to community and stakeholder expectations and the district's commitment to water resources stewardship, the district's goals have kept pace with changing community values through the use of natural flood protection activities where possible.

Natural Flood Protection Strategies

Given community expectations, the district now employs natural flood protection principles into its flood protection activities whenever feasible. In doing so, the district balances the need to provide flood protection with the need to protect streams and natural resources. The district uses numerous flood protection technologies that help keep creeks to be as natural and beautiful as possible. New multipurpose flood protection projects protect property while preserving habitat and improving water quality. In doing so, the district evaluates alternatives for flood protection projects using a multi-criteria framework as shown in Table 2.1. The district also conducts work on existing creeks to maintain floodwater conveyance capacity and to stabilize or restore eroding stream channels. Other strategies include activities to: improve stream stability, construct erosion repair projects to create greater

environmental value, and provide technical advice to others to better manage stormwater. A detailed list of flood protection strategies is provided in Table 2.2.

Table 2.2: Strategies to Achieve Goal 3.1 Natural Flood Protection

GOAL	OBJECTIVE	STRATEGIES
3.1 NATURAL FLOOD PROTECTION FOR RESIDENTS, BUSINESSES, AND VISITORS	3.1.1: Balance environmental quality and protection from flooding in a cost effective manner	1. Evaluate alternatives for flood protection capital projects whereby natural stream functions are achieved to the extent feasible and practicable, while providing flood protection and balancing the following: a. Homes, schools, businesses, and transportation networks are protected from flooding and erosion. b. Ecological functions and processes, including habitat goals, are supported. c. Natural stream functions and processes, including stability and dynamic equilibrium of streams, are preserved, restored, and integrated. d. Maintenance requirements are minimized. e. Projects are integrated within the watershed as a whole. f. The quality and availability of water is protected. g. Cooperation with local agencies achieves mutually beneficial goals. h. Community benefits are provided beyond flood protection. i. Life-cycle costs are minimized. 2. Identify existing stream erosion conditions and stream characteristics and implement practical solutions, where appropriate, to improve stream stability and its dynamic equilibrium. 3. Use natural materials where practical in erosion repair projects to create greater environmental value while protecting streams, creeks, and levees. 4. Provide technical advice and, if appropriate, participate with municipalities to manage stormwater to address stream instability. 5. Develop and provide technical advice on the design of floodplains and channels that support the physical and dynamic equilibrium of streams.
	OBJECTIVE	**STRATEGIES**
	3.1.2: Preserve flood conveyance	1. Maintain the design floodwater conveyance capacities within District-owned channels. 2. Stabilize, rehabilitate and/or restore eroding District-owned channels. 3. Reduce debris accumulation. 4. Support and promote land use decisions to maintain stream capacity.

2.3.2 Strategies Related To the Goal of a Reduced Potential for Flood Damages

This section summarizes the district's goal of reduced potential for flood damages, and lists the associated Master Plan objectives and strategies in Table 2.3.

Reduced Potential for Flood Damages Overview

In addition to strategies related to natural flood protection, the district, local cities and agencies work together to reduce the potential for flood damages. These strategies are employed to "keep the people away from the water." It is important to note that the local cities and county play a primary role and have direct control in accomplishing these strategies. Cities and the county are also floodplain management agencies under FEMA and administer their own flood plain management programs. As shown on Table 2.3, the district's role in this area is defined as working with others and providing support to execute these strategies without having direct control over land use decisions.

Reduced Potential for Flood Damages Strategies

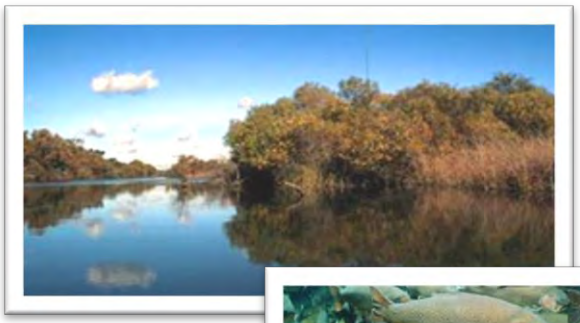
Strategies to reduce flood damage potential include floodplain management that relies on land use decisions to manage activities in order to accommodate floodwater without significant disruption to public health, safety or property. Under this goal, the district works with municipalities, communicates risk to the communities most at risk, and provides technical advice and services that seek to avoid expansion of flood prone areas. Technical advice includes incorporation of flood-wise design features and technical assistance in the mitigation of negative effects associated with new development. In addition, the district participates in and provides advice related to: storm related emergency response, community awareness, risk reduction outreach and proper stream care and management. A list of strategies associated with reducing flood damage potential is presented in Table 2.3.

Table 2.3: Strategies to Achieve Goal 3.2: A Reduced Potential for Flood Damages

GOAL	OBJECTIVE	STRATEGIES
3.2: A REDUCED POTENTIAL FOR FLOOD DAMAGES	3.2.1: Reduce flood risks in flood prone areas	1. Provide flood frequency and forecast services. 2. Prepare for effective response to storm-related emergencies. 3. Assist cities and citizens when needed to lessen potential flood impacts. 4. Work with municipalities to clearly identify roles and responsibilities for floodplain management and emergency management. 5. Work with FEMA to ensure floodplain maps are based on best available data. 6. Include municipal planners in regional or local flood management planning activities. 7. Promote community awareness about best practices to avoid or minimize exposure to flooding potential. 8. Promote risk reduction activities through targeted outreach to areas protected by levees. 9. Maintain and make available technical resources to assist municipalities in floodplain management activities. 10. Promote removal or abandonment of infrastructures located within floodplains.
	OBJECTIVE	**STRATEGIES**
	3.2.2: Avoid the creation of expanded flood prone areas	1. Assist in the incorporation of flood-wise design features (e.g., minimizing imperviousness, maximizing permeability and preserving natural drainage and vegetation) into new development projects. 2. Encourage and provide technical assistance in mitigating erosion, sedimentation and high flows from new development or redevelopments. 3. Advocate detention of runoff in areas where flood protection facilities are nearing capacity. 4. Advocate or support protection of stream functions from the negative impacts of development. 5. Promote green projects (e.g., rainwater harvesting) or other or practices to manage stormwater runoff and improve water quality. 6. Promote awareness of risks for developing in flood hazard areas.

2.3.3 Strategies Related To the Goal of Healthy Creek and Bay Ecosystems

This section summarizes the district's goal of healthy creek and bay ecosystems and lists the associated Master Plan objectives and strategies in Table 2.4



Healthy Creek and Bay Ecosystems Overview

Unique among other water districts, state legislation authorizes the district "to enhance, protect, and restore streams, riparian corridors, and natural resources." The district employs strategies to support healthy creek and bay ecosystems, and works collaboratively with others to support these efforts.

Healthy Creek and Bay Ecosystems Strategies

The health of a creek reflects the conditions throughout the watershed, not just those along its banks. The district's environmental work contributes to the protection and restoration of habitats and encourages the return of endangered species such as the red-legged frog, steelhead trout and salt marsh harvest mouse. Under the district's general goals regarding healthy creeks and bay ecosystems, the district conducts numerous activities to protect and restore environmental resource functions, improve natural resources, and promote community awareness of environmental stewardship. Some of these strategies and activities include: identifying and mitigating capital and operational impacts; implementing potential mitigation banking opportunities; implementing stream stewardship opportunities; and protecting, enhancing and restoring riparian and tidal habitat conditions. A detailed list of strategies to support healthy creeks and bay ecosystems is presented in Table 2.4.

Table 2.4: Strategies To Achieve Goal 4.1: Healthy Creek And Bay Ecosystems

GOAL	OBJECTIVE	STRATEGIES
4.1: HEALTHY CREEK AND BAY ECOSYSTEMS	4.1.1: Balance water supply, natural flood protection and water resources stewardship functions	1. Balance the protection and restoration of sensitive fisheries and aquatic species, such as steelhead trout, with a reliable water supply. 2. Identify and mitigate capital projects' and operations' impacts to watersheds, streams and natural resources. 3. Identify and implement potential mitigation banking opportunities in order to streamline future mitigation requirements. 4. Provide information on stormwater management and design of floodplains and channels.
	OBJECTIVE	**STRATEGIES**
	4.1.2: Improve watersheds, streams, and natural resources	1. Implement stream stewardship opportunities, including environmental enhancements and seek to achieve the physical stability and ecological health. 2. Engage in habitat conservation planning. 3. Protect groundwater recharge areas in creeks and riparian corridors. 4. Protect, enhance and restore riparian vegetation and in-stream and tidal habitat conditions conducive to healthy ecology, including diked historical bayland wetlands, or former salt ponds. 5. Protect, enhance and restore populations of key species indicative of watershed health.
	OBJECTIVE	**STRATEGIES**
	4.1.3: Promote awareness of creek and bay ecosystem functions	1. Provide technical expertise for applying ecosystems functions knowledge. 2. Promote the awareness of sensitive groundwater recharge areas. 3. Advocate for protection, preservation and enhancement of creek and bay ecosystems functions. 4. Promote the preservation of ecological buffers.

2.3.4 Strategies Related To the Goal of Clean Safe Water in Creeks and Bays

This section summarizes the district's goal of clean safe water in creeks and bays, and lists the associated Master Plan objectives and strategies in Table 2.5

Clean Safe Water in Creeks and Bays Overview

Preventing pollution to our creeks and bays is a major undertaking in a county with 1.8 million residents. Clean safe water benefits the community and natural resources relying on these precious resources. The district conducts programs and projects to support clean safe water in addition to collaborating with agencies and stakeholder groups.

Clean Safe Water in Creeks and Bays Strategies

Strategies employed under the district's objectives for clean safe water include: preserving and protecting water quality, promoting awareness of water quality, and stream stewardship. Other specific strategies include: hazardous material response, creek inspections, and pollution reduction activities.

In addition, the district participates in many programs in cooperation with local agencies. Through its participation, the district supports efforts to prevent urban runoff that is detrimental to water quality. The district supports efforts of agencies and stakeholders to educate and encourage county residents to prevent pollution from reaching our creeks and rivers. Specific strategies to support clean safe water in creeks and bays are presented in Table 2.5.

Table 2.5: Strategies to Achieve Board Goal 4.2 Clean Safe Water in Creeks and Bays

GOAL	OBJECTIVE	STRATEGIES
4.2 CLEAN SAFE WATER IN CREEKS AND BAYS	4.2.1: Preserve or improve surface and ground water quality for beneficial uses	1. Provide hazardous materials management and incident response. 2. Inspect and clean creeks from neighborhood litter and graffiti. 3. Protect groundwater recharge areas in creeks and riparian corridors. 4. Improve water quality of listed impaired water bodies.
	OBJECTIVE	**STRATEGIES**
	4.2.2 : Promote awareness of water quality and stream stewardship	1. Promote community awareness of benefits of preserving water quality and providing stream stewardship. 2. Promote awareness of sensitive groundwater recharge areas. 3. Promote awareness of riparian corridors and provide guidance for residential development, landowner practices and grazing activities that support watershed health. 4. Reduce pollutants in streams from urban runoff and minimize the effects on surface and ground water.

2.3.5 Strategies Related To the Goal of Improved Quality of Life in Santa Clara County through Trails, Open Space and Water Resources Management

This section summarizes the district's goal of improved quality of life in Santa Clara County through trails, open space and water resources management, and lists the associated Master Plan objectives and strategies in Table 2.6

Improved Quality of Life Overview

Watersheds, stream corridors and flood protection levees offer hundreds of acres of land for the entire community to use and enjoy. The district partners with cities and the county to provide open space and recreational opportunities along creeks and reservoirs in the county. In addition, the district seeks to provide for improved quality of life by addressing the threats of climate change

Improved Quality of Life Strategies

Strategies to support open space and recreational opportunities are currently conducted through the Trail and Open Space Grant Program. In addition, the current Environmental Enhancements Program and ensuing Environmental Enhancement Planning Grant call for the creation of additional wetlands, riparian habitat and favorable streams conditions for fisheries and wildlife.

The district is also addressing climate change issues under the goal of an improved quality of life. The district is keeping track of developments in policy and guidance at both the state and national level to help define its climate change related strategies. Currently, the district's partnership with Sustainable Silicon Valley's CO2 Initiative is a key strategy to respond to climate change resulting from the accumulation of human-generated greenhouse gases like CO2 in Santa Clara County.

The district is taking action by changing the way it manages energy usage and optimizing our operations so that they are energy efficient. In addition, the district's water conservation programs have resulted in some of the biggest energy savings of any programs in the county.

Climate change and, in particular, sea level rise are also being addressed in the district's flood protection and stream stewardship planning processes and in the district's preparation of environmental documentation for projects. Sea level rise may affect the flow conveyance of district facilities near south San Francisco Bay. A list of specific strategies related to an improved quality of life is provided in Table 2.6.

Table 2.6: Strategies to Achieve Board Goal 4.3 Improved Quality Of Life in Santa Clara County through Trails, Open Space and Water Resources Management

GOAL	OBJECTIVE	STRATEGIES
4.3 IMPROVED QUALITY OF LIFE IN SANTA CLARA COUNTY THROUGH TRAILS, OPEN SPACE AND WATER RESOURCES MANAGEMENT	4.3.1: Support additional trails, parks and open space along creeks and in the watersheds when reasonable and appropriate.	1. Work with other entities for planning, design, construction, maintenance, and operation of trails/open space amenities. 2. Increase public access to district lands as appropriate; extend trails network. 3. Support creek-side or water related recreation, as appropriate.
	OBJECTIVE	**STRATEGIES**
	4.3.2: Reduce greenhouse gas (GHG) emissions when reasonable and appropriate	1. Reduce project-specific Greenhouse Gas Emissions through district-wide programmatic actions and ensure reductions attributable to water conservation programs are properly credited to the Santa Clara County community. 2. Increase fleet fuel use efficiency. 3. Maintain a portfolio of alternative energy supplies. 4. Increase energy use efficiency. 5. Promote best practices for GHG emission reduction throughout district.

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3 FLOOD PROTECTION AND STREAM STEWARDSHIP PROGRAM

INTRODUCTION

The purpose of this chapter is to describe the current levels of service provided by the Flood Protection and Stream Stewardship Program in 2010 and to project those levels of service to the year 2035 based upon program elements anticipated to stay the same and evolving needs stemming from new anticipated obligations. This chapter also describes the potential impacts to the program if there is no new funding to replace the special parcel tax approved by the voters in November 2000 for the Clean, Safe Creeks and Natural Flood Protection Plan (Clean, Safe Creeks). The special parcel tax will automatically end after 15 years in 2016.

The objectives of this chapter are to describe the various capital projects and operational programs conducted by the district to achieve the goals and objectives of the master plan; to present financial assumptions and analysis of the Flood Protection and Stream Stewardship program for the planning horizons from 2010 to 2016 and from 2017 to 2035; and to describe the anticipated levels of service supported and funded under each planning horizon.

Capital projects as listed in this chapter are defined by those that, exceed $50,000 in cost, have long-term life spans, and are generally non-recurring. Capital projects usually fall within one of six categories. These categories include acquisitions of land for public purposes; construction of new flood protection facilities; addition to or expansion of an existing facility; rehabilitation or repair to all or part of a facility (exceeding $50,000); specific planning, engineering study, or design work related to a project; and significant one-time investment or improvements that provide benefits over several years, such as radio system upgrades to improve day-to-day operations and emergency response.

Operational programs are either operations or operating projects. Operations are ongoing, recurring activities such as stream maintenance activities. Operating projects support and complement services provided in the operations budget. Operating projects have a beginning and an ending date; in general, these projects should be completed within 2-3 years. An example of an operating project is a habitat conservation plan.

This chapter summarizes the district's overall Flood Protection and Stream Stewardship program as it exists in 2010 (Section 3.1), followed by a more detailed description of the programs and projects that support the master plan implementation (Section 3.2). Section 3.2 also includes the current and projected levels of service under anticipated funding levels for both planning horizons: 2010 to 2016 and 2017 to 2035. This chapter also provides the results of the financial analysis (Section 3.3) conducted under the assumptions that: (a) no new funding for the program is secured after the sunset of the Clean, Safe Creeks special parcel tax in 2016, and (b) that many Flood Protection and Stream Stewardship

program elements will continue, while recognizing that the program will adapt to changing needs, obligations and board direction. Following the financial analysis, Section 3.4 - Findings, provides a summary in terms of what programs and projects could be affected after 2016 by the sunset of Clean, Safe Creeks special tax funding.

3.1 FLOOD PROTECTION AND STREAM STEWARDSHIP PROGRAM OVERVIEW

The district's approach to the management of streams and flood protection facilities has experienced many changes since the program began in the 60's. These changes include new or changed regulations that affect water quality and how projects are designed and maintained; increased development in floodplains and near streams; increased public awareness and interest in habitat protection and enhancement; and the public's expectations that streams are amenities to the community that should be accessible to the public for use as trails and open space. In response to changing environmental values and laws, the district modified its official mission statement in 2002 to include watershed stewardship as a key component of its charter, in addition to flood protection and water supply. Stewardship is defined as, "Entrusting the careful and responsible management of the environment and natural resources to one's care for the benefit of the greater community."

The Flood Protection and Stream Stewardship program as it exists in 2010 was initially developed in the late 1990s through extensive community input to assess the needs, priorities and expectations of the Santa Clara County community. The goal of that effort was to build consensus with a plan that both received community support and met the Board of Directors' (board) policy direction.

The Flood Protection and Stream Stewardship program has evolved since its inception as it responded to new challenges whether they are funding-based, regulatory-based or community-driven. It is anticipated that this evolution will continue into the next planning horizons. The Flood Protection and Stream Stewardship program strives to fulfill the community interests and the board objectives by continuing or modifying over a hundred projects and programs to achieve five specific goals:

- Goal 1: Natural flood protection for residents, businesses, and visitors.
- Goal 2: Reduced potential for flood damages.
- Goal 3: Healthy creek and bay ecosystems.
- Goal 4: Clean, safe water in our creeks and bays.
- Goal 5: Improved quality of life in Santa Clara County through trails, open space and water resource management.

In support of Goal 1, the main program components include new flood protection projects; inspection and maintenance of new and existing flood protection facilities to preserve flood conveyance; stream capacity vegetation control; sediment and debris removal; and land development review.

Activities aimed at achieving Goal 2 include: conducting emergency flood response activities; providing flood frequency and forecast services; coordinating with cities, county, regional and state agencies on land use decisions and floodplain management; providing Federal Emergency Management Agency mapping services; and performing public education and school programs on flood safety.

Goal 3 activities provide for crucial environmental work to protect and restore habitats and to contribute to the protection of endangered species. Examples of this work include: repairing stream bank erosion; removing barriers to fish passage or migration, maintaining revegetation mitigation sites, managing watershed upland vegetation, removing nonnative invasive plant species, creating or restoring tidal and/or riparian habitat, and recycling or reducing solid waste and sediment from maintenance activities.

Goal 4 activities are aimed at reducing or eliminating pollutants from local waterways. The district provides for response to hazardous materials incidents; patrols creeks for illegal dumping; cleans creeks of illegally–dumped chemicals; cleans neighborhood creeks of trash; and removes graffiti from bridges and floodwalls. The district also conducts activities to help improve water quality of our creeks, reservoirs, and bays by reducing pollutants such as mercury, diazinon, copper, zinc, PCBs, and selenium.

To achieve Goal 5, the district works with cities and the county to plan, design, construct, maintain, and operate trails and open space amenities. The district has increased public access to its property and supports creek-side or water-related recreation. Additionally, the district has implemented programmatic actions to reduce greenhouse gas (GHG) emissions; maintains a portfolio of alternative energy supplies; and has increased energy use efficiency.

3.2 FLOOD PROTECTION AND STREAM STEWARDSHIP – SUPPORTING OPERATIONAL PROGRAMS AND CAPITAL PROJECT DESCRIPTIONS

This section provides a detailed description of the various capital projects and operational programs conducted by the district to achieve the goals and objectives of this Master Plan. The projects and programs have been categorized in terms of the five specific governance policy goals identified in Section 3.1. The supporting projects and programs descriptions are followed by a description of the Levels of Service applicable to those projects and programs for the two master plan planning horizons.

Levels of service for the master plan are based on agreements, regulatory obligations, and adopted board policies. Existing Levels of Service are based on existing agreements that are in effect in 2010 and existing funding levels. Future Levels of Service will be developed based on agreements that the district may enter into in the future, or based on foreseeable or anticipated changes in funding revenues.

San Francisquito Creek Flooding in 1998

3.2.1 Natural Flood Protection

The district provides floodwater management in two basic ways: it builds and restores natural flood protection capital projects, and it conducts operations programs to maintain flood conveyance capacity to carry storm runoff and to protect the public's investment in flood protection facilities.

To construct natural flood protection capital projects, the district utilizes a multiple-objective approach to providing environmental quality, community benefit, and protection from creek or tidal flooding. It does so in a cost-effective manner through integrated planning and management that considers the physical, hydrologic and ecologic functions and processes of streams within the community setting. This approach emphasizes working with creeks and rivers rather than against them. The resulting projects protect property while contributing to the preservation of habitat, improving water quality, and providing other community benefits. These principles also help keep creeks natural and restore them whenever feasible.

In addition to constructing natural flood protection projects, the district conducts operational programs designed to preserve flood conveyance capacity of channels and streams. This ensures that these facilities continue to provide the level of protection for which they were constructed; that the public's investment in these facilities is protected and not allowed to fall into disrepair; and that the district programs comply with the regulations of the federal flood insurance program. In general, these programs include regular and systematic inspections of channels and waterways, technical and engineering analysis to assess their condition, maintenance of flood protection facilities, erosion repair along stream banks, and restoration of flood conveyance capacity and stream stability.

Table 3.1 lists the specific projects and programs supporting the natural flood protection goal.

Guadalupe Multipurpose Flood Protection Project

Table 3.1 Natural Flood Protection Projects and Programs

Goal One: Natural flood protection for residents, businesses, and visitors.	
Projects and Programs	
Operations Programs as of 2010 • Basic hydrology • Geomorphic data analysis • Stream Maintenance Program (SMP) Implementation • Facility condition assessment • General field maintenance programs • Levee maintenance and safety • Erosion protection and repair (to protect facility infrastructure) • Watershed property vegetation management • Debris and obstruction removal • Sediment removal • Stream capacity vegetation control **Operating Projects as of 2010** • Stream Maintenance Program Permit Renewal • Watershed Total Asset Management Program • Levee Recertification Project	**Capital Improvement Projects as of 2010** • Adobe Creek (El Camino Real to Rhus Ridge) • Permanente Creek (S. F. Bay to Foothill Expressway) • San Francisquito Creek planning and design(S.F. Bay through Searsville Dam) • Calabazas Creek (Central Expressway to Miller Avenue) • Calabazas Creek (Miller to Wardell Road) • San Tomas Aquino Creek (Quito Road Bridge) • Sunnyvale East and West Channels Improvement • Lower Guadalupe River (Alviso Marina to I-880) • Guadalupe River Downtown (I-880 to I-280) • Upper Guadalupe River (I-280 to Blossom Hill) • Berryessa Creek (Calaveras Boulevard to Old Piedmont Road) • Berryessa Creek (L. Penitencia Cr. to Cal. Blvd.) • Coyote Creek planning and design, partial construction (Montague Expressway to I-280) • Lower Silver Creek, Reaches 1-3 (Coyote Creek to I-680) • Lower Silver Creek, Reaches 4-6 (I-680 to Lake Cunningham) • Lake Cunningham Improvements • Upper Penitencia Creek • Upper Llagas Creek • Lower Llagas Capacity Restoration • San Francisco Bay Shoreline Planning

3.2.1.1 Operations Programs – Natural Flood Protection Goal

Basic Hydrology is a program that supports and maintains the district's Hydrology Management System. This program uses hydrology models to provide flood forecasts; analyzes frequency of storm and precipitation events; determines the district's reservoirs' starting storages to optimize flood protection and water supply benefits; and updates design flows when climate change effects are known. The program provides planners and engineers with design flows for each creek in all five watersheds. These design flows are the basis for flood protection facility planning, design, construction, and operations. This program also provides hydrology information when requested by other agencies and members of the public.

Geomorphic Data Analysis is a program that collects and analyzes fluvial geomorphic data to develop an understanding of the natural streams of our watersheds. This understanding serves as a basis for project design to ensure that we co-exist harmoniously with the creeks. Data that result from this program include bankfull channel geometry, bankfull discharge, hydrologic regime, and sediment characteristics and loads.

Stream Maintenance Program (SMP) Implementation program coordinates routine maintenance activities to ensure that work is completed consistent with environmental regulatory permits. The SMP applies to all of the district's routine stream maintenance activities, including three major types of activities: sediment removal, vegetation management, and bank protection. Work areas have been pre-determined, but will evolve and expand as new capital projects are completed. The program includes: report preparation and submittal, agency meetings, adaptive management, and best management practices training. Best management practices (BMPs) are methods that protect environmental quality or reduce environmental impacts from stream maintenance activities. To be effective, BMPs must be properly selected and implemented, applied consistently, and their effectiveness evaluated onsite to assure that they are meeting the required objective. The environmental permits provide cost savings not only to the district, but also to the regulatory agencies by eliminating repetitive applications and permit processing for routine maintenance activities; by providing consistent permit requirements; and by streamlining reporting requirements.

Facilities Condition Assessment programs provide for scheduled inspections of district facilities where the district holds property rights either in fee title or easement (including areas in and around creeks and fish ladders), and includes non-scheduled citizen-initiated inspections and emergency inspections. Inspections document deficiencies in categories such as erosion, sediment accumulation, debris blockages, vegetation, trash, graffiti, and fence, gate and sign damage.

Bank repair and stabilization

General Field Maintenance programs provide for small construction projects, repairs and preventative maintenance needed to maintain flood protection infrastructure such as, flood walls, outfalls and channels. Routine work also includes access road work, fence repair and installation, sign installation

and miscellaneous property maintenance. This operation includes engineering, inspection, planning, design, construction, and environmental review to repair these facilities.

Levee Maintenance and Safety is an ongoing program that includes levee inspections, structural stability evaluations after earthquakes or flood events, and preparation and implementation of corrective designs and action plans for levee upgrades to ensure that levees are maintained to design conditions.

Erosion Protection and Repair programs provide erosion control and repair of stream banks to protect facility infrastructure and reduce sediment deposition downstream. Practical solutions are implemented to improve stream stability and to restore the stream's dynamic equilibrium. Natural materials are used in erosion repair projects, where practical, to create greater environmental value to those waterways.

Watershed Property Vegetation Management- This operation provides for upland vegetation management activities on 2,638 acres in all five watersheds throughout the county. Work activities in this project include upland vegetation management for right of way access and fire code compliance.

Debris and Obstruction Removal activities include emergency, routine and miscellaneous debris removal activities such as fallen tree removal, debris removal from bridge supports, and fish passage structure maintenance to preserve the existing flood water conveyance capacity in creeks. Removal of large urban trash and debris removes pollutants and provides for healthy creeks and bay ecosystems. Removal of obstructions to creek flows also eliminates blockages that could cause bank erosion.

Sediment Removal

Sediment Removal activities provide for routine and emergency sediment removal and sediment management from creeks to preserve flood conveyance. Sediment is removed using best management practices in accordance with the Stream Maintenance Program.

Stream Capacity Vegetation Control- This operation provides for in-stream vegetation management of 619 acres annually on predetermined sections of creeks in all five watersheds. Work activities in this project include a variety of integrated vegetation control methods to manage and control stream vegetation, including non-native plants and other vegetation obstructing flood conveyance.

3.2.1.2 Operating Projects – Natural Flood Protection Goal

Stream Maintenance Program Renewal- This operating project provides for continuous operations of the district's routine stream maintenance by renewing the current environmental permits for an additional ten years. The SMP currently provides a predictable and efficient process for completing routine maintenance tasks. Because management of the long term program necessarily involves cumulative tracking of operations, the SMP implementation project and the SMP renewal have significant

interrelationships of staff and tasks. The SMP renewal project includes the underlying program activities and the increased extent of those activities, such as new reaches of sediment removal and vegetation management. It also includes new work types, such as levee protection elements and larger woody vegetation removal, which must be negotiated with various regulatory agencies. This project lays out a strategy to accomplish this. The operating project started in 2002 and is scheduled to be completed in 2012.

Watershed Total Asset Management Program- This operating project provides an Asset Management Program (AMP) that will provide management tools for watershed operation of district facilities in an efficient and effective manner. The goals of this project are to establish a systematic approach for reducing the cost of operating and maintaining capital assets; maintain reliability of service; predict and plan for maintenance far into the future; forecast maintenance and capital cost; and stabilize expenses with respect to the risks and service levels. Specifically the AMP will provide an estimate of life-cycle costs and liabilities of assets in relation to an identified Level of Service. The strategic outcomes of the AMP are 1) An inventory of all watershed operations assets, 2) Current condition of assets, 3) Identify the required sustainable level of Service, 4) The life-cycle cost for operations and maintenance and capital improvements, 5) Identification of cost options for sustainable level of service, 6) Liabilities incurred in the absence of improvement or replacement and 7) Strategy of implementation to maximize the liability reduction to investment ratio. The operating project started in August 2008 and is scheduled to be completed in June 2012.

Levee Recertification Project- This project assesses the district's existing levees and floodwalls according to FEMA's published standards, ascertains whether individual levees are certifiable to today's standards, and provides certification documentation to FEMA for those levees that are certifiable. This effort will continue to include intensive coordination with FEMA, the Army Corps of Engineers (Corps) and cities which are responsible for floodplain management and administering the National Flood Insurance Program. The operating project started in 2008 and all certification materials have been submitted to FEMA in 2010.

3.2.1.3 Capital Projects- Natural Flood Protection Goal

Natural Flood Protection projects are designed to meet multiple objectives, whenever feasible. Some of the benefits or outcomes of multi-objective projects may include: stream habitat restoration, removal of invasive plants, replanting of native species, improvement in water quality through stream stabilization, and new recreational enhancements. These capital projects not only support the goal of Natural Flood Protection, they support the other four goals identified in Section 3.1.

As of FY 2010 there are 20 projects that plan for, and/or construct, improvements on 46 miles of creeks to protect homes, schools, businesses and roadways from flooding. These projects combine to protect over 30,000 parcels from potential flood risks. These projects include:

The district maintains and implements a Capital Improvement Program (CIP) which contains flood protection construction projects. The CIP process includes prioritization of all projects to ensure the projects in the CIP reflect Board priorities. The CIP prioritizes projects through a system that quantifies potential benefits, using weighted criteria to determine a ranking for future funding and construction. Once the district ranks a project as high priority, it evaluates a number of alternative designs, taking into account a variety of objectives—natural resource protection, property protection, community benefits and costs.

Adobe Creek project, from El Camino Real to Rhus Ridge, plans, designs, and constructs improvements to accomplish the following objectives: provide 1-percent protection to 328 parcels against flooding and erosion; improve sediment transport; protect and

enhance the creek ecosystem, and provide for fish passage. This project is funded by the district's watershed and stream stewardship fund. Clean, Safe Creeks special tax funds the creek ecosystem enhancement component of this project. The Adobe Creek project was started in July 1991 and is scheduled to be completed in April 2012. Planning and design phases are complete as of 2010.

Permanente Creek project plans, designs, and constructs improvements along 10.6 miles from San Francisco Bay to Foothill Expressway; Hale Creek from its confluence with Permanente Creek to Foothill Expressway; and the Permanente Diversion Channel between Permanente and Stevens creeks. These construction elements will accomplish the following objectives: provide natural flood protection by taking a multiple-objective approach; reduce erosion and sedimentation; reduce maintenance costs; improve safety and stability of the failing channel between the bay and Foothill Expressway; provide environmental restoration and enhancement benefits; and allow for recreation enhancements where opportunities exist. This project will provide 1-percent flood protection to 1,664 parcels. This project is funded by the district's watershed and stream stewardship fund and by Clean, Safe Creeks. It was started in July 2001 and is scheduled to be completed in June 2016.

San Francisquito Creek project, from San Francisco Bay through Searsville Dam, provides coordination and support to the San Francisquito Joint Powers Authority, in partnership with the U.S. Army Corps of Engineers, to complete planning and design documents for an approved project alternative to accomplish the following objectives: define a project that will eventually provide flood protection to 3,000 homes and businesses; reduce bank erosion and sedimentation-related impacts; avoid potential adverse impacts on fish and wildlife habitats; minimize impacts to the creek's environmental resources; restore the riparian corridor where feasible; and develop public support for the preferred alternative. This project is funded by the district's watershed and stream stewardship fund and by Clean, Safe Creeks with contributions from the Corps and San Mateo County for feasibility study activities only. This is predominantly for planning and design phases only. This project was started in July 2004 and is scheduled to be completed in June 2016.

Calabazas Creek project, from Central Expressway to Miller Avenue, plans, designs, and constructs approximately 2 miles of improvements to accomplish the following objectives: provide 1-percent flood protection to 2,250 parcels, and correct invert erosion along Calabazas Creek downstream of Miller Avenue. Successful completion of this project will have the added benefit of reducing sediment deposition in the downstream reaches that would otherwise compromise stream capacity. This project was funded by the district's watershed and stream stewardship fund. It was started in January 2005 and completed in December 2009.

Calabazas Creek project, 3.3 miles from Miller Avenue to Wardell Road, plans, designs and constructs improvements to accomplish the following objectives: provide 1-percent flood protection to 2,483 homes, businesses, and schools; reduce erosion, sedimentation, and maintenance costs; provide environmental restoration and enhancement benefits; and allow for recreation enhancements where opportunities exist. This project is funded by Clean, Safe Creeks. It was started in December 2003 and is scheduled to be completed in June 2014.

San Tomas Aquino Creek at Quito Road project partners with the City of Saratoga, the Town of Los Gatos, and Caltrans to plan, design, and construct two bridge replacements and to provide 1-percent flood capacity. This project was funded by the district's watershed and stream stewardship fund. It was started in July 2001 and is scheduled to be completed in March 2013.

Sunnyvale East and West Channels Improvement project plans, designs, and constructs improvements to approximately 6.4 miles of the Sunnyvale East Channel, from Guadalupe Slough to Interstate 280, and 2.3 miles of the Sunnyvale West Channel, from Guadalupe Slough to Highway 101. This project will provide flood protection to 1,629 parcels; provide environmental enhancement benefits where opportunities exist; provide recreation enhancements where opportunities exist; reduce erosion, sedimentation, and maintenance costs; and protect fish and wildlife habitat. This project is funded by the district's watershed and stream stewardship fund and by Clean, Safe Creeks. It was started in March 2006 and is scheduled to be completed in December 2015.

Sunnyvale East Channel bank erosion

Lower Guadalupe River project, approximately 6 miles from the Alviso Marina to Interstate 880, plans, designs, and constructs improvements to accomplish the following objectives: eliminate the potential for flood damage to 1,602 homes and businesses during a 1-percent flood event; reduce bank erosion and sedimentation-related impacts along the lower Guadalupe River; avoid potential adverse impacts on fish and wildlife habitats within the riparian corridor where feasible; provide long-term riparian habitat improvement to offset impacts resulting from constructing flood control facilities; provide, where possible, continuous maintenance access along the river, which can be used as a trail; provide opportunities to protect and enhance the existing wetlands and riparian habitat, and improve conditions favoring Chinook salmon and steelhead trout; identify potential project impacts on Alviso and bay land areas and mitigate for unavoidable adverse impacts; provide mitigation for unavoidable adverse impacts on environmental resources; and specify best management practices to protect water quality. This project was funded by the district's watershed and stream stewardship fund. It was started in June 1999 and completed in June 2010.

Guadalupe River Downtown Flood Protection, from Interstate 880 to Interstate 280, partners with the U.S. Army Corps of Engineers (Corps), State of California, City of San Jose, and San Jose Redevelopment Agency to plan, design, and construct improvements along 2.6 miles of the Guadalupe River, to accomplish the following objectives: provide 1-percent flood protection to 3,292 parcels in downtown San Jose's technology and commercial industries and residential neighborhoods; provide recreational and open space benefits in cooperation with the Corps, City of San Jose, and San Jose Redevelopment Agency; preserve and enhance the river's habitat, fish and wildlife; and protect and improve water quality of the river. This project is funded by the district's watershed and stream stewardship fund with contributions from federal, state, and local agencies. It was started in March 1990 and is scheduled to be completed in June 2011.

Guadalupe River Multipurpose Flood Control Project

Upper Guadalupe River project along approximately 6 miles of the Guadalupe River, from Interstate 280 to Blossom Hill Road, partners with the Corps to plan, design, and construct improvements to accomplish the following objectives: provide 1-percent flood protection to nearly 7,000 parcels along

the Guadalupe River, from I-280 to Blossom Hill Road, including portions of Ross Creek and Canoas Creek; provide access to an additional 19 miles of suitable upstream spawning and rearing habitat, which would result in significant long-term beneficial impacts on fisheries resources; provide an opportunity to incorporate a continuous 6-mile trail by connecting the trail at Interstate 280 to the Alamitos Creek trail; provide long-term net gains of 15 acres in riparian forest acreage, quality, and continuity of wildlife habitat, and conditions favoring Chinook salmon and steelhead trout; improve water quality by reducing bank erosion and sedimentation-related impacts along the river and tributaries; and address and resolve permit coordination activities and watershed integration issues through the Guadalupe Watershed Integration Working Group. This project is funded by Clean, Safe Creeks with contributions from federal, state, and local agencies. It was started in July 2001 and is scheduled to be completed in May 2015.

Berryessa Creek project partners with the Corps to plan, design, and construct improvements along approximately 4.3 miles of Berryessa Creek, from Calaveras Boulevard to Old Piedmont Road. This project will provide 1-percent flood protection to more than 2,900 homes, businesses, and public buildings; reduce sedimentation and maintenance requirements, mitigate for project impacts, improve stream habitat values, and identify opportunities to integrate recreation improvements consistent with the Cities of San Jose's and Milpitas' Trail Master Plans. This project is funded by Clean, Safe Creeks with contributions from state and federal partners. It was started in July 2001 and is scheduled to be completed in December 2018.

Berryessa Creek project, from the confluence with Lower Penitencia Creek to Calaveras Boulevard and the lower reaches of both Calera and Tularcitos Creeks, plans, designs, and constructs improvements along approximately 3 miles of Berryessa Creek and its tributaries to accomplish the following objectives: provide 1-percent flood protection to the surrounding area; improve the structural integrity of the levees; improve maintenance access and safety for district staff, and identify opportunities to integrate recreation inputs consistent with the City of Milpitas' Trail Master Plan. This project is funded by the district's watershed and stream stewardship fund. It was started in March 2001 and is scheduled to be completed in June 2021.

Coyote Creek project, from Montague Expressway to Interstate 280, plans, designs, and partially constructs improvements along approximately 6.1 miles of Coyote Creek to accomplish the following objectives: provide flood protection to the surrounding area; identify opportunities to improve water quality within the project limits; identify opportunities to provide for public recreation and access; obtain community support; mitigate for project impacts to stream habitat and fisheries; and create a self-sustaining system within the project limits to reduce long-term operations and maintenance costs. This project is funded by Clean, Safe Creeks. It was started in September 2002 and is scheduled to be completed in June 2016.

Lower Silver Creek (Reach 1-3) project from Coyote Creek to Interstate 680 partners with the Natural Resource Conservation Service (NRCS) to plan, design, and construct improvements along approximately 2.3 miles of the Lower Silver Creek, to accomplish the following objectives; provide 1-percent flood protection to properties in the surrounding area; identify opportunities for additional enhancement of existing habitat values by increased wetlands and riparian habitat; provide on-site mitigation for project impacts; improve stream habitat values and improve fisheries potential; improve pedestrian bridges crossing Lower Silver Creek; and facilitate the opportunity for future pedestrian trails along Lower Silver Creek. This project is funded by the district's watershed and stream stewardship fund. Clean, Safe

Creeks funded the wetland and riparian habitat enhancement component of this project. The Lower Silver Creek project was started in January 1990 and is scheduled to be completed in June 2010.

Lower Silver Creek Reimbursable (Reaches 4-6) project, from I-680 to Lake Cunningham, is part of a flood control project that partners with the NRCS to plan, design and construct improvements along approximately 2.3 miles of the Lower Silver Creek. This project includes elements that are eligible for reimbursement from the State and helps to accomplish the following objectives: increase flood protection to 5,400 properties in the surrounding area; allow for on-site mitigation of project impacts, and in some cases enhancement of existing habitat values by increased wetlands and riparian habitat; and improve vehicle and pedestrian bridges crossing Lower Silver Creek. This project is funded by the district's watershed and stream stewardship fund and with contributions from state and federal partners. It was started in August 2008 and is scheduled to be completed in March 2014.

Lake Cunningham Improvements- This project plans, designs, and constructs improvements to Lake Cunningham in the City of San Jose between Cunningham Avenue and Tully Road, to function as a detention basin. When completed, this project will provide 1-percent flood protection to at least 3,800 parcels. This project is funded by the district's watershed and stream stewardship fund. It was started in August 1999 and is scheduled to be completed in June 2014.

Flooding at King Road on Upper Penitencia Creek

Upper Penitencia Creek project, from Coyote Creek to Dorel Drive, partners with the Corps to plan, design, and construct improvements along approximately 4.2 miles of Upper Penitencia Creek, to accomplish the following objectives: provide 1-percent flood protection to more than 5,000 homes, businesses, and public buildings; mitigate for project impacts; improve stream habitat values and fisheries potential; reduce sedimentation and maintenance requirements; obtain a Letter of Map Revision (LOMR) from the Federal Emergency Management Agency (FEMA); and identify opportunities to integrate recreation improvements consistent with the City of San Jose's and Santa Clara County Parks' Master Plan. In FY 2010, this project is funded through the planning and partial design phases only. The scope, schedule, costs and funding sources of the remaining design and construction phases will be determined at the completion of planning. Planning and partial design are funded by the district's watershed and stream stewardship fund. This project started in March 1996. Preliminary design is scheduled to be completed in December 2010 with final design to resume in FY 2017 due to funding constraints. Final design is scheduled to be completed in FY 2019.

Upper Llagas Creek project, from Buena Vista Road to Wright Avenue, partners with the Corps to plan, design, and construct improvements on approximately 13.6 miles of Upper Llagas Creek, from Buena Vista Avenue to Wright Avenue, to accomplish the objective of providing an increased level of flood protection with adequate freeboard. Approximately 1,397 parcels will be protected. This project is funded by Clean, Safe Creeks and with contributions from state and federal partners and the City of Morgan Hill. It was started in August 2000 and is scheduled to be completed in December 2015. The project schedule may vary considerably and is dependent upon the Corps and Congressional appropriations.

Lower Llagas Creek Capacity Restoration Project, from Highway 152 to Pajaro River, is a partially-funded (planning phase only) project that plans, designs, and constructs improvements on approximately 3.35 miles of Lower Llagas Creek, from Hwy 152 to Pajaro River, to accomplish the following objectives: restore flood capacity in Lower Llagas Creek; coordinate with South County Wastewater Authority as a principal stakeholder and water resource co-planner; and integrate flood protection with habitat protection to satisfy Endangered Species Act regulations. This project is funded by the district's watershed and stream stewardship fund. It was started in July 2008 and is scheduled to be completed in December 2014.

San Francisco Bay Shoreline is a partially-funded (planning phase only) project that provides district coordination with the California Coastal Conservancy, Corps, and other project partners to plan, design, and construct improvements to accomplish the following objectives: provide integrated fluvial and tidal flood protection; restore and/or enhance tidal marsh and related habitats; provide recreational and public access opportunities throughout the tidal floodplain of Santa Clara County; and pursue continued federal funding. This project is funded by the district's watershed and stream stewardship fund with contributions from various partners. Clean, Safe Creeks funded the enhancement component of this project. The project is currently funded for the planning phase only. The scope, schedule, costs and funding sources for the design phase and construction phase will be determined at the completion of the planning phase. The San Francisco Bay Shoreline project was started in July 2003 and is scheduled to be completed in June 2020.

Marshland in San Francisco Bay near shoreline project

3.2.1.4 Levels of Service - Natural Flood Protection Goal

Through the ends policies, the board has adopted the goal of natural flood protection for residents, businesses, and visitors. To attain this goal, the Flood Protection and Stream Stewardship program is structured to achieve a 100% Level of Service around two objectives:

- Objective 1- Balance environmental quality and protection from flooding in a cost effective manner
- Objective 2- Preserve flood conveyance capacity

The ability of the district to satisfy the target Levels of Service is determined by setting key performance measures or indicators and tracking progress of that performance. The first objective is centered on having a capital improvement program that provides additional protection from flooding through multiple-objective projects that also identify opportunities for environmental enhancements, trails, parks, and open spaces. Key performance indicators for capital projects are the number of parcels protected from 1-percent flooding (although, in response to a community's desires, the board may approve projects that provide an alternative level of protection) and miles of streams that are modified or studied.

The second objective is centered on stream maintenance program activities, total asset management principles, and other activities that preserve flood conveyance capacity. Key performance indicators for

preserving flood conveyance capacity include average annual sediment removal quantities, number of facility condition assessments performed annually, miles of levees inspected and maintained, and acres of vegetation control for restoring in-stream capacity.

Natural Flood Protection Operating Programs Existing Levels of Service

Operations

Under the Flood Protection and Stream Stewardship program as it exists in 2010, all the operating projects and operations programs identified in Section 3.2.1 can be provided at a 100% Level of Service through 2016. This includes all the objectives stated in each of the operating projects and all the routine activities in the operations programs. These levels of service are listed below in terms of measurable key performance indicators, which will be adjusted as newly-constructed creek projects are completed:

- 100% of flood protection facilities are inspected a minimum of two times annually to assess their condition and readiness to convey design flows.
- Field maintenance programs are provided at a 100% level of service for preventative and corrective maintenance as prescribed in the operation and maintenance manuals.
- Levee maintenance and safety activities are conducted for 7.6 miles of levees annually (out of a total of 107 miles of levees).
- 100% of identified bank or channel bottom erosion threats to flood protection infrastructure are repaired.
- Average 80,000 cubic yards of sediment are removed annually, as necessary, to preserve flood conveyance capacity.

Capital Projects

In the existing 2010 capital improvement program there are 20 capital projects to protect homes, schools, businesses and roadways from flooding. These projects were selected due to their high priority to solve problems in areas which have experienced flooding at least once over the last 20 years. In addition to flood protection, these projects also include stream habitat restoration, removal of invasive plants, replanting of native species, improvement in water quality, and new recreational opportunities.

The current capital improvement program for flood protection will receive a 100% Level of Service to plan, design, and construct 18 projects that are on track to be completed by 2016. Two other projects (San Francisquito and mid-Coyote creeks) are primarily planning and design projects for which a 100% Level of Service will be given to complete those studies by 2016.

Key performance indicators for meeting this Level of Service are:

- Constructing channel modifications to 32 miles of streams.
- Providing 1-percent flood protection to over 30,000 parcels.
- Completing planning, design, and partial construction on 14 miles of streams to provide eventual 1-percent flood protection to over 3,000 homes and businesses.

Natural Flood Protection Levels of Service 2017 to 2035 with no New Funding

If no new funding is secured after the sunset of the Clean, Safe Creeks special parcel tax, future Levels of Service may change over time for certain activities because of this anticipated constraint in the district's revenue. Factors that may change the desired Levels of Service in the future include new agreements or obligations stemming from current operating programs or capital projects; changes in regulations which can raise the minimum Levels of Service required; funding and implementation of new projects; requests from community interests; and board policy changes relative to the expected or required Levels of Service to be provided.

Construction on Lower Guadalupe River

In terms of Objective 1, under the scenario of no new funding to replace the Clean, Safe Creeks special parcel tax, it is likely that no new major flood protection projects will be started in this planning horizon. Two projects on Berryessa Creek projects will be mostly complete by 2016, but have off-stream construction and plant establishment elements that will extend into this planning horizon. The future Levels of Service for providing additional protection to parcels that are currently subject to 1-percent flooding is anticipated to decrease to a 0% Level of Service.

In terms of Objective 2, operating programs that currently support preserving flood conveyance capacity are anticipated to continue in this planning horizon for both existing and newly constructed facilities. These operating programs include stream maintenance program implementation, sediment removal, facility condition assessments, general field maintenance, repairing bank or channel bottom erosion that threatens facility infrastructure, levee maintenance and safety, and debris and obstruction removal. It is anticipated that most of these programs will be continued at a 100% Level of Service. Some programs such as stream capacity vegetation control may be provided at reduced Levels of Service if funding constraints or the board dictate that only the required elements of a program are to be continued.

Table 3.2 summarizes projected Levels of Service in each planning horizon.

Table 3.2 Natural Flood Protection Projects, Programs, and Levels of Service

Goal One: Natural flood protection for residents, businesses, and visitors		
Projects and Programs	**Levels of Service 2010 to 2016**	**Levels of Service 2017 to 2035**
Operations Programs as of 2010	**Operations Programs Levels of Service**	**Operations Programs Levels of Service**
• Basic hydrology	• 100% to maintain Hydrology Management System	100%
• Geomorphic data analysis	• 100% to develop geomorphic database	100%
• Stream Maintenance Program (SMP) Implementation	• 100% to comply with permit conditions and BMPs	100%
• Facility condition assessment	• 100% to provide annual inspection for all facilities	100%
• General field maintenance programs	• 100% of preventative and corrective maintenance	100%
• Levee maintenance and safety	• 100% to maintain average of 7.6 miles of levees annually	100%
• Erosion protection and repair (infrastructure protection)	• 100% to correct threats to infrastructure	100%
• Watershed property vegetation management	• 100% on 2638 acres of upland vegetation maintenance	100%
• Debris and obstruction removal	• 100% to remove identified obstructions	100%
• Sediment removal	• 100% to remove average of 80,000 cubic yards annually	100%
• Stream capacity vegetation control	• 100% to maintain 619 acres annually of in-stream vegetation control	60% (natural channel component eliminated due to CSC sunset in 2016)
Operating Projects as of 2010	**Operating Projects**	**Operating Projects**
• Stream Maintenance Program Permit Renewal	• 100% to obtain new ten-year permits to conduct stream maintenance activities	None identified at this time. There may be new operating projects that stem from current watershed total asset management program.
• Watershed Total Asset Management Program	• 100% to provide a watershed asset management program	
• Levee Recertification Project	• 100% to recertify all levees that FEMA indicates are non-certified to current standards	

Table 3.2 Natural Flood Protection Projects, Programs, and Levels of Service

Goal One: Natural flood protection for residents, businesses, and visitors		
Projects and Programs	**Levels of Service 2010 to 2016**	**Levels of Service 2017 to 2035**
Capital Improvement Projects as of 2010 • Adobe Creek • Permanente Creek • San Francisquito Creek (Plan & Design) • Calabazas Creek (Central Expressway to Miller Avenue • Calabazas Creek (Miller to Wardell Road) • San Tomas Aquino Creek (Quito Road Bridge) • Sunnyvale East and West Channels Improvement • Lower Guadalupe River (Alviso Marina to I-880) • Guadalupe River Downtown (I-880 to I280) • Upper Guadalupe River (I-280 to Blossom Hill) • Berryessa Creek (Calaveras Boulevard to Old Piedmont Road) • Berryessa Creek (L. Penitencia Cr. to Cal. Blvd.) • Coyote Creek Planning and Design, Partial Construction (Montague Expressway to I-280) • Lower Silver Creek (Reach 1-3) • Lower Silver Creek (Reach 4-6) • Upper Penitencia Creek • Upper Llagas Creek • Lower Llagas Capacity Restoration • San Francisco Bay Shoreline Planning	**CIP Levels of Service** 100% to complete planning, design, and construction on Adobe, Permanente, Calabazas (two projects), San Tomas Aquino, Lower Silver (two projects), Upper Llagas, and Lower Llagas creeks; Sunnyvale East and Sunnyvale West Channels; and Lower, Downtown, and Upper Guadalupe River by 2016. 100% to complete planning and design for two projects on Berryessa Creek by 2016. 100% to complete planning and preliminary design for Upper Penitencia by 2016 100% to complete planning, design, and partial construction on San Francisquito and Coyote creeks. 100% to complete planning for San Francisco Bay Shoreline project by 2016.	**CIP Levels of Service** 0% for new major capital improvement projects for flood protection (planning, design, or construction) without a new source of funding. 100% to complete construction on Berryessa Creek (Calaveras Blvd. to Old Piedmont) by 2018. 100% to complete construction on Berryessa Creek (Lower Penitencia Creek to Calaveras Blvd.) by 2021. 100% to complete final design on Upper Penitencia Creek by 2019.

3.2.2 Reduced Potential for Flood Damages

This section summarizes the supporting projects and programs associated with the Reduced Potential for Flood Damages goals and objectives. The supporting projects and program descriptions are followed by the section that identifies the levels of service applicable to those projects and programs.
The goal of reduced potential for flood damages has two primary objectives. These objectives are to reduce flood risks in flood prone areas, and to avoid the creation of expanded flood areas.

The first objective is centered on providing flood forecasting and emergency response services. Other activities are aimed at conducting an effective floodplain management program. This entails working with municipalities to clearly identify roles and responsibilities for flood plain management and emergency response; responding to development proposals that could impact district facilities; promoting community awareness about best practices to avoid or minimize exposure to flooding; and working with FEMA to ensure that floodplain maps are based on the best available data.

The second objective is centered around providing technical support on subjects such as flood-wise designs, mitigating erosion, sedimentation, and high flows from new developments; promoting green projects or other practices to manage stormwater runoff and improve water quality; and to promote awareness of the risks for developing in flood hazard areas. Table 3.3 lists the specific programs and projects that support the goal of reduced potential for flood damages.

Table 3.3 Reduced Potential for Flood Damages Projects and Programs

Goal Two: Reduced potential for flood damages	
Projects and Programs	
Operations Programs as of 2010	**Capital Improvement Projects as of 2010**
• Hydrologic Data Measurement and Management • Flood Warning System • Flood Management Policy and Coordination • Emergency Services • Watershed Asset Protection Support • Sandbag Program • Public Outreach and Flood Awareness	• Radio Repeater System Infill

3.2.2.1 Operations Programs- Reduced Potential for Flood Damages

Hydrologic Data Measurement and Management- This ongoing operation provides for collection, processing, analysis, storage, and dissemination of hydrologic data and maintenance of 39 precipitation stations, 70 stream flow gauges, 11 reservoir stations, and 1 evaporation and weather station. This program also manages ALERT, a database program which provides for real time data from most stations and is displayed on the district's web site.

Flood Warning System– This operation program intends to predict the stream flows and reservoir spills a few hours before the actual occurrence. The objective is to provide warnings to residents who are affected by the imminent flood event to allow emergency actions to reduce flood damage. The system involves developing and calibrating a hydrologic model for each watershed that can properly account for the rainfall-runoff process. It also develops an information dissemination system that automatically dispatches warning messages.

Flood Management Policy and Coordination- This program provides for coordination with local municipal floodplain managers on matters to increase local flood risk awareness, to encourage actions to mitigate the local flood risk, and to maintain the district's influence in activities affecting local flood risk management. To increase local flood awareness, the project will work with Federal Emergency Management Agency (FEMA) to improve the accuracy and usefulness of local flood maps and economic assessments of flood risk. The project will coordinate this information with the district's asset management program to facilitate prioritization of maintenance and capital expenditures. The project also continues the district's participation in FEMA's Community Rating System (CRS), for which the district receives credit for specific flood risk-reducing activities. CRS credit translates to lower flood insurance rates for policies in Santa Clara County.

This project will also coordinate information with district's automated flood warning system. Detailed maps produced in this project will be linked to the flood warning system. Information will also be developed for use by local emergency management staff in planning, preparing and responding to flood emergencies. This project will provide for an increased understanding - internally and externally - of local flood risks through improved mapping and strong partnerships with local municipalities and assure the district's voice in matters of local, state and national policy.

Emergency Services**-** The district conducts various ongoing activities of the Emergency Services program. Among these activities, the district maintains the Emergency Operation Center (EOC) emergency equipment and supplies to be available at anytime for activations for an emergency event. This project also includes activities to address FEMA requirements for the National Incident Management System (NIMS). Other activities include preparing staff to effectively respond to emergencies; timely operation of the EOC during emergency activations; partnering with other emergency professionals; and providing project management to ensure compliance with FEMA requirements and deadlines to ensure state and federal eligibility for reimbursements and grants.

Watershed Asset Protection Support**-** Following the adoption of the Water Resources Protection Ordinance in 2006, the district's role in land development review shifted from a regulatory permit basis to one of collaboration and technical support. The regulatory permit component of land development review is defined as the protection of district assets through the enforcement of the ordinance and the issuance of encroachment permits on district rights of way. Among the services that the district provides are:

District Emergency Operations Center

- Review and evaluate projects for compliance with CEQA and/or issuance and inspection of encroachment permits
- Enforce Water Resources Protection Ordinance
- Administer the Underground Service Alert program

- Maintain District right of way maps
- Renew and prepare leases and joint use agreements
- Prepare land surveys, title searches, or appraisals as needed to determine district land rights or value
- Negotiate land dedications, exchanges or deed outs associated with development
- Research and respond to requests for flood zone information
- Coordinate and maintain accessibility to FEMA flood maps on District's Geographic Information System (GIS) system

Sandbag Program

Sandbag Program- The district sandbag program provides filled sandbags or sand and empty bags for public use during winter storm events. The purpose of this program is to assist homeowners and businesses in protecting their property and assets. The district also provides educational materials on the proper usage of sandbags to divert storm waters and minimize storm-related damage to properties. On average, about 250,000 sandbags are provided between November 1 and April 30 at seven satellite facilities throughout the county.

Public outreach and flood awareness- This program focuses on efforts to raise the general public's awareness of flood safety, flood protection and stream stewardship issues. The objectives are to provide information and education to residents, businesses and commuters about the risks associated with flooding in Santa Clara County and how to be flood safe and reduce the loss of life and property. It is also designed to demonstrate the district's value to the community in terms of flood protection and stream stewardship.

3.2.2.2 Capital Projects- Reduced Potential for Flood Damages

Radio Repeater System Infill- The objective of this project is to expand the district's ability to communicate quickly and securely with Santa Clara County public agencies during day-to-day operations, large scale events, and regional disasters. This project studies the extent of repeater and receiver system infill and considers existing antenna sites that are available through the county, cities, and other public agencies. This project is funded by the district's watershed and stream stewardship fund and the water utility enterprise fund. It was started in July 2008 and is scheduled to be completed in April 2012.

3.2.2.3 Levels of Service- Reduced Potential for Flood Damages

The board has adopted the goal of reduced potential for flood damages. To attain this goal, the Flood Protection and Stream Stewardship program is structured to achieve a 100% Level of Service around two objectives:

- Objective 1- Reduce flood risks in flood prone areas, and
- Objective 2- Avoid the creation of expanded flood areas.

Under current and projected levels of funding, it is anticipated that the operating programs can be funded through 2035. To satisfy the target Level of Service, key performance measures or indicators have been determined to meet these objectives. Key performance indicators for achieving these

objectives include collecting, maintaining, and disseminating hydrologic data from precipitation and streamflow stations and reservoirs; incorporating standardized emergency management practices into emergency response preparedness activities; providing sandbags to cities and the public; conducting outreach and awareness programs; and responding to requests for development review. Table 3.4 indicates the level of service for each program activity.

Table 3.4 Reduced Potential for Flood Damages Projects, Programs, and Levels of Service

Goal Two: Reduced Potential for Flood Damages		
Projects and Programs	**Levels of Service through 2016**	**Levels of Service 2017 to 2035**
Operations Programs as of 2010	**Operations Programs Levels of Service**	**Operations Programs Levels of Service**
• Hydrologic data measurement and management	• 100% Maintenance and data dissemination from 39 precipitation stations, 70 stream flow stations, 11 reservoirs, and 1 evaporation and weather station	100%
• Emergency Services	• 100% to comply with state standards, conduct emergency drills, prepare flood team to respond during winter season. 100% availability of EOC for emergency activations.	100%
• Watershed Asset Protection Support	• 100% to respond to land development review request within 30 days	100%
• Sandbag Program	• 100% to provide 40,000 filled sandbags at district facilities and provide empty bags and sand at seven satellite locations	100%
• Public outreach and flood awareness	• 100% to produce advertisements to promote flood awareness. Provide direct contact with the community to help increase flood protection and flood safety awareness	100%
• Flood Warning System	• 100% to develop the flood warning system	100%
Capital Improvement Projects as of 2010	**Capital Improvement Projects**	**Capital Improvement Projects**
• Radio Repeater System Infill	• 100% to provide county-wide radio system reliability	100%

3.2.3 Healthy Creek and Bay Ecosystems

This section summarizes the supporting projects and programs associated with the Healthy Creek and Bay Ecosystems goals and objectives. These services provide for crucial environmental work to protect and restore habitats. The projects and program descriptions are followed by the section that identifies the Levels of Service applicable to those projects and programs.

Coyote Parkway freshwater wetlands

The goal of healthy creeks and bay ecosystems has three primary objectives. These objectives are 1) to balance water supply, flood protection, and environmental stewardship functions, 2) to improve watersheds, streams, and natural resources, and 3) to promote awareness of stream and bay ecosystem functions.

The first objective is centered around activities aimed at protecting and restoring sensitive fisheries and aquatic species; identifying and mitigating impacts to watersheds, stream, and natural resources by capital projects and operations programs; identifying and implementing potential mitigation banking opportunities to streamline future mitigation requirements; and providing information on stormwater management and design of floodplains and channels.

The second objective is centered around implementing stream stewardship opportunities, including environmental enhancements, and seeking to achieve the physical stability and ecological health; engaging in habitat conservation planning; protecting groundwater recharge areas in creeks and riparian corridors; protecting, enhancing, and restoring riparian vegetation and in-stream and tidal habitat conditions; and protecting, enhancing, and restoring populations of key species.

The third objective is centered around providing technical expertise for applying ecosystems functions knowledge; promoting awareness of sensitive groundwater recharge areas; and promoting the preservation of ecological buffers.

The projects and programs supporting the goal of healthy creeks and bay ecosystems are listed in Table 3.5.

Table 3.5 Healthy Creeks and Bay Ecosystems Projects and Programs\

Goal Three: Healthy creeks and bay ecosystems	
Projects and Programs	
Operations Programs as of 2010 • Revegetation mitigation maintenance • Watershed property vegetation management • Watershed erosion protection • Downtown Guadalupe River mitigation monitoring • Pond A4 operations • SMP biodiversity monitoring • Ecological monitoring and assessment **Operating Projects as of 2010** • Island ponds mitigation and monitoring • Tick Creek enhancement • Lower Uvas fish passage at Bolsa Road • Guadalupe Creek cape ivy control • Adobe Creek mitigation monitoring • Coyote Creek mitigation monitoring • Lower Silver Creek mitigation monitoring • Lower Llagas mitigation monitoring • Smooth cordgrass control • SMP Mitigation, Arundo Control Program • Carnadero preserve management • Alviso Collaborative • Comprehensive Habitat Conservation Plan	**Capital Projects as of 2010** • Stream Maintenance Program Mitigation, Coyote Parkway freshwater wetland • SMP Mitigation, Laguna Seca freshwater wetland • SMP Mitigation, Pajaro Basin freshwater wetland • SMP Mitigation, Stream and watershed land preservation • Alviso Slough restoration • Clean, Safe Creeks Stevens Creek Corridor restoration • Gold Street education center • Jacques Gulch restoration • Pond A8 Applied study final design and construction • Thompson Creek stream stabilization • Fish and Aquatic Habitat Collaborative Effort (FAHCE) Stevens Creek fish passage enhancement • Clean, Safe Creeks Soap Lake floodplain property acquisition

3.2.3.1 Operations Programs- Healthy Creek and Bay Ecosystems

Bank repair on Saratoga Creek

Revegetation Mitigation Maintenance- This ongoing operation provides for management of 327 acres of revegetation plantings throughout the five watersheds. Work activities conducted under this program include maintenance of mitigation plantings on completed capital improvement projects and other watershed mitigation projects. The scope of work for this operation will expand as new capital projects are completed.

Watershed Erosion Protection- This operation provides for on-going routine and emergency stream bank stabilization to protect property, protect public health and safety, and reduce sediment deposits downstream. This project also provides stream bank stabilization to maintain improved facilities to ensure they continue to function as designed; prevent environmental degradation; and improve water

quality. This operation emphasizes the use of the "softest" feasible solution to stabilize stream banks and provide vegetation and habitat. Fluvial geomorphic stream management methods will be used where feasible with follow-up monitoring to evaluate effectiveness. On average 4,800 lineal feet of stream banks are stabilized annually.

Downtown Guadalupe River Mitigation Monitoring Program**-** This ongoing operation satisfies monitoring and reporting requirements in compliance with the permits issued by regulatory agencies for the Downtown Guadalupe River Project. The district, regulatory agencies, and interested parties participate on an Adaptive Management Team (AMT) that meets annually to review the Mitigation and Monitoring Report and come to consensus on recommended changes to the monitoring plan. The goal of the AMT is to recommend adaptive management strategies that will result in a successful mitigation program for the Guadalupe River Project. This is an ongoing operation.

Pond A4 Operations maintains and operates Pond A-4 as stipulated by the memorandum of understanding (MOU) with the United States Fish and Wildlife Service (USFWS). This project maintains the current state of Pond A-4, preventing its environmental and tidal flood benefit degradation. Ongoing facility maintenance and improvements such as levee repair, road grading, pump operation, fencing and signage are also components of this project. A potential benefit of the pond is its use for sediment disposal.

SMP Biodiversity Monitoring- This operation addresses mitigation requirements under the Stream Maintenance Program (SMP). It was developed under Best Management Practice 3.19 in the SMP as a 10-year program, designed to identify and evaluate the habitats and the distribution and abundance of sensitive species in areas covered under the SMP. The program provides advanced information on sensitive species which will help with the planning and implementation of maintenance and other types of projects. In FY 2010, the program will be adding the collection of biological information needed to support the expected SMP permit renewal process in FY2012 and support the Asset Management Program. Collecting biological information will help establish level of service for some district assets and also contribute to the condition assessments for these assets. SMP Biodiversity Monitoring is coordinating with the SMP Permit Renewal Project to ensure that the species data collection efforts of both projects supplement each other and do not duplicate efforts.

Ecological Monitoring and Assessment Program is being designed to ensure that timely and cost-effective scientific information of known quality on the health of stream ecosystems within the jurisdiction of the district is available to inform, evaluate, and improve watershed management decisions. The goals of the program are to programmatically manage district monitoring activities; to develop the strategies, tools, and procedures to improve the efficiency and effectiveness of district ecological monitoring activities; and to ensure that cost-effective and timely ecological information is available.

3.2.3.2 Operating Projects- Healthy Creek and Bay Ecosystems

Several mitigation, conservation, and monitoring projects are underway on several creeks, former salt ponds, and lands acquired for mitigation and enhancement purposes. Each is described in more detail below. These projects are implemented to fulfill regulatory permit requirements, agreements, or to provide enhancements. The mitigation and monitoring requirements vary in length, but are usually

either five years or ten years of monitoring. At the end of the appropriate time, ongoing mitigation maintenance may be conducted.

Island Ponds Mitigation site changes from April 2008 to Sep. 2009

Island Ponds Mitigation and Monitoring is an operating project to conduct long term monitoring activities to track the progress of the restoration efforts and to determine if there are adverse effects from the project. The district obligations are documented in the Final Restoration and Mitigation Monitoring Plan for the Island Ponds Restoration Project (RMMP; Feb 2006). This restoration project satisfies the district's tidal wetland mitigation needs of 30 acres for the Stream Maintenance Program (SMP) and approximately 36 acres for the Lower Guadalupe River Flood Control Project (LGRP). It also provides enhancement opportunities to help achieve the Clean, Safe Creeks fifteen-year goal for creation of additional wetlands. It consists of three former salt production ponds flanked by Mud Slough to the north and Coyote Creek to the south. In addition to satisfying the approximately 66 acres of tidal wetlands mitigation needs, this project will result in an enhancement of 299 acres of tidal wetlands. The operating project started in 2005 and is scheduled to be completed in February 2020.

Tick Creek Riparian Enhancement project will provide for the active revegetation of channel bank and/or near channel bank along Tick Creek within the Carnadero Preserve. This project will result in 2.3 acres of riparian habitat. The district acquired the Carnadero Preserve in 2004 primarily for Stream and Watershed Protection requirements under the Stream Maintenance Program. Additional acreage was purchased at the time in anticipation of future enhancement and mitigation opportunities, including fifty feet on either side of Tick Creek and adjacent fields which exhibit high groundwater and frequently flooded conditions. This project is included in the Pajaro Integrated Regional Water Management Plan. Benefits expected from the planting include increases to riparian vegetation, erosion control and habitat for beneficial insects. The operating project started in 2005 and is scheduled to be completed in December 2013.

Lower Uvas Fish Passage at Bolsa Road- This operating project proposes to design an appropriate fish way to accommodate fish passage at a larger range of flows throughout the migration period for steelhead (see fish ladder at Evelyn photo for a sample redesign). This project is an enhancement for fisheries increasing connectivity to seven miles of upstream fish habitat. A number of variables will be considered to select an appropriate fish way design. These variables include species and age class to be passed; hydraulic analysis of channel; degree of flow control available; dependability; and cost of operations and maintenance. Specific data required for collection during the design phase consists of bathymetry of pools, identification of channel and bar configuration to aid in the understanding of high flow hydraulics, ordinary and high water marks, and surveying channel cross sections to develop a hydraulic model and tailwater rating curve. In addition, bed and debris load quantity and quality and characterization of site soil conditions will be considered in the planning phase. The operating project started in 2009 and is scheduled to be completed in April 2014.

Guadalupe Creek Cape Ivy Control- This operating project is an enhancement that consists of removal of Cape Ivy (Delaria odorata) on Guadalupe Creek between Camden Avenue and Masson Dam. The area is vegetated with mature riparian vegetation which provides rich, stream-side habitat for wildlife and migrating salmonids. The native vegetation has been heavily infested with Cape Ivy which has degraded the habitat and threatens the downstream watershed, including a habitat restoration area located immediately downstream of Masson Dam. The project consists of physically removing invasive Cape Ivy biomass from riparian vegetation and the stream edge, treating the remaining Cape Ivy with specified herbicides, and performing follow up monitoring and treatment for an additional year to ensure adequate control of the vegetation. This project will restore 9.5 acres of quality riparian habitat along Guadalupe Creek by removing the negative impacts of this invasive exotic species. The operating project started in 2008 and is scheduled to be completed in June 2010.

Adobe Creek Mitigation Monitoring- This operating project provides for the management and maintenance of mitigation sites for three projects in Adobe Creek Reaches 1-4 and one site for Adobe Creek Reach 5. The district is required by three resource agency permits to mitigate for impacts to vegetation from project construction. Additional monitoring is required by the agencies for geomorphic monitoring of the project site and monitoring for San Francisco dusky-footed woodrat nests. Monitoring will be for ten years. After ten years, ongoing maintenance for this and other mitigation monitoring projects will be conducted under the Revegetation Mitigation Maintenance program. The operating project started in 2005 and is scheduled to be completed in February 2018.

Matadero Overflow Channel Mitigation Monitoring- This operating project will monitor biological mitigation for the Matadero Creek Overflow Channel Project to ensure that 2.46 acres of riparian habitat and 0.28 acres of wetland habitat are successfully established and meet the permit conditions from the agencies for construction related impacts. In 2005, the first year monitoring report was submitted to the regulatory agencies for this project. The district is required to submit mitigation monitoring reports for ten years ending in December 2014. In addition, the district was required to submit mitigation monitoring reports for five years for the created wetland area. This requirement ended in 2009. The project end date is June 30, 2015.

Bollinger Road Bridge Mitigation Monitoring- This project will monitor mitigation efforts consisting of non-native vegetation removal and revegetation with native species. The mitigation is a permit requirement for the removal of the old Bollinger Road bridge abutments and the new bridge modifications at Calabazas Creek. Monitoring will be for five years. The operating project started in 2005 and is scheduled to be completed in June 2011.

Coyote Creek Mitigation Monitoring- This project will restore a self-sustaining riparian forest and suitable wildlife habitat in order to replace the similar habitats which were removed during construction of the flood control project. This project will satisfy the permit conditions of the 1984 Coyote Creek Flood Control Project from San Francisco Bay to Montague Expressway through the management, monitoring, and reporting of results for reaches 1B, 2, and 3 of Coyote Creek.

Lower Silver Creek Mitigation Monitoring- This project will monitor revegetation sites for survivorship, cover, etc.; jurisdictional wetlands for species diversity and wetland hydrology; and channel features for geomorphic processes as required by the project's updated Lower Silver Creek Mitigation Monitoring Program (SCVWD 2001). The 4.6 mile flood protection and creek restoration project is divided into six reaches starting at the Lower Silver and Coyote Creek confluence, extending north to the Cunningham Avenue creek crossing. As reaches are completed, the mitigation components will be monitored for ten

years and reported annually to the permitting agencies. Mitigation for the project impacts includes 12.7 acres of jurisdictional waters, including wetlands, six acres of upland habitat, and five acres of riparian/shaded riverine aquatic. The operating project started in 2001 and is scheduled to be completed in June 2014.

Lower Llagas Mitigation and Monitoring- The Llagas Creek Watershed Project Plan was approved by the three local sponsoring agencies and the governing bodies of Santa Clara County, Gilroy, and Morgan Hill in 1968 and authorized by Congress in 1969 under Public Law 83-566. Different reaches have been constructed in phases starting in the early 1970s and continuing in the early 1980's and 1990's following further environmental review. Mitigation for construction impacts included restoring riparian resources with vegetative plantings, installing low flow channels and fish ladders, establishing plantings to mitigate visual impacts, and complying with various local and state ordinances for air and water quality. This will investigate and document mitigation and monitoring responsibilities agreed to in the permitting of the Lower Llagas Flood Control Project. The investigation will determine whether mitigation responsibilities have been fulfilled or, if not, whether a systematic mitigation and monitoring plan needs to be developed and implemented.

Smooth Cordgrass Control- This project is a mitigation condition of the Corps, USFWS, and CDFG permits for the SMP. The district is responsible for controlling existing and limiting future infestations of invasive smooth cordgrass (Spartina alterniflora) in the South San Francisco Bay tidal marshes. This project provides regional coordination, plant distribution monitoring, and control of up to 10 acres of invasive smooth cordgrass in Santa Clara County and Coyote Slough over a 5-year period, with an additional 3 years of retreatment work, if necessary. The operating project started in 2002 and is scheduled to be completed in July 2011.

Arundo Control Program- The Arundo donax control program is required mitigation for vegetation management activities under the long-term regulatory permits for the SMP. The program objective is to control 125 acres of existing Arundo donax, commonly referred to as giant reed, located in various riparian corridors throughout Santa Clara County. The program provides identification and control of 125 acres of Arundo donax over a ten year period (12.5 acres annually) with up to three years of ongoing control beyond the ten year project expiration.

Control consists of removal of above-ground biomass, chemical treatment of remaining rhizomes, removal and disposal of biomass and follow-up control (re-treatment). Arundo donax offers little to no wildlife habitat value but is highly used by homeless populations. Left unattended, Arundo donax infestations will expand in Santa Clara county streams, reducing flow conveyance, eliminating valuable wildlife habitat, and causing other negative impacts to the county's riparian resources. The operating project started in 2002 and is scheduled to be completed in June 2015.

Carnadero Preserve revegetation project

Carnadero Preserve Management- This project purchased and manages the Carnadero Preserve, located between Uvas-Carnadero Creek and Highway 101 south of Gilroy. The acquisition earned mitigation credits for the SMP. The site encompasses the areas of the confluences of Uvas-Carnadero Creek with the Pajaro River, Tick Creek,

and Tar Creek. This project provides stream and watershed protection mitigation credits for the district to conduct activities under the SMP in the Pajaro Basin. One of the project objectives is to identify and develop opportunities for potential wetland and riparian enhancements or enhancement of the site for ecosystem and water quality benefits. The operating project started in 2004 and is scheduled to be completed in June 2020.

Alviso Collaborative- The Alviso and Lower Guadalupe Collaborative was formed to collectively work toward effective flood protection, habitat enhancement and restoration, and recreation in the Alviso area. The collaborative participants include district staff and the Alviso Water Task Force, which consists of Alviso residents, interested parties, and legislators. The members of the collaborative understand that there are a multitude of projects such as the Lower Guadalupe Flood Protection Project and the Alviso Slough Restoration Project. The goal of the collaborative is to create a model in combining effective flood protection, habitat enhancement and restoration, and recreation in an urban area. The operating project started in 2004 and is scheduled to be completed in June 2016.

Comprehensive Habitat Conservation Plan- This project, the Santa Clara Valley Habitat Conservation Plan/Natural Communities Conservation Plan (HCP/ NCCP), addresses development and implementation of a cooperative program that will provide long-term protection of habitats and biodiversity in much of Santa Clara County. The district has formed a partnership with the County of Santa Clara (lead agency), the City of San José, and Valley Transportation Authority as full partners and the City of Gilroy and Morgan Hill as half-partners. This project will improve efficiency and certainty of the Endangered Species Act/California Endangered Species Act (ESA/CESA) permitting for public and private infrastructure and development projects, and assure that the costs of mitigation are equitably spread among the planning partners. Stakeholder input will be included throughout plan development and implementation to ensure that all perspectives are considered. The end result will include streamlined permitting, incidental take coverage for covered activities within the geographic scope of the Habitat Conservation Plan/Natural Communities Conservation Plan and more effective conservation efforts. The operating project started in 2004 and is scheduled to be completed in December 2012.

3.2.3.3 Capital Projects- Healthy Creek and Bay Ecosystems

SMP Mitigation, Coyote Parkway Freshwater Wetland**-** This project plans, designs, and constructs a freshwater wetland basin at the Coyote Parkways Lakes area, near Monterey Road and south of the Highway 101 and Highway 85 interchange in San Jose. This project will provide seven acres of freshwater wetland habitat and in part meet the district's mitigation requirements for the multi-year SMP in the Santa Clara Basin. This project is funded by the district's watershed and stream stewardship fund. It was started in July 2003 and completed in June 2011.

SMP Mitigation- Pajaro Basin Freshwater Wetland**-** This project plans, designs, and constructs improvements to create a freshwater wetland in the Pajaro Basin. It is located in the district's Carnadero Preserve, approximately two miles south of Gilroy. This project will create about four acres of freshwater wetland habitat to meet the district's mitigation requirements for implementing the SMP in the Pajaro Basin. Another of the project objectives is to identify possible enhancement opportunities for presentation to the board of directors. This project is funded by the district's watershed and stream stewardship fund. It was started in July 2002 and is scheduled to be completed in June 2011.

SMP Mitigation, Laguna Seca Freshwater Wetland- This project plans, designs, and constructs improvements at Coyote Valley Research Park detention basin, formerly known as the Laguna Seca wetland site. It is located in San Jose where Fisher Creek intersects Santa Teresa Boulevard, north of Bailey Avenue. This project will create about 30 acres of freshwater wetland habitat, and in part, will meet the district's mitigation requirements for implementing the SMP in the Santa Clara Basin. This project is funded by the district's watershed and stream stewardship fund. It was started in July 2007 and is scheduled to be completed in June 2015.

Laguna Seca Freshwater Wetland

SMP Mitigation, Stream and Watershed Land Preservation- This project preserves streams and watershed lands in the Santa Clara Basin and implements appropriate restorations in these lands. This project will provide 71 acres of SMP mitigation credits through preservation of approximately 720 to 950 acres of stream and watershed to provide long-term protection of unique and valuable local stream resources and watersheds. Approximately 108 acres of the total land preservation will be for protection of riparian and upland habitats that are known to support California red-legged frogs and Western pond turtles. This project is funded by the district's watershed and stream stewardship fund. It was started in April 2004 and is scheduled to be completed in December 2012.

Alviso Slough Restoration- This project plans, designs, and constructs improvements to Alviso Slough between Gold Street and the Santa Clara County Marina. Upon completion, this project will restore the slough's open water channel width to conditions that existed prior to 1983. Navigation will be improved so the community can expand boating and other recreational opportunities. This project is funded by the district's watershed and stream stewardship fund. It was started in November 2004 and is scheduled to be completed in January 2012. This project is currently funded for the planning phase only.

Clean, Safe Creeks Stevens Creek Corridor Restoration- This project partners with the City of Cupertino, which will construct improvements to Stevens Creek from Stevens Creek Boulevard to McClellan Road near Blackberry Farms. This project will restore four acres of Stevens Creek riparian habitat, thereby fulfilling part of the district's Fish and Aquatic Collaborative Effort (FAHCE) requirements. In addition to removing four fish barriers, this project will implement environmental, floodplain, and water quality benefits.

Gold Street Educational Center- This project plans, designs, and constructs improvements at Gold Street adjacent to Guadalupe River in Alviso to provide an outdoor educational center for the Alviso community. This project is funded by the district's watershed and stream stewardship fund. It was started in December 2004 and is scheduled to be completed in February 2011.

Jacques Gulch Restoration- This project plans, designs and constructs improvements to Jacques Gulch, a tributary to Almaden Reservoir. Project objectives include removing mercury calcine deposits, stabilizing stream banks, and restoring habitat along Jacques Gulch. This project is funded by the water utility enterprise fund with contributions from local partners. It was started in July 2003 and is scheduled to be completed in March 2013.

Pond A8 Applied Study Final Design and Construction- This project constructs a pilot project at Pond A8 that provides a reversible tidal connection between a former salt pond and Alviso Slough. This project will convert Pond A8 from its previous use for salt production to a muted or fully tidal connection, resulting in the restoration of up to 200 acres of tidal wetland habitat. This project is funded by the district's watershed and stream stewardship fund with contributions from federal and state agencies. Clean, Safe Creeks funded the wetlands and riparian habitat enhancement component of this project. Planning and some design activities were funded by the San Francisco Bay Shoreline Project. This project was started in July 2008 and is scheduled to be completed in June 2011.

The Thompson Creek Stream Stabilization, Quimby Road to Aborn Road- This project provides coordination with the U. S. Army Corps of Engineers under the Aquatic Ecosystem and Restoration Program (Section 206 Program) to plan, design, and construct improvements along 1.2 miles of Thompson Creek. The project objectives include restoring the low-flow channel to an equilibrium state; restoring riparian habitat adjacent to the low-flow channel; improving water quality and providing diverse stream channel habitats; providing erosion protection along the creek; and identifying enhancement opportunities. This project is funded by the district's watershed and stream stewardship fund with a contribution from the Corps. It was started in July 2003 and is scheduled to be completed in June 2012.

Fish and Aquatic Habitat Collaborative Effort (FAHCE) Stevens Creek Fish Passage Enhancement- This project plans, designs, and modifies or reconstructs fish passages on Stevens Creek at Evelyn Avenue, Fremont Avenue and Moffett Boulevard and constructs a portable, gravity-fed outlet at Stevens Creek Dam. This project is funded by the district's watershed and stream stewardship fund and the water utility enterprise fund. It was started in July 2008 and is scheduled to be completed in June 2013.

Clean, Safe Creeks Soap Lake Floodplain Property Acquisition- This project partners with regional stakeholders to acquire easements or property as recommended by the Pajaro River Flood Prevention Authority. By securing rights on these properties, development in the Soap Lake floodplain will be prevented. This project is funded by the district's watershed and stream stewardship fund. Clean, Safe Creeks funded the wetlands and riparian habitat enhancement component of this project. This project was started in July 2007 and is scheduled to be completed in June 2011.

3.2.3.4 Levels of Service- Healthy Creek and Bay Ecosystems

The board has adopted the goal of healthy creeks and bay ecosystems. To attain this goal, the Flood Protection and Stream Stewardship program is structured to achieve a 100% Level of Service around three objectives:

- Objective 1- Balance water supply, natural flood protection, and water resources stewardship functions.
- Objective 2- Improve watersheds, streams, and natural resources.
- Objective 3- Promote awareness of stream and bay ecosystem functions

To satisfy the target Levels of Service, key performance indicators have been established to meet these objectives. Key performance indicators include establishing annual amounts in acres for revegetation mitigation maintenance, acres of watershed vegetation control, acres of mitigation to offset operations programs and capital projects impacts, length in feet of stream bank erosion protection projects, acres of tidal wetlands or riparian habitat creation, and acres of invasive plant control.

Healthy Creek and Bay Ecosystems Levels of Service 2010 to 2016

Coyote Parkways and Laguna Seca Wetlands

Under current levels of funding, the district anticipates that it can provide the operating programs identified in Section 3.2.2.1 at a 100% Level of Service through 2016. Additionally, many of the flood protection capital projects described in Section 3.2.2.3 and the mitigation or enhancement capital projects described in this section will have permit conditions for mitigation monitoring upon completion. Operating projects have been or will be initiated for these monitoring activities and will receive a 100% Level of Service to comply with permit requirements. Some of these operating projects will be funded past 2016 until regulatory requirements for monitoring have been satisfied. Typically, mitigation monitoring has been required for a period of ten years after installation of mitigation measures. At the end of the reporting period, routine maintenance of the mitigation sites will be conducted as part of the operations programs. This includes all the objectives stated in each of the operating projects and all the routine activities in the operating programs.

In the current capital improvement program, twelve capital projects are included to construct, or plan for, the creation, preservation, and protection of riparian, freshwater and tidal wetlands and habitats; remove vegetation; improve water quality; and improve fish passage. Approximately 1000 acres of habitat enhancement or improvement are planned under these projects. Some of these projects are also designed to meet multi-objectives, whenever feasible, and may include: erosion protection, floodplain improvements, recreation opportunities, ecosystem improvements, and SMP mitigation credits. The district will provide a 100% Level of Service to complete planning, design, and construction of these projects and the planning-only effort (at this time) for Alviso Slough restoration.

Healthy Creek and Bay Ecosystems Levels of Service 2017 to 2035 with no New Funding

Under current and projected funding, it is anticipated that all the operating programs that exist in 2010 will be continued through 2035 except for two operations, SMP biodiversity monitoring and ecological monitoring and assessment. The two operations are SMP permit requirements and will be completed by 2016. Most operations will be funded to provide a 100% Level of Service. Stream capacity vegetation control will be provided at a 60% Level of Service, eliminating the natural channel component of this operation due to Clean, Safe Creeks sunset in 2016.

For the capital improvement program, it is anticipated that there will be new obligations and agreements that will result from current projects, such as the Comprehensive Habitat Conservation Plan, Three Creeks Habitat Conservation Plan, and the stream maintenance permit renewal project. Capital projects will be established to provide a 100% Level of Service to comply with these new obligations and agreements. New capital projects to create, preserve, or enhance riparian habitats, tidal and freshwater wetlands; improve water quality; or improve fish passage will be subject to funding availability and board direction.

The Levels of Service for both planning horizons are listed for each program or project in terms of measurable key performance indicators in Table 3.6.

Table 3.6 Healthy Creeks and Bay Ecosystems Capital Projects Levels of Service

Goal Three: Healthy Creek and Bay Ecosystems		
Projects and Programs	**Levels of Service through 2016**	**Levels of Service 2017 to 2035**
Operations Programs as of 2010	**Operations Programs Levels of Service**	**Operations Programs Levels of Service**
• Revegetation mitigation maintenance	• 100% on 327 acres of revegetation planting	100%
• Watershed erosion protection	• 100% to stabilize 4,800 LF of stream banks and channel bottoms annually to reduce sediment, improve water quality, and prevent environmental degradation	100%
• Downtown Guadalupe River mitigation monitoring	• 100% to satisfy monitoring and reporting requirements	100%
• Pond A4 operations	• 100% to maintain environmental and tidal flood benefits	100%
• SMP biodiversity monitoring	• 100% to comply with SMP mitigation requirements	0% (pending new requirements)
• Ecological monitoring and assessment	• 100% to comply with SMP mitigation requirements	0% (pending new requirements)
Operating Projects as of 2010	**Operating Projects Levels of Service**	**Operating Projects Levels of Service**
• Island ponds mitigation and monitoring	• 100% to satisfy mitigation requirements for the SMP and the Lower Guadalupe River Flood Control Project impacts to tidal wetlands.	100% until project completion in 2020. 0% hereafter
• Tick Creek enhancement	• 100% to provide 2.3 acres of riparian habitat	0%
• Lower Uvas fish passage at Bolsa Road	• 100% to modify fish ladder to improve fish passage and maintenance	0%
• Guadalupe Creek cape ivy control	• 100% to restore 9.5 acres of quality riparian habitat	0%
• Adobe Creek mitigation	• 100% to provide	100% until project

Table 3.6 Healthy Creeks and Bay Ecosystems Capital Projects Levels of Service

Goal Three: Healthy Creek and Bay Ecosystems		
Projects and Programs	**Levels of Service through 2016**	**Levels of Service 2017 to 2035**
monitoring	mitigation at four sites for vegetation and construction impacts	completion in 2018
• Matadero Overflow Channel mitigation monitoring	• 100% to establish 2.46 acres of riparian habitat and 0.28 acres of wetlands	0%
• Coyote Creek mitigation monitoring	• 100% to restore a self-sustaining riparian forest and suitable wildlife habitat	100% until mitigation monitoring requirements have been fulfilled
• Lower Silver Creek mitigation monitoring	• 100% to provide mitigation for 12.7 acres of jurisdictional waters, including wetlands, six acres of upland habitat, and five acres of riparian/shaded riverine aquatic.	0%
• Lower Llagas mitigation monitoring	• 100% to provide mitigation monitoring until responsibilities have been fulfilled	100% until mitigation monitoring requirements have been fulfilled
• Smooth cordgrass control	• 100% to control up to 10 acres of invasive smooth cordgrass	0%
• SMP Mitigation, Arundo Control Program	• 100% to control 125 acres of existing arundo donax	0%
• Carnadero preserve management	• 100% to comply with provisions of the site management plan	100% until project completion in 2020
• Alviso Collaborative	• 100% to create a model combining effective flood protection, habitat enhancement and restoration, and recreation	Undetermined at this time
• Comprehensive Habitat Conservation Plan	• 100% to complete the plan that will streamline permitting and provide incidental take coverage for covered activities	0%

Table 3.6 Healthy Creeks and Bay Ecosystems Capital Projects Levels of Service

Goal Three: Healthy Creek and Bay Ecosystems		
Projects and Programs	**Levels of Service through 2016**	**Levels of Service 2017 to 2035**
Capital Projects as of 2010 • SMP Mitigation, Coyote Parkway freshwater wetland • SMP Mitigation, Laguna Seca freshwater wetland • SMP Mitigation, Pajaro Basin freshwater wetland • SMP Mitigation, Stream and watershed land preservation • Alviso Slough restoration • Clean, Safe Creeks Stevens Creek Corridor restoration • Gold Street education center • Jacques Gulch restoration • Pond A8 Applied study final design and construction • Thompson Creek stream stabilization • FAHCE Stevens Creek fish passage enhancement • Clean, Safe Creeks Soap Lake floodplain property acquisition	**Capital Improvement Projects Levels of Service** 100% to complete planning for Alviso Slough restoration project 100% to complete all other water resources stewardship capital projects by 2016.	**Capital Improvement Projects Levels of Service** 100% to satisfy new obligations and agreements 0% for new major capital improvement projects for water resources stewardship (planning, design, or construction)without a new source of funding except when directed by the board.

3.2.4 Clean Safe Water in Our Creeks and Bays

Services supporting the goal of clean safe water in our creeks and bays are aimed at reducing and preventing pollution in Santa Clara County creeks and San Francisco and Monterey bays. These services ensure the safety of drinking water, detect and monitor toxic materials and sediments, protect ecosystems, and increase hazardous-material emergency response countywide.

The district also provides trash and graffiti removal services that improve creek aesthetics and the quality of life throughout the county.

The supporting programs and projects are described followed by a section that identifies the levels of service applicable to those projects and programs.

Table 3.7 lists the specific projects and programs supporting the goal of clean safe water in our creeks and bays.

Table 3.7 Clean Safe Water in Our Creeks and Bays Projects and Programs

Goal Four: Clean safe water in our creeks and bays	
Projects and Programs	
Operations Programs as of 2010 • District urban runoff program • Good neighbor maintenance • Illegal encampment cleanup program • HAZMAT emergency response • Water quality/stream stewardship awareness • Creekwise education and volunteer program **Operating Projects as of 2010** • Inter-agency urban runoff program • Pollution prevention activity • Surface water quality improvement • Urban runoff program South County	**Capital Projects as of 2010** There are no capital projects identified to support this goal

3.2.4.1 Operations Programs- Clean Safe Water in our Creeks and Bays

District Urban Runoff Program- This program ensures that the district is in compliance with the requirements of the National Pollutant Discharge Elimination System (NPDES) permit and the provisions related to the permit. Activities performed under this program include compiling and preparing the Annual Report of Pollution Prevention Activities; preparing the annual work plan of activities the district will complete in support of the NPDES permit; and participating in regional public outreach activities that reinforce the stormwater pollution prevention message.

Good Neighbor Maintenance- This element provides greatly expanded creek side trash removal services to improve the appearance of waterways and enhance quality of the life in Santa Clara County. Services include inspection of creeks for illegal dumping, trash removal events, removal of graffiti from flood walls and bridges, repair of fences for aesthetic purposes, and a five-day response time for trash, graffiti, and other complaints.

Illegal Encampment Cleanup Program- This project provides for the removal of trash and reduction of damages to district assets from illegal encampments in the creeks. This is accomplished by a monthly program coordinated by the City of San Jose which targets large encampments and a weekly program coordinated by the district. These programs locate and remove trash at illegal encampments along creeks. Both weekly and monthly programs include collaboration with City of San Jose. The city

provides trash disposal, homeless possessions storage, housing department support to homeless individuals and police support. The district provides labor and equipment for clean-up and trash transport to disposal locations. The coordination with the city is under a Memorandum of Agreement (MOA).

HAZMAT Emergency Response**-** This operation provides a 24-hour-a-day, 7-day-a-week hotline for reporting hazardous materials and other pollutants that impact or threatens water quality in creeks and reservoirs throughout the county. Response to hazardous material incidents along creeks, lakes, and reservoirs occurs within two hours of the report. The district advertises and conducts four hazardous material disposal events per year for creekside communities.

Creekwise Education and Volunteer Program- This project raises awareness, educates, and affects behavior change in creek side landowners. Programs and services will be developed addressing such topics as proper creek care, native plant species, runoff issues/concerns, pollution prevention tips, upstream and downstream implications, and suggestions for working as a community on creek protection. This project also manages the district's Adopt-A-Creek and Creek Connections volunteer programs.

3.2.4.2 Operating Projects- Clean Safe Water in our Creeks and Bays

Inter Agency Urban Runoff Program**-** This operating project provides for district coordination with 14 co-permittees for compliance with the Bay Area wide National Pollutant Discharge Elimination System (NPDES) permit which will soon be replaced by the Municipal Regional Permit, issued by the San Francisco Bay Regional Water Quality Control Board (Regional Board). This permit imposes waste discharge requirements for reduction of stormwater pollutants and effective elimination of non-stormwater discharges. The co-permittees jointly developed and established in 1988 the Santa Clara Valley Urban Runoff Pollution Prevention Program to collaborate on compliance with the joint permit. Under this collaborative approach, compliance with the permit is achieved by: (1) each agency developing and implementing agency specific activities to achieve compliance specific to its own facilities and jurisdiction, and (2) all of the agencies collaboratively developing and implementing area-wide activities to comply with permit conditions common to all, or that are most effectively and efficiently addressed collectively. The operating project started in 1998 and is scheduled to be completed in June 2014.

Pollution Prevention Activity**-** This operating project provides funding to County of Santa Clara, other public agencies, and community organizations under the district's public commitment to partner in various pollution prevention efforts. This project is completely funded by the Clean, Safe Creeks and Natural Flood Protection Plan special tax. The operating project started in 2002 and is scheduled to be completed in June 2016.

Laboratory water quality testing

Surface Water Quality Improvement- This operating project addresses existing regulations under the Clean Water Act to develop and implement Total Maximum Daily Loads (TMDL) for impaired water bodies within Santa Clara County and for San Francisco Bay and Monterey Bay. The district implements the Surface Water Quality Improvement Management Plan to support Regional Water Quality Control Board and Environmental Protection Agency regulations in reducing pollutants in our waterways. This project includes evaluation and prioritizing actions to address pollutant sources under district ownership and/or control. Several pollutants, such as mercury, diazinon, copper, zinc, PCBs and selenium, affect 18 freshwater bodies (which include 14 creeks and 4 reservoirs) designated as impaired in Santa Clara County. The primary pollutant being addressed by this project is mercury in fish in the Guadalupe River Watershed. Near-term actions (through 2011) include removal of mine waste deposits on district land along Alamitos Creek and applied studies of treatment alternatives to reduce the bioaccumulation of mercury in fish. This operating project started in July 2001 and is scheduled to be completed in June 2016, except for any project elements that become regulatory requirements and will need to be continued.

Urban Runoff Program South County- This operating project provides funding to the cities of Gilroy and Morgan Hill to help reduce pollution in the Uvas/Llagas watershed. The operating project started in 2002 and is scheduled to be completed in June 2016.

3.2.4.3 Capital Projects- Clean Safe Water in our Creeks and Bays

There are no capital projects identified that support this goal.

3.2.4.4 Levels of Service- Clean Safe Water in our Creeks and Bays

The board has adopted the goal of clean safe water in our creeks and bays. To attain this goal, the Flood Protection and Stream Stewardship program is structured to achieve a 100% Level of Service around two objectives:

- Objective 1- Preserve or improve surface and groundwater quality for beneficial uses, and
- Objective 2- Promote awareness of water quality and stream stewardship.

To satisfy the target Level of Service, key performance indicators have been established to meet these objectives. Key performance indicators include providing hazardous material management and incident response within two hours; inspecting creeks for illegal dumping of trash and pollutants; removing graffiti; repairing fences; complying with regulatory requirements or agreements with cities; and conducting Creekwise education and volunteer programs.

Under current levels of funding, it is anticipated that the operating programs and operating projects identified in Section 3.2.4 will be provided at a 100% Level of Service through 2016. There are currently no capital projects identified to support the goal of clean safe water in our creeks and bays.

From 2017 to 2035 without new funding, the district urban runoff program and the creek wise education and volunteer program will be provided at 100% Level of Service. Good neighbor maintenance, illegal encampment cleanup, and HAZMAT emergency response will be provided at a

decreased Level of Service due to the sunset of the Clean, Safe Creeks special parcel tax. The Inter Agency Urban Runoff Program will be continued at a 100% Level of Service, but it is anticipated that Pollution Prevention Activities and the Urban Runoff Program South County will be eliminated due to funding limitations. The Surface Water Quality Improvement operating project will be provided after 2016 at a greatly reduced Levels of Service or eliminated without new funding. New obligations stemming from those projects will be provided at a 100% Level of Service subject to available funding. Table 3.8 indicates the level of service for each project and program.

Table 3.8 Clean, Safe Water in our Creeks and Bays Projects, Programs, and Levels of Service

Goal Four: Clean, Safe Water in our Creeks and Bays		
Projects and Programs	**Levels of Service through 2016**	**Levels of Service 2017 to 2035**
Operations Programs as of 2010	**Operations Programs Levels of Service**	**Operations Programs Levels of Service**
• District urban runoff program	• 100% to comply with district NPDES permit	100%
• Good neighbor maintenance	• 100% to provide four creek cleanup events per year and five-day response to remove litter and graffiti	40%
• Illegal encampment cleanup	• 100% to comply with the terms of the MOA	90%
• HAZMAT emergency response	• 100% to provide 24/7 hotline for reporting hazardous materials and two-hour response to incidents and increased services to south county	70%
• Creekwise education and volunteer program	• 100% for education and Adopt-A-Creek and Creek Connections volunteer programs.	100%
Operating Projects as of 2010	**Operating Projects Levels of Service**	**Operating Projects Levels of Service**
• Inter-agency urban runoff program	• 100% to comply with bay area NPDES and the municipal regional permit	100%
• Pollution prevention activity	• 100% to fund to pollution prevention efforts	0%
• Surface water quality improvement	• 100% to support regulations to reduce pollutants in our waterways	80%
• Urban runoff program South County	• 100% to expand the urban runoff program to the Uvas/Llagas watershed	0%

3.2.5 Trails, Open Space and Water Resource Management

The district partners with cities and the county to provide access to creek-side trails and parks, such as those identified by the County Trail Master Plan: Upper Llagas Creek, Sunnyvale East and West Channels, Upper Guadalupe River, Berryessa Creek and Permanente Creek.

This program provides access to bicycle paths for alternative transportation and increases community recreational opportunities countywide. The district is working with the cities and county to implement 70 miles of new trails by 2016 to meet the community expectations stated in the Clean, Safe Creeks program.

Guadalupe River bike trail

3.2.5.1 Operations Programs- Trails, Open Space and Water Resource Management

Open Spaces and Trail Administration**-** This program provides community access to additional trails and open space along creeks and in watersheds to meet the Clean, Safe Creeks commitment to the community. By collaborating with outside entities such as the County of Santa Clara, the county's 15 cities, and other various organizations, the district will help provide 70 miles of trails or the equivalent in open space by 2016. This will be accomplished through the execution of Trails, Parks and Open Space Grant Program Agreements, and the development and adoption of joint-use agreements and joint-trail agreements.

3.2.5.2 Operating Projects- Trails, Open Space and Water Resource Management

Prepare for Climate Change**-** This operating project will develop strategies to mitigate for and adapt to the changing local and regional weather and precipitation patterns while addressing water supply, flood risk management and ecosystem stewardship needs. Integrating climate change considerations into water supply planning, groundwater protection programs and water supply operations are critical for providing reliable water supply. Climate change also brings new focus on water conservation, desalination and recycling. Stewardship efforts such as habitat conservation, tidal wetlands or riparian habitat restorations could also benefit from a comprehensive strategy for climate change adaptation.

3.2.5.3 Capital Projects- Trails, Open Space and Water Resource Management

There are no capital projects identified that support this goal.

3.2.5.4 Levels of Service- Trails, Open Space and Water Resources Management

The board has adopted the goal of improved quality of life through trails, open spaces and water resources management. To attain this goal, the Flood Protection and Stream Stewardship program is structured to achieve a 100% Level of Service around two objectives:

- Objective 1- Support additional trails, parks and open space along creeks and in the watersheds when reasonable and appropriate, and
- Objective 2- Reduce green house gas emissions when reasonable and appropriate.

To satisfy the target Levels of Service, key performance indicators have been established to meet these objectives. Key performance indicators include providing additional miles of trails along creeks and access to open space by 2016 and preparing a climate action plan.

Under current levels of funding, it is anticipated that the open spaces and trail administration program will continue at a 100% Level of Service until 2016. The operating project, Prepare for Climate Change, will be completed within the 2010-2016 planning horizon. There are currently no capital projects identified to support the goal of trails, open space and water resource management.

From 2017 to 2035 without new funding, the open spaces and trails administration program will be unfunded due to the sunset of the Clean, Safe Creeks special parcel tax. Currently, no other operations, operating projects, or capital projects have been identified for the 2017 to 2035 planning horizon.

Table 3.9 indicates the level of service for each project and program.

Table 3.9 Trails, Open Space and Water Resources Projects, Programs, and Levels of Service

Goal Five: Trails, Open Space and Water Resources Management		
Projects and Programs	**Levels of Service through 2016**	**Levels of Service 2017 to 2035**
Operations Programs as of 2010 • Open Spaces and Trail Administration	**Operations Programs Levels of Service** 100% for 70 miles of trails or the equivalent in open space	**Operations Programs Levels of Service** 0% (District will partner with cities to provide access to open space or trails along creeks by providing right of way.)
Operating Projects as of 2010 • Prepare for Climate Change	**Operating Projects Levels of Service** 100% to develop strategies to mitigate for and adapt to climate change	**Operating Projects Levels of Service** 0%

3.3 FINANCIAL ANALYSIS

STRATEGIC VISION
We are a fiscally responsible water resources agency valued by the community.

This section summarizes the financial analysis of the Flood Protection and Stream Stewardship program for the two planning horizons: from FY 2010 to FY 2016 and from FY 2017 to FY 2035. This analysis was conducted under the assumptions that: (a) no new funding for the Flood Protection and Stream Stewardship program is secured after the sunset of the Clean, Safe Creeks special parcel tax in FY 2016, (b) only required elements of programs and projects funded fully or in part by the Clean, Safe Creeks special parcel tax will be continued after FY 2016, and (c) the remainder of the Flood Protection and Stream Stewardship projects and programs will continue through the year FY 2035, except for eliminating enhanced elements of some programs and projects to balance outlays to revenue sources.

The financial analysis presented in this section is based on the district's operating and capital budget for FY 2010, project priority rankings, and the district's Long Term Forecast financial model.

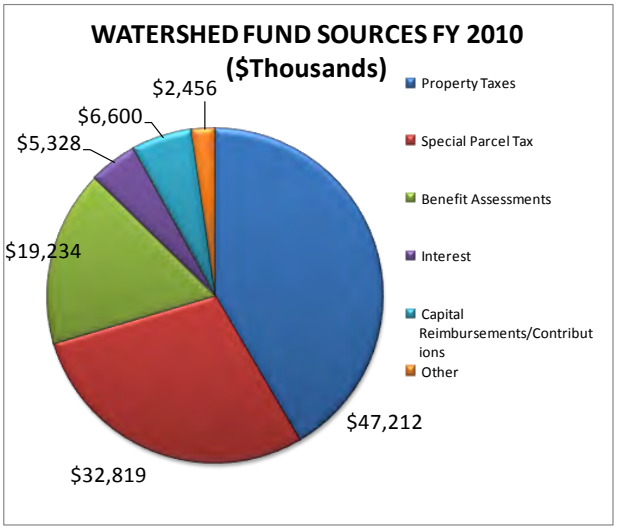
3.3.1 Budget Overview

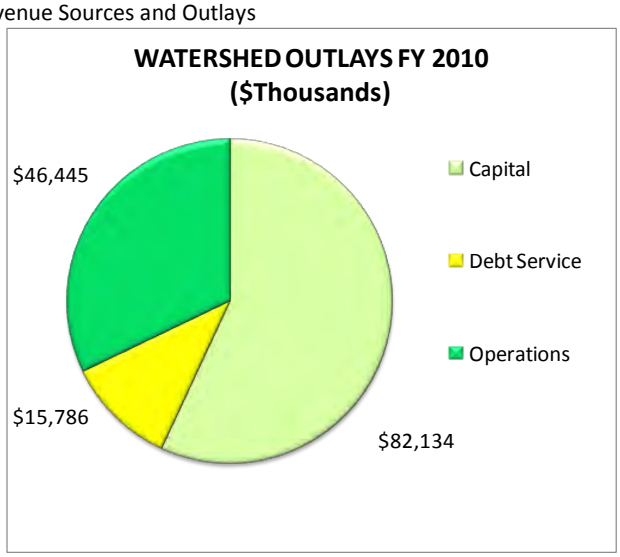
The Flood Protection and Stream Stewardship Program derives its revenues from a) a portion of the County ad valorem property tax, b) the Clean, Safe Creeks special parcel tax, c) benefit assessments, d) proceeds from debt financing, and e) income from investments. Capital reimbursements from local, state, and federal sources and grants, to a lesser degree, provide the balance of available funding.

In FY 2010, the overall value of the Santa Clara County assessment roll declined and resulted in reduced ad valorem property tax revenues that were less than projected. Benefit assessments, which are levied to meet debt service obligations, are projected to be relatively constant from year to year. Clean, Safe Creeks special parcel tax revenue is anticipated to increase 3 percent in FY 2010. Under the pay-as-you-go structure of the Clean, Safe Creeks plan, projects are prioritized and constructed as money becomes available. In any given year, when revenues exceed outlays, those funds are added to the capital and operating reserves. When planned outlays exceed anticipated revenues, funds are drawn from reserves.

Total revenue for the Flood Protection and Stream Stewardship program in FY 2010 is estimated to be $113.6 million. Outlays for FY 2010 are budgeted among capital improvement projects, operations programs and projects, and debt service obligations, and are projected to be approximately $144.4 million. The $30.7 million difference between revenues and outlays will be funded by capital and operating reserves. The amount and distribution of these revenues for FY 2010 is shown in Figure 3.1.

Figure 3.1: Flood Protection and Stream Stewardship FY 2010 Revenue Sources and Outlays





3.3.2 Long Term Forecast Overview and Assumptions

Long Term Forecast Process

Projected revenues, outlays, and reserves for the Flood Protection and Stream Stewardship program are maintained in the district's Long Term Forecast (LTF) financial model. The financial model is updated annually and covers a 10-year financial planning horizon. By financing with a combination of state and federal reimbursements, current year revenues and reserves, and other non-operating revenues, the district evaluates its ability to meet operations and capital investment plans. The objectives of the financial model are to balance outlays and revenues, and at the same time, comply with district policy of maintaining minimum operating reserves (6 months of operational outlays). In subsequent figures the minimum reserve levels are indicated by a dotted line.

For the purposes of the LTF financial model, projected operation outlays over the 10-year forecast period are proposed by operations program managers. The projections are based on anticipated needs and services for their various activities. Future cost savings or increases in work activities, regulatory requirements, or other factors such as inflation or disposal costs for sediment and vegetation are considered in making these projections. Other factors that affect projections include future increases in operational activities and requirements as new projects are completed and transferred to operations programs.

For capital expenditures, the LTF financial model utilizes data from the annual 5-Year Capital Improvement Plan which identifies resource needs and financial constraints to complete the projects. During the capital project planning phase, capital project staff estimate cost impacts to operations programs that will be incurred when projects are completed. This information is used to project future operations and maintenance cost increases or cost savings as a result of project completion. These costs are then included in the Long Term Forecast model.

Long Term Forecast Assumptions

The standard inflation rate used in the LTF financial model for operations cost projections beyond the 10-year forecast is 4% annually. Interest earnings (revenue) are increased at 3% annually beyond the 10-year forecast. Property tax revenue inflation for North County is calculated at 3.6% annually and in South County at 6% annually for the extended financial projections beyond the 10-year forecast.

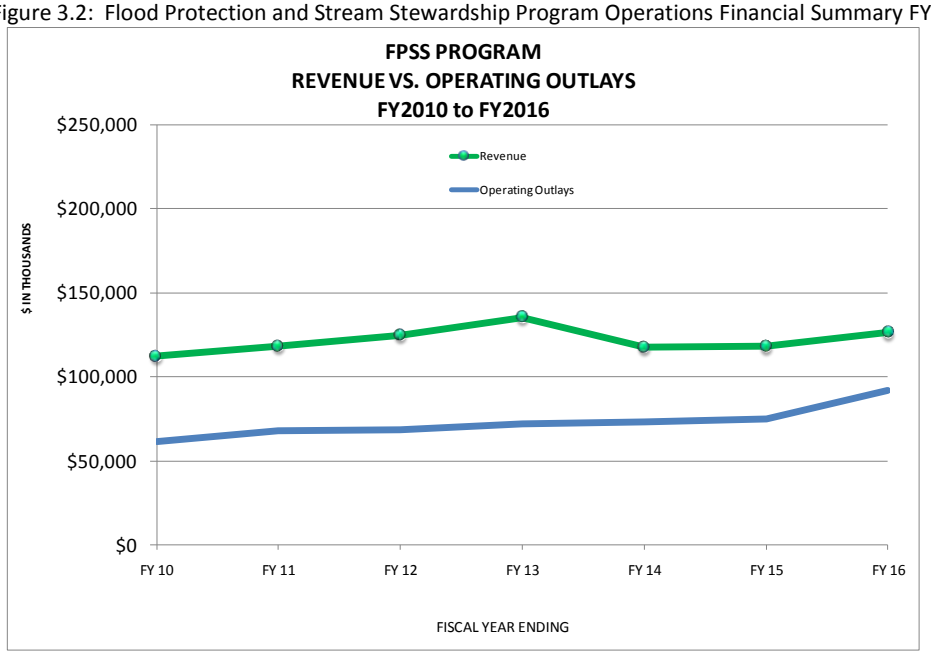
As described in more detail in the following sections, some Clean, Safe Creek special tax funded activities are extended beyond FY 2016 due to the high priority nature of the work or due to requirements or commitments of the district. Outlays for these activities are included in the FY 2017 to FY 2035 planning horizons. Conversely, outlays for some low priority or enhanced activities have been reduced in the financial outlook to balance outlays with revenue.

3.3.3 Flood Protection and Stream Stewardship Program Financial Outlook – FY 2010 to FY 2016

Operations Programs Financial Outlook FY 2010 to FY 2016

Based on the LTF financial model, there are sufficient revenues available to cover projected operating outlays (expenditures) during this planning horizon as shown in Figure 3.2. Where annual revenue exceeds operating and capital outlays, unspent funds are added to reserves for future allocations and expenditures.

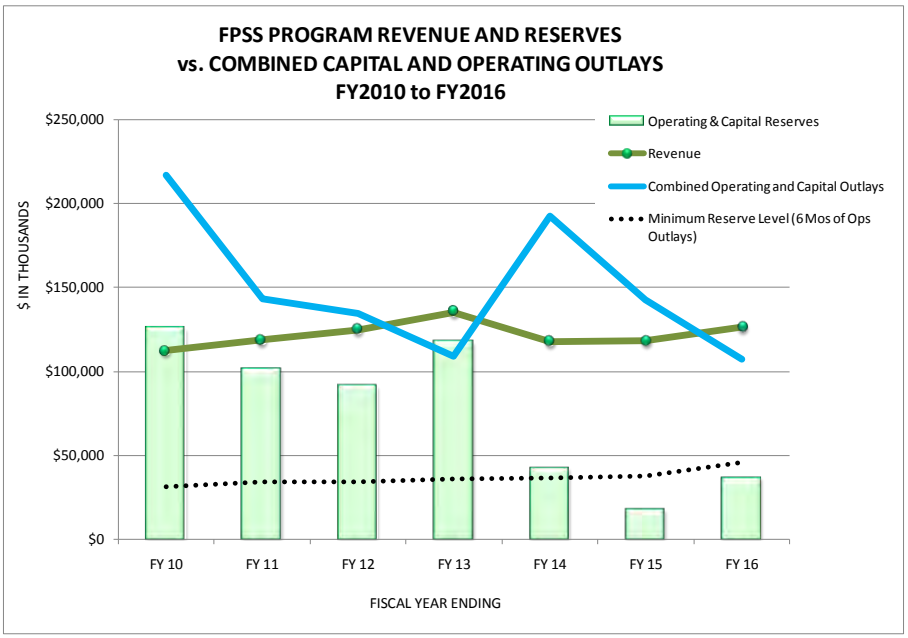
Figure 3.2: Flood Protection and Stream Stewardship Program Operations Financial Summary FY 2010 to FY 2016



Combined Capital Improvement Program and Operations Programs Financial Outlook FY 2010-FY 2016

Figure 3.3 shows the effect on program reserves when the Capital Improvement Program outlays are combined with operational outlays. Based on the LTF financial model, there appears to be sufficient revenues and reserves (with minor adjustment to outlays to maintain minimum reserves) available to cover projected operations and capital program outlays during this planning horizon. This figure illustrates the combined operations and capital improvement programs outlays (blue line) over the planning horizon and the annual revenues (green line) and reserves available on an annual basis (vertical bars). In some years, the total available revenues are less than planned expenditures. In those years, the district will draw from reserves to make up the difference.

Figure 3.3: Flood Protection and Stream Stewardship Program Operations and Capital Financial Summary FY 2010 to FY 2016



3.3.4 Flood Protection and Stream Stewardship Program Financial Outlook - FY 2017 to FY2035

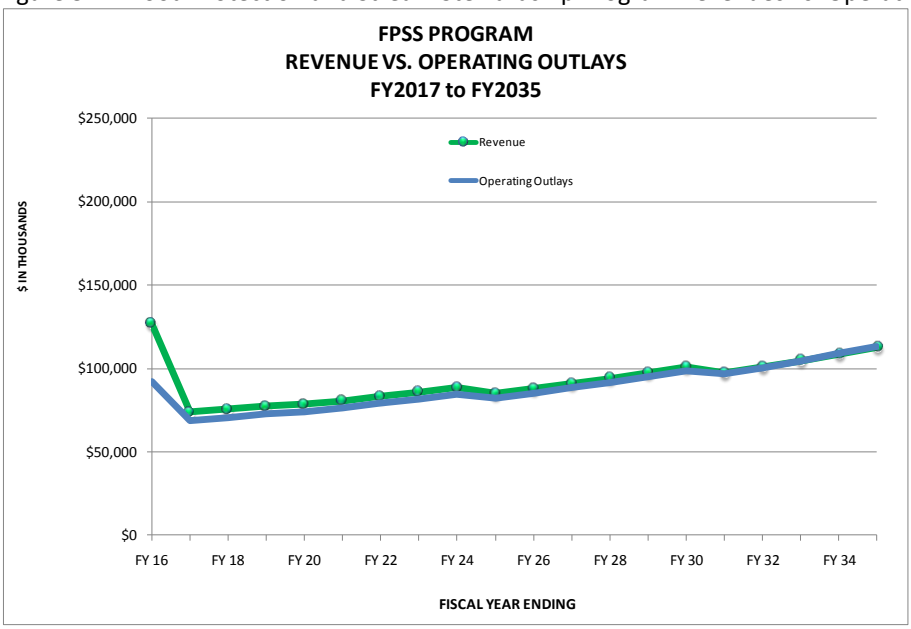
Operating Programs Financial Outlook FY 2017 to FY 2035

The Clean, Safe Creeks special parcel tax is due to sunset in 2016. Many of the services that the Flood Protection and Stream Stewardship program provides, including some of the activities that this tax funds, will need to continue past 2016. They need to continue because they are now required due to changes in regulations or because of agreements or commitments that the district has made. For the purposes of establishing a financial outlook that includes required and high priority activities, changes were made to the LTF financial model assumptions for the long term planning horizon. These planning assumptions are: (a) activities funded by the Clean, Safe Creeks special tax that are considered required and/or high priority by the district's project priority ranking system need to continue, (b) only the

required components of those activities will be continued, and (c) enhanced components of other programs and projects were removed from the LTF financial model to balance outlays with revenues. Under these planning assumptions, there appears to be sufficient projected revenues available to cover anticipated operating outlays during this planning horizon, as shown in Figure 3.4.

Assumptions used in the projected revenues include increases (due to inflation) in property tax revenues, interest earnings, and other non-operating revenues. This figure also illustrates anticipated increases in operational costs, primarily due to assumptions of increasing costs of services and supplies over the planning horizon. Some of these increasing operational costs are also associated with increased maintenance and operations of the soon to be constructed capital projects. Despite the sunset of the Clean, Safe Creeks special tax, the LTF financial model shows that revenues closely match operating outlays over the planning horizon.

Figure 3.4: Flood Protection and Stream Stewardship Program Revenues vs. Operating Outlays FY 2017 to FY 2035



Combined Capital Improvement Program and Operations Programs Financial Outlook FY 2017-FY 2035

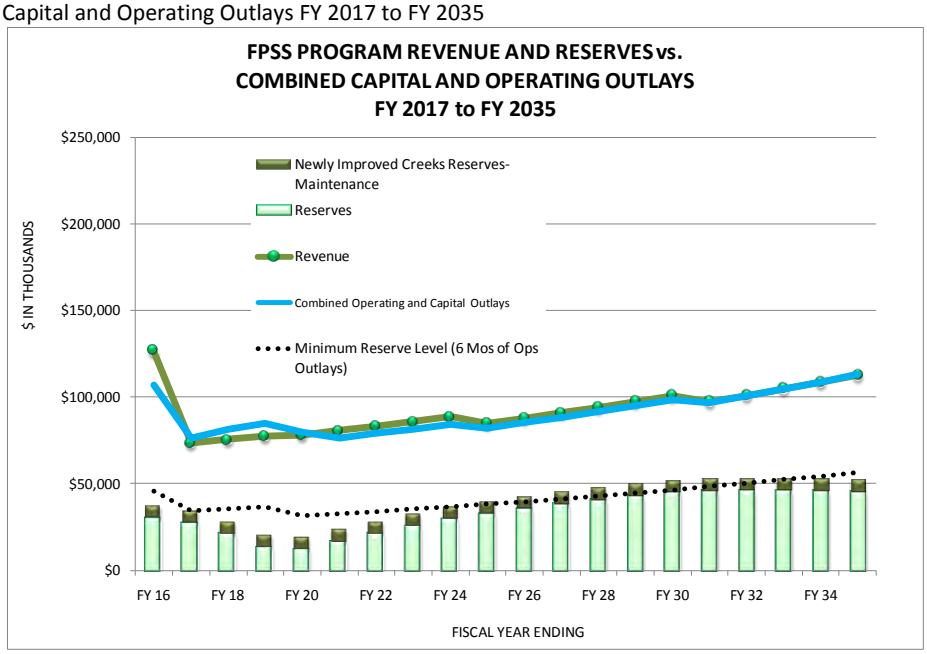
In this analysis, revenues and reserves are compared to the combined Capital Improvement Program and operating outlays. It is assumed that no new major flood protection projects will be started after 2016 without new funding. However, the 2009-2010 Capital Improvement Plan (CIP) anticipates expenditures for four projects to occur in FY 2019 to FY 2021. These projects include Upper Penitencia Creek, Berryessa Creek from Lower Penitencia to Calaveras, Berryessa Creek from Calaveras to Old Piedmont and SMP Mitigation at Laguna Seca Freshwater Wetland. Although these capital expenditures are not considered significant, the effect on the LTF financial model is that operating reserves fall below the minimum reserve requirement set by district policy (indicated by the dotted line in Figure 3.5). Note that operational and capital reserves depicted in this figure are distinguished from the designated reserves for newly modified creek maintenance as the designated reserve is not available to meet the

minimum reserve policy. Therefore, the minimum reserve level should be compared to the base reserve bars.

Figure 3.5 shows that revenues, overall, are higher than projected operations early in this planning horizon. This is shown by the gradual increase in operating reserves. Nonetheless, in this scenario the reserves do not rise to the minimum reserve policy level. These deficits will be evaluated in future financial planning efforts for the FY 2017 to FY 2035 planning horizon. During the latter part of the planning horizon, expenditures are greater than available revenue and reserves begin to decline. The result is that further cuts and adjustments will need to be made to enhanced elements of programs and projects. Adjustments to close gaps between revenues and expenditures will be explored in future financial planning efforts for the FY 2017 to FY 2035 planning horizon.

Figure 3.5: Flood Protection and Stream Stewardship Program Revenue and Reserves vs.

Capital and Operating Outlays FY 2017 to FY 2035



3.4 FINDINGS

The master plan is divided into two planning horizons- a 6-year planning horizon from FY 2010 to FY 2016 and a 19-year planning horizon from FY 2017 to FY 2035. An examination of the funding mechanism for all identified projects and programs in the current program indicates that funding levels are sufficient to support all identified activities in the 6-year planning horizon.

After FY 2016, revenues cannot sustain the current levels of service. The most significant impacts will be on projects and programs funded by the Clean, Safe Creeks special parcel tax, which include: flood protection and other capital programs, environmental enhancements, impaired water bodies improvements, and trails and open space programs.

In the 19-year planning horizon following the sunset of Clean, Safe Creeks special parcel tax, program activities funded by revenue sources other than Clean, Safe Creeks are sustainable except for the

enhanced elements of some programs. Other activities that are funded fully, or in part, by Clean, Safe Creeks special parcel tax through 2016 must either be discontinued, reprogrammed to receive funding from other programs, or be provided with alternative sources of funding. For the purposes of this analysis, it is assumed that the required portions of these programs continued and will be funded by the remaining funding sources.

This section lists a number of projects and programs that support each of the five goals of the master plan. Below are the major projects and programs that will be impacted by the sunset of Clean, Safe Creeks special parcel tax.

Goal One- Natural Flood Protection

- Nearly all 20 capital projects in the current Flood Protection and Stream Stewardship program are scheduled to be completed, for the most part, by 2016. Some projects, such as the two Berryessa Creek flood protection projects, will be nearly complete, but will have follow up elements, such as revegetation establishment contracts, mitigation monitoring, or other offsite construction, extending into 2021. After 2016, there will be limited funding for new major capital improvement projects.
- Factors such as sea level rise may affect the flow conveyance capacity of district facilities near south San Francisco Bay. Preserving or restoring flow conveyance capacity and freeboard to these facilities will require additional funding or reprogramming of existing revenues.

- Stream capacity vegetation control activities and watershed upland vegetation management (maintenance and removal) are performed to preserve flood conveyance capacity and to ensure healthy creek habitat. Forty percent of these activities are funded by Clean, Safe Creeks special parcel tax. Additional funds will be needed after 2016 to continue these activities at the current 100% Level of Service.
- Approximately 10% of the total annual sediment removal is currently funded by Clean, Safe Creeks special parcel tax. Without additional funding, the annual sediment removal quantities will be reduced from 88,000 cubic yards to 80,000 cubic yards.
- Ten percent of the Stream Maintenance Program implementation is currently funded by Clean, Safe Creeks special parcel tax. The state and federal permits are due for renewal in 2012. This ongoing operation will ensure that routine maintenance activities will be conducted consistent with the environmental permit requirements. Additional funding may be needed after 2016 to continue this activity at the current 100% Level of Service.

Goal Two- Reduced Potential for Flood Damages

- Operations programs can continue through 2035 at the current 100% Level of Service.

Goal Three- Healthy Creeks and Bay Ecosystems

- Vegetation management activities, including revegetation site maintenance and nonnative vegetation removal, are performed to protect healthy creek and bay ecosystems. Forty percent of these activities are funded by Clean, Safe Creeks special parcel tax. Additional funds will be needed after 2016 to continue these activities at the current 100% Level of Service.
- Creation or restoration of 100 acres of additional tidal or riparian habitat is currently funded by Clean, Safe Creeks special parcel tax. Funding for this activity will not be available after 2016.

Goal Four- Clean Safe Water in Our creeks and Bays

- The program that supports public outreach activities in south county cities to reduce urban runoff pollutants is funded 100% by Clean, Safe Creeks special parcel tax. The funding portion needed to support this program will not be available after 2016.
- The hazardous materials management and incident response program (including reservoirs in Uvas/Llagas Watersheds) is funded 30% by Clean, Safe Creeks special parcel tax. The funding portion needed to support this activity will not be available after 2016.
- Trash removal and graffiti removal elements of good neighbor maintenance are funded 60% by Clean, Safe Creeks special parcel tax. Additional funds will be needed to maintain the current level of service.
- The illegal encampment cleanup program is funded 60% by Clean, Safe Creeks special parcel tax. Additional funds will be needed to maintain the current level of service.
- County-wide pollution prevention activities are currently funded 100% by Clean, Safe Creeks. Additional funds will need to be reallocated after 2016 to fund the required portion of this program stemming from new obligations and agreements.
- Surface water quality improvement (impaired water bodies improvement) activities are currently funded 100% by Clean, Safe Creeks special parcel tax. Portions of this program are now required (e.g., water bodies impaired by mercury). Additional funds will need to be reallocated after 2016 to fund this portion of the program.

Goal Five- Trails, Open Space and Water resource Management

- Open spaces and trail administration is funded 100% by Clean, Safe Creeks. After 2016 funding for this program will not be available.

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Key term	Definition
1-percent flood	A flood that has a 1-percent chance of occurring in any given year; also referred to as the 100-year flood.
Aquifer	Geological formation that holds or conducts groundwater
Baseline program	The water district's flood protection and stream stewardship program, which consists of only those services which can be supported by revenue available in fiscal year 2016, after the sunset of the clean, safe creeks special tax
Bathymetry	The study of underwater depth of lake
Biodiversity	The existence of a wide range of different types of organisms in a given place at a given time.
Board policies	Written governing policies which, at the broadest levels, address each category of organizational decision
Diversion channel	A waterway used to divert water from its natural course
Ecosystems	An ecological community together with its environment, functioning as a unit
Environmental enhancement	Action taken by the district that benefits the environment, is not mitigation, and is undertaken voluntarily. Enhancement actions may include environmental restoration, rehabilitation, preservation or creation. In instances where enhancements are located in the same vicinity as a mitigation project, actions must exceed required compliance to compensate for environmental impacts to be considered environmental enhancements.
Erosion	The process by which soil is removed from one place by forces such as water or construction activity and eventually deposited at a new place as sediment
Fish passage	A generic term for several methods incorporated into flood protection projects which allow native fish species to travel upstream to spawn
Flood	A general and temporary condition of partial or complete inundation of normally dry land areas from inland or tidal waters
Flood conveyance capacity	The maximum amount of water that can flow through a channel, stream, or culvert before flooding of surrounding properties would result
Flood plain	The low, flat, periodically flooded lands adjacent to creeks and rivers

Freeboard	Vertical distance between the top of an embankment adjoining a channel and the water level in the channel
Geomorphic/geomorphology	The study of the natural relationship between a stream and its bank and bed. Pertaining to those processes that affect the form or shape of the surface of the earth (creeks)
Habitat	The specific and physical location or area in which a particular type of plant or animal lives. To be complete, an organism's habitat must provide all of the basic requirements of life for that organism.
Hydrology	The behavior (properties, distribution, and circulation) of water in the atmosphere, on land surface, and in soil
Invasive plants	A non-native species that has spread into native or minimally managed plant communities (habitats)
Levee	An embankment constructed to provide flood protection from seasonal high water
Mitigation	Action taken to fulfill permit requirements and court mandated mitigation to avoid, minimize, rectify or reduce adverse environmental impacts, or compensate for the impact(s) by replacing or providing substitute resources or environments
Natural flood protection	A multiple-objective approach to providing environmental quality, community benefit and protection from creek flooding in a cost effective manner through integrated planning and management that considers the physical, hydrologic and ecologic functions and processes of streams within the community setting
Nonpoint source pollutants	Pollutants that are carried by storm water runoff into receiving waters; contrasted with “point” source pollutants such as effluent from wastewater treatment facilities.
Permitting requirements	There are a number of state and federal laws and regulations to protect the environment. These laws and regulations are often enforced by requiring specified government agencies to issue a permit prior to work in environmentally sensitive areas. The district regularly is required to obtain permits from the U.S. Army Corps of Engineers, U.S. Fish And Wildlife Service, NOAA Fisheries, Regional Water Quality Control Board, and the California Department of Fish And Game. Each permit gives the permitting agency an opportunity to attach specific measures to the project to reduce the impact to the environment.

Reach (creek)	A portion of a creek or watercourse usually defined by both an upstream and a downstream unit
Recharge	The addition of new water to an aquifer or to the zone of saturation
Restore/restoration	Action taken by the district, to the extent practicable, toward the re-establishment as closely as possible of an ecosystem's pre-disturbance structure, function, and value, where it has been degraded, damaged, or otherwise destroyed
Re-vegetate	Re-establishing vegetation in areas which have been disturbed by project construction
Riparian	Pertaining to the banks of a body of water, (the banks of a stream), and other adjacent terrestrial environments of freshwater bodies and watercourses
Riparian corridor	The corridor along the bank or shore of a body of water sediments materials in a lake or reservoir which are either suspended in the water column or deposited on the bottom. They usually consist of the remains of aquatic organisms, precipitated minerals and eroded material from the watershed
Riparian ecosystem	Natural association of soil, plants and animals existing within the floodplain of a stream and dependent for their survival on high water tables and river flow
Sediment/ sedimentation	Mineral or organic material that is deposited by moving water and settles at the bottom of a waterway
Stewardship	To entrust the careful and responsible management of the environment and natural resources to one's care for the benefit of the greater community
Threatened species	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range
Watershed	Land area from which water drains into a major body of water
Watershed stewardship	Protecting and enhancing the county's creeks, streams and water bodies in order to preserve a vibrant, healthy ecosystem and provide recreational opportunities when appropriate
Wetland	Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions

APPENDIX 3B-7

LSC 456A PHASE II

Project No. E8505-06-01
May 2010

Mr. Jim Schul
Ruggeri – Jensen – Azar
8055 Camino Arroyo
Gilroy, California 95020

Subject: LIMITED SITE INVESTIGATION REPORT
LOWER SILVER CREEK REACHES 4, 5, AND 6B
SAN JOSE, SANTA CLARA COUNTY, CALIFORNIA

Dear Mr. Schul:

In general accordance with Geocon's *Workplan for a Limited Site Investigation, Lower Silver Creek, Reaches 4, 5, and 6A, San Jose, California* dated January 14, 2010, Geocon has performed environmental engineering services at the above-referenced project site. The project site consists of Lower Silver Creek from Interstate 680 to Moss Point Drive in San Jose, California.

The accompanying report summarizes the services performed including the advancement of soil borings, the collection of soil and groundwater samples, and chemical analyses.

If there are any questions concerning the contents of this report, or if Geocon may be of further service, please contact the undersigned at your convenience.

Sincerely,

GEOCON CONSULTANTS, INC.

Richard W. Day, CEG, CHG
Vice President

RWD

Addressee (1)

LIMITED SITE INVESTIGATION REPORT

LOWER SILVER CREEK
REACHES 4, 5, AND 6A
SAN JOSE, CALIFORNIA

PREPARED FOR:

RUGEERI – JENSEN – AZAR
8055 CAMINO ARROYO
GILROY, CALIFORNIA

PREPARED BY:

GEOCON CONSULTANTS, INC.
6671 BRISA STREET
LIVERMORE, CALIFORNIA

GEOCON PROJECT No. E850-06-01

MAY 2010

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LIMITED SITE INVESTIGATION REPORT

1.0 INTRODUCTION

This Site Investigation Report presents the results of a limited subsurface soil and groundwater investigation performed at Lower Silver Creek Reaches 4, 5, and 6A. This Site Investigation Report was prepared in general accordance with Geocon's *Workplan for a Limited Site Investigation, Santa Clara Valley Water District, Lower Silver Creek Reach 4, 5, and 6A*, dated January 14, 2010.

The areas investigated included the subgrade soil on the Creek bank, sediments in the creek, and groundwater that may discharge to the creek during flood control construction efforts. The project location is depicted on the attached Vicinity Map, Figure 1.The sampling locations are depicted on the Site Plans, Figures 2a and 2b.

1.1 Purpose

The purpose of the investigation is for general characterization of sediment, soil, and groundwater that may be encountered during project construction. Specifically, the investigation was performed to confirm the previous analytical results obtained from investigation conducted by Geocon and others in 2001. The current investigation will evaluate baseline concentrations of metals, petroleum hydrocarbons, pesticides, polychlorinated biphenyls (PCBs), and volatile organic compounds (VOCs) along Reached 4, 5, and 6A. The results of this investigation will be used to evaluate hazardous materials impacts and provide recommendations for soil and groundwater handling during construction.

2.0 BACKGROUND

Geocon reviewed the following sources of information to develop the sampling plan for this limited investigation:

- Geocon, *DRAFT Site Investigation Report, Lower Silver Creek, Reach 4, San Jose, California*, July 2001
- Parsons, *Phase II Hazardous Materials Investigation Report, Santa Clara Valley Water District, Lower Silver Creek Reaches 5 & 6 Project*. March 2001.
- D&M Consulting Engineers, Inc., *Environmental Site Assessment Report, Lower Silver Creek Confluence to Aborn Road, San Jose, CA, Project 1445*, September 2000.

The findings of these investigations indicated the presence of low levels of metals, pesticides, PCBs, and petroleum hydrocarbons compounds in sediment, soil and groundwater samples.

The previous investigation reports concluded that the reported analyte concentrations in sediment and soil were below applicable regulatory levels for hazardous materials, and therefore would not require special handling if taken offsite or pose unacceptable human health risks. The metals reported in the groundwater samples at or above maximum contaminant levels (MCLs) were attributed to the presence of sediment. Therefore, it was recommended that engineering controls be implemented during project construction to allow 1) water retention, sampling and potential treatment prior to discharge, and 2) reduction in suspended sediment load and discharge rate.

Based on a review of the above documents, Geocon prepared the *Workplan for a Limited Site Investigation, Santa Clara Valley Water District, Lower Silver Creek Reaches 4, 5, and 6A*, dated January 14, 2010. The workplan provided the proposed sample locations and rationale for the sampling and analysis.

2.1 Hazardous Waste Determination Criteria

Regulatory criteria to classify a waste as California hazardous for handling and disposal purposes are contained in the CCR, Title 22, Division 4.5, Chapter 11, Article 3, §66261.24. Criteria to classify a waste as Resource, Conservation, and Recovery Act (RCRA) hazardous are contained in Chapter 40 of the Code of Federal Regulations (40 CFR), Section 261.

For waste containing metals, the waste is classified as California hazardous when: 1) the total metal content exceeds the respective Total Threshold Limit Concentration (TTLC); or 2) the soluble metal content exceeds the respective Soluble Threshold Limit Concentration (STLC) based on the standard Waste Extraction Test (WET). A waste has the potential of exceeding the STLC when the waste's total metal content is greater than or equal to ten times the respective STLC value since the WET uses a 1:10 dilution ratio. Hence, when a total metal is detected at a concentration greater than or equal to ten times the respective STLC, and assuming that 100 percent of the total metals are soluble, soluble metal analysis is required. A material is classified as RCRA hazardous, or Federal hazardous, when the soluble metal content exceeds the Federal regulatory level based on the Toxicity Characteristic Leaching Procedure (TCLP).

The above regulatory criteria are based on chemical concentrations. Wastes may also be classified as hazardous based on other criteria such as ignitability and corrosivity; however, for the purposes of this investigation, toxicity (i.e., TTLC and STLC metals concentrations) is the primary factor considered for waste classification since waste generated during the construction activities would not likely warrant testing for ignitability or other criteria. Waste that is classified

as either California hazardous or RCRA hazardous requires management as a hazardous waste.

2.2 Environmental Screening Levels

The San Francisco Bay Regional Water Quality Control Board (SFRWQCB) has prepared a technical report entitled *Screening For Environmental Concerns At Sites With Contaminated Soil and Groundwater, Interim Final* (May 2008), which presents environmental screening levels (ESLs) for soil, groundwater, soil gas, and surface water, to assist in evaluating sites impacted by releases of hazardous chemicals. The ESLs are conservative values for more than 100 commonly detected contaminants, which may be used to compare with environmental data collected at a site. ESLs are strictly risk assessment tools and "not regulatory clean up standards." The presence of a chemical at concentrations in excess of an ESL does not necessarily indicate that adverse impacts to human health or the environment are occurring; this simply indicates that a potential for adverse risk may exist and that additional evaluation is or "may be" warranted (SFRWQCB, 2008).

3.0 SCOPE OF SERVICES

The scope of services conducted during this project included the following:

3.1 Pre-Field Activities

- Marked sample locations in the field and notified Underground Services Alert regarding scheduled drilling activities.
- Prepared a health and safety plan for the proposed field activities. The health and safety plan provided guidelines on the use of personal protective equipment and the health and safety procedures implemented during the field activities.
- Retained the services of Advanced Technology Laboratories (ATL), a California certified analytical laboratory, to perform soil, sediment, and groundwater analyses.

3.2 Field Activities

The field investigation was performed on March 17 and 18, 2010, by Geocon geologist Lauren Vigliotti. The following activities were performed during field investigation:

- Advanced nine soil borings (B1 to B9) using Geocon's direct-push rig to depths ranging from 8 to 18 feet.
  - Collected soil samples at a depth of 3 feet from each boring and submitted for laboratory analysis for total petroleum hydrocarbons as gasoline (TPHg), as diesel (TPHd), and as motor oil (TPHmo), California Assessment Manual (CAM) 17 metals, benzene, toluene, ethylbenzene, and xylenes (BTEX), and methyl tert-butyl ether (MTBE).
  - Collected grab groundwater samples from each boring and submitted for laboratory analysis for TPHg, TPHd, and TPHmo, CAM 17 metals, BTEX, MTBE, and VOCs.
- Recorded the sample locations using Differential Global Positioning System (GPS) equipment. The soil boring coordinates are tabulated in Table 1, GPS Coordinates.
- Collected sediment samples (S1 to S9) from Silver Creek adjacent to the nine soil boring locations.
  - Submitted sediment samples for laboratory analysis for TPHg, TPHd, and TPHmo, CAM 17 metals, BTEX, and MTBE.
  - Sediment samples from alternating borings were also analyzed for pesticides (4 locations) and PCBs (5 locations).

4.0 INVESTIGATIVE METHODS

The following presents the method of investigation for the boring advancement and sampling procedures and protocols.

4.1 Soil, Sediment, and Groundwater Sample Collection Methodology

Soil borings B1 to B9 were advanced and sampled using Geocon's Geoprobe direct-push sample rig. Soil samples were collected at a depth of 3 feet from each boring for laboratory analysis. Once the soil samples were collected each borehole was further advanced to a maximum depth of 18 feet to collect grab groundwater samples.

Soil samples collected using the direct-push rig were obtained by hydraulically advancing a 4-foot-long stainless steel core-barrel sampler lined with an acetate sample tube into undisturbed soil. Soil samples were collected for laboratory analysis by cutting an approximately 6-inch-long section of the acetate tube from the target sample depth, capping the ends with Teflon tape and plastic end caps, labeling, and then placing the sample tube in a chest cooled with ice for storage and delivery to the analytical laboratory.

Grab-groundwater samples were collected by placing temporary PVC well casing into the open boreholes and then pumping groundwater through the well casing using ¼-inch-diameter disposable polyethylene tubing fitted with a check valve. Groundwater samples for TPHg, BTEX, and VOC analyses were collected into six 40-milliliter (ml) glass vials preserved with hydrochloric acid (HCl) and samples for TPHd, TPHmo, and CAM 17 metals analyses were collected in three one-liter non-preserved amber jars. Two of the amber jars were used to settle sediment before decanting the groundwater sample into one 500-ml polyethylene container preserved with nitric acid (HNO_3) for CAM 17 metals analysis.

Sediment samples were collected from the center of the stream channel near each soil boring location. The sediment samples were collected by scooping material from the bottom of the stream channel using a Teflon scoop attached to a 10-foot-long handle. Sediment collected in the scoop was emptied into a #10 sieve to remove excess water from the sediment sample before it was placed in a stainless steel sample tube. The sample was labeled, capped on both ends with Teflon tape and plastic end caps, and placed in a chest cooled with ice for transport to the analytical laboratory.

Sampling equipment was cleaned between sample locations using a non-phosphate detergent followed by a double rinse with deionized water. Decontamination water and soil cuttings from each boring were released to ground surface, and each boring was completely back-filled with Portland cement.

4.2 Laboratory Analyses

Selected soil, sediment, and groundwater samples were submitted to ATL for the following analyses:

- CAM 17 metals following United EPA Test Method 6010/7471A
- TPHd, and TPHmo following EPA Test Method 8015B
- TPHg, BTEX, and MTBE following EPA Test Methods 8015B/8021B
- VOCs following EPA Test Method 8260B
- Organochlorine Pesticides following EPA Test Method 8081A
- PCBs following EPA Test Method 8082

Quality Assurance/Quality Control (QA/QC) procedures were performed for each method of analysis with specificity for each analyte listed in the test method's QA/QC. The laboratory QA/QC procedures included the following:

- One method blank for every ten samples, batch of samples, or type of matrix, whichever was more frequent.
- One sample analyzed in duplicate for every ten samples, batch of samples, or type of matrix, whichever was more frequent.
- One spiked sample for every ten samples, batch of samples, or type of matrix, whichever was more frequent, with the spike made at ten times the detection limit or at the analyte level.

The laboratory reports were reviewed for accuracy and consistency with the chain-of-custody documentation. In addition, the laboratory QA/QC summary reports were reviewed to determine if the laboratory results are within tolerance control limits. Based upon this review process, the data quality appears to be adequate.

5.0 SOIL AND GROUNDWATER CONDITIONS

Soils encountered during the advancement of borings B1 to B9 consisted primarily of stiff to very stiff silty and sandy clay with interbedded sands and gravels from ground surface to the total depth of each borehole, which ranged from 8 to 18 feet.

Groundwater was encountered in borings B2 to B9 at depths ranging from 2.5 feet (boring B4) to 13.4 feet (boring B2). Groundwater was not encountered in boring B1, which was advanced to a depth of 18 feet.

6.0 SOIL, SEDIMENT, AND GROUNDWATER SAMPLE RESULTS

Soil, sediment, and groundwater sample results are summarize in Tables 2 through 5. The tables also provide a listing of hazardous waste criteria, MCLs, and ESLs, as appropriate. Copies of the analytical laboratory data sheets are provided in Appendix A.

6.1 Soil Sample Results

TPHg, BTEX, or MTBE were not detected above laboratory reporting limits in the 3-foot soil samples collected from borings B1 to B9 (see Table 2)

TPHd was reported in each of the 3-foot soil samples collected from all boring except B5. The reported TPHd concentrations ranged from 1.7 to 41 milligrams per kilogram (mg/kg).

TPHmo was only detected in two samples above the laboratory reporting limit of 1 mg/kg (1.1 mg/kg in boring B1 and 130 mg/kg in boring B2).

Arsenic, barium, chromium, cobalt, copper, lead, nickel, vanadium, and zinc were detected in each of the soil samples analyzed during this investigation. None of the reported concentrations exceeded hazardous waste criteria (see Table 3)

Arsenic and vanadium were the only metals with reported concentrations exceeding ESLs. The arsenic concentrations in B1 to B9 ranged from 2.6 mg/kg to 8.1 mg/kg. Each of these concentrations exceeded the SFRWQCB residential and commercial ESLs of 0.39 mg/kg and 1.6 mg/kg for shallow depth (<3 meters) soils (SFRWQCB, Table A, May 2008). Vanadium was reported at concentrations ranging from 16 mg/kg to 38 mg/kg, equaling or exceeding the residential land use ESL of 16 mg/kg.

6.2 Sediment Sample Results

TPHg, BTEX, MTBE, or PCBs were not detected above laboratory reporting limits in the sediment samples (see Table 2)

Pesticides were not detected above laboratory reporting limits in sediment samples S2, S6, or S8. The pesticides 4,4'-DDE (2.3 micrograms per kilogram [ug/kg]) and chlordane (12 ug/kg) were reported in sediment sample S4. The reported pesticide concentrations do not exceed their respective residential or commercial ESLs.

TPHd was not detected above the laboratory reporting limit of 1.0 mg/kg in the sediment sample collected near boring S9. TPHd was reported at concentrations ranging from 3.0 to 80 mg/kg in the other eight sediment samples. The reported TPHd concentrations do not exceed the residential and commercial land use ESLs of 83 mg/kg.

TPHmo was reported at concentrations ranging from 2.5 to 140 mg/kg in the sediment samples. The reported TPHd concentrations do not exceed the residential and commercial land use ESL of 370 mg/kg.

Arsenic, barium, chromium, cobalt, copper, lead, mercury, nickel, vanadium, and zinc were detected in each of the sediment samples analyzed during this investigation. None of the reported concentrations exceeded hazardous waste criteria (see Table 3).

Arsenic and vanadium were the only metals with reported concentrations exceeding ESLs. The arsenic concentrations in sediment samples S1 to S9 ranged from 2.9 mg/kg to 6.4 mg/kg. Each of these concentrations exceeded the residential and commercial land use ESLs of 0.39 mg/kg and 1.6 mg/kg. Vanadium was reported at concentrations ranging from 12 mg/kg to 25 mg/kg, with seven samples exceeding the residential land use ESL of 16 mg/kg.

6.3 Grab Groundwater Sample Results

TPHd, TPHmo, TPHg, BTEX, MTBE, or VOCs were not detected above laboratory reporting limits in the sediment samples (see Table 4).

Metals were reported in the eight grab groundwater samples collected from B2 to B9. Of these detections, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, vanadium, and zinc were reported at concentrations that exceeded one or more groundwater or surface water ESLs (see Table 5).

7.0 COMPARISON TO PREVIOUS INVESTIGATION RESULTS

In general, soil, sediment, and groundwater sample results collected during the recent investigation were similar to results presented in the *Phase II Hazardous Materials Investigation Report, Santa Clara Valley Water District, Lower Silver Creek Reaches 5 & 6 Project*, prepared by Parsons in 2001, and in the *DRAFT Site Investigation Report, Lower Silver Creek, Reach 4, San Jose, California*, prepared by Geocon in July 2001.

TO BE COMPLETED ON TUESDAY, MAY 4.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the investigation results, the reported chemical concentrations in sediment, soil, or groundwater do not pose a human health risk but may require special handling and disposal practices during construction as discussed below.

Geocon anticipates that the contractor will be required to complete a waste profile and may be required to perform additional sampling and analysis prior to acceptance for offsite reuse or disposal. Additional sample frequency and analytical methods will be dependent on the volume of material to be exported and contractor-selected facility-specific acceptance criteria.

Soil

TPHg, BTEX, or MTBE were not detected above laboratory reporting limits in the 3-foot soil samples collected from borings B1 to B9 (See Table 2)

TPHd was reported in each of the 3-foot soil samples collected from all boring except B5. The reported TPHd concentrations ranged from 1.7 to 41 milligrams per kilogram (mg/kg). TPHmo was only detected in two samples above the laboratory reporting limit of 1 mg/kg (1.1 mg/kg in boring B1 and 130 mg/kg in boring B2). The reported TPHd and TPHmo concentrations do not exceed their respective residential or commercial ESLs.

Arsenic, barium, chromium, cobalt, copper, lead, nickel, vanadium, and zinc were detected in each of the soil samples analyzed during this investigation. None of the reported concentrations exceeded hazardous waste criteria (see Table 3). Arsenic was reported at concentrations exceeding the residential and commercial ESLs Vanadium was reported at concentrations equaling or exceeding its residential land use ESL (see Table 3).

Based on the results of soil samples collected during this investigation, soil excavated during the flood control construction activities would likely be accepted by most Class II or Class III landfills. It is recommended that the excavation contractor obtain acceptance for soil reuse/disposal from the receiving location(s) prior to construction.

Sediment

TPHg, BTEX, MTBE, or PCBs were not detected above laboratory reporting limits in the sediment samples (see Table 2)

Pesticides were not detected above laboratory reporting limits in sediment samples S2, S6, or S8. The pesticides 4,4'-DDE (2.3 micrograms per kilogram [ug/kg]) and chlordane (12 ug/kg) were reported in sediment sample S4. The reported pesticide concentrations do not exceed their respective residential or commercial ESLs.

TPHd was not detected above the laboratory reporting limit of 1.0 mg/kg in the sediment sample collected near boring S9. TPHd was reported at concentrations ranging from 3.0 to 80 mg/kg in the other eight sediment samples. TPHmo was reported at concentrations ranging from 2.5 to 140 mg/kg in the sediment samples. The reported TPHd and TPHmo concentrations do not exceed the residential and commercial land use ESLs.

Arsenic, barium, chromium, cobalt, copper, lead, mercury, nickel, vanadium, and zinc were detected in each of the sediment samples analyzed during this investigation. None of the reported concentrations exceeded hazardous waste criteria (see Table 3). Arsenic was reported at concentrations exceeding the residential and commercial ESLs Vanadium was reported at concentrations equaling or exceeding its residential land use ESL (see Table 3).

Based on the results of sediment samples collected during this investigation, sediment excavated during the flood control construction activities would likely be accepted (after dewatering) by most Class II or Class III landfills. It is recommended that the excavation contractor obtain acceptance for sediment reuse/disposal from the receiving location(s) prior to construction.

Groundwater

TPHd, TPHmo, TPHg, BTEX, MTBE, or VOCs were not detected above laboratory reporting limits in the sediment samples (see Table 4).

Antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, vanadium, and zinc were reported at concentrations that exceeded one or more groundwater or surface water ESLs (see Table 5). Accordingly, groundwater discharge or disposal may be restricted based on metal content.

9.0 REPORT LIMITATIONS

This report has been prepared in accordance with generally accepted practices using standards of care and diligence normally practiced by recognized consulting firms performing services of a similar nature. This report presents our professional judgment based upon data and findings identified in this report and the interpretation of such data based on our experience and background, and no warranty, either express or implied, is made. The conclusions presented are based on the current regulatory climate and may require revision if future regulatory changes occur.

The findings identified in this report are predicated on the results of the limited sampling and laboratory testing performed. This report does not address impacts related to sources other than those specified herein.

The contents of this report reflect the views of Geocon Consultants, Inc., who is responsible for the facts and accuracy of the data presented herein. This report does not constitute a standard, specification, or regulation.

TABLE 5
SUMMARY OF METALS RESULTS - GROUNDWATER
Lower Silver Creek Reaches 4, 5 and 6A
San Jose, Santa Clara County, California

Sample ID	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
B2-W	<0.0050	<0.010	0.49	<0.0030	<0.0030	0.086	0.020	0.055	0.030	0.00024	0.017	0.11	<0.010	<0.0030	<0.015	0.069	0.11
B3-W	<0.0050	0.054	1.8	<0.0030	0.0042	0.45	0.12	0.29	0.083	0.00094	0.019	0.80	0.014	<0.0030	<0.015	0.30	0.54
B4-W	0.032	0.19	6.1	0.013	0.03	2.2	0.44	1.3	0.33	0.0095	0.031	2.5	0.059	<0.0030	<0.015	2.0	2.4
B5-W	0.048	1.8	18	0.055	0.076	5.9	1.70	3.6	0.75	0.0076	0.074	10	0.11	<0.015	<0.075	7.3	7.1
B6-W	<0.0050	0.04	1.3	<0.0030	0.0035	0.37	0.085	0.20	0.081	0.00083	0.015	0.53	<0.010	<0.0030	<0.015	0.36	0.47
B7-W	<0.0050	<0.010	0.89	<0.0030	0.0033	0.20	0.035	0.058	0.019	0.00045	0.024	0.19	<0.010	<0.0030	<0.015	0.17	0.19
B8-W	0.016	0.13	5.7	0.011	0.024	1.6	0.29	0.61	0.17	0.0055	0.015	1.7	0.029	<0.0030	<0.015	1.3	1.6
B9-W	<0.0050	<0.010	0.17	<0.0030	<0.0030	0.042	0.0060	0.011	<0.0050	<0.00020	0.0091	0.047	<0.010	<0.0030	<0.015	0.037	0.032
California MCLs																	
Primary	0.006	0.05	1.0	0.004	0.005	0.05	---	1.3	15	0.002	---	0.1	0.05	---	0.002	---	---
Secondary	---	---	---	---	---	---	---	1.0	---	---	---	---	---	0.1	---	---	5.0
Groundwater ESLs																	
Current/Potential Source	0.006	0.036	1.0	0.00053	0.00025	0.05	0.003	0.0031	0.0025	0.000025	0.035	0.0082	0.005	0.00019	0.002	0.015	0.081
Not Current/Potential Source	0.03	0.036	1.0	0.00053	0.00025	0.18	0.003	0.0031	0.0025	0.000025	0.24	0.0082	0.005	0.00019	0.004	0.019	0.081
Surface Water ESLs																	
Freshwater	0.006	0.00014	1.0	0.00270	0.00025	0.05	0.003	0.0090	0.0025	0.000025	0.035	0.052	0.005	0.00034	0.002	0.015	0.12
Marine	0.5	0.00014	1.0	0.00053	0.00930	0.18	0.003	0.0031	0.0056	0.000025	0.24	0.0082	0.071	0.00019	0.004	0.019	0.081
Estuarine	0.03	0.00014	1.0	0.00053	0.00025	0.18	0.003	0.0031	0.0025	0.000025	0.24	0.0082	0.005	0.00019	0.004	0.019	0.081

Notes:

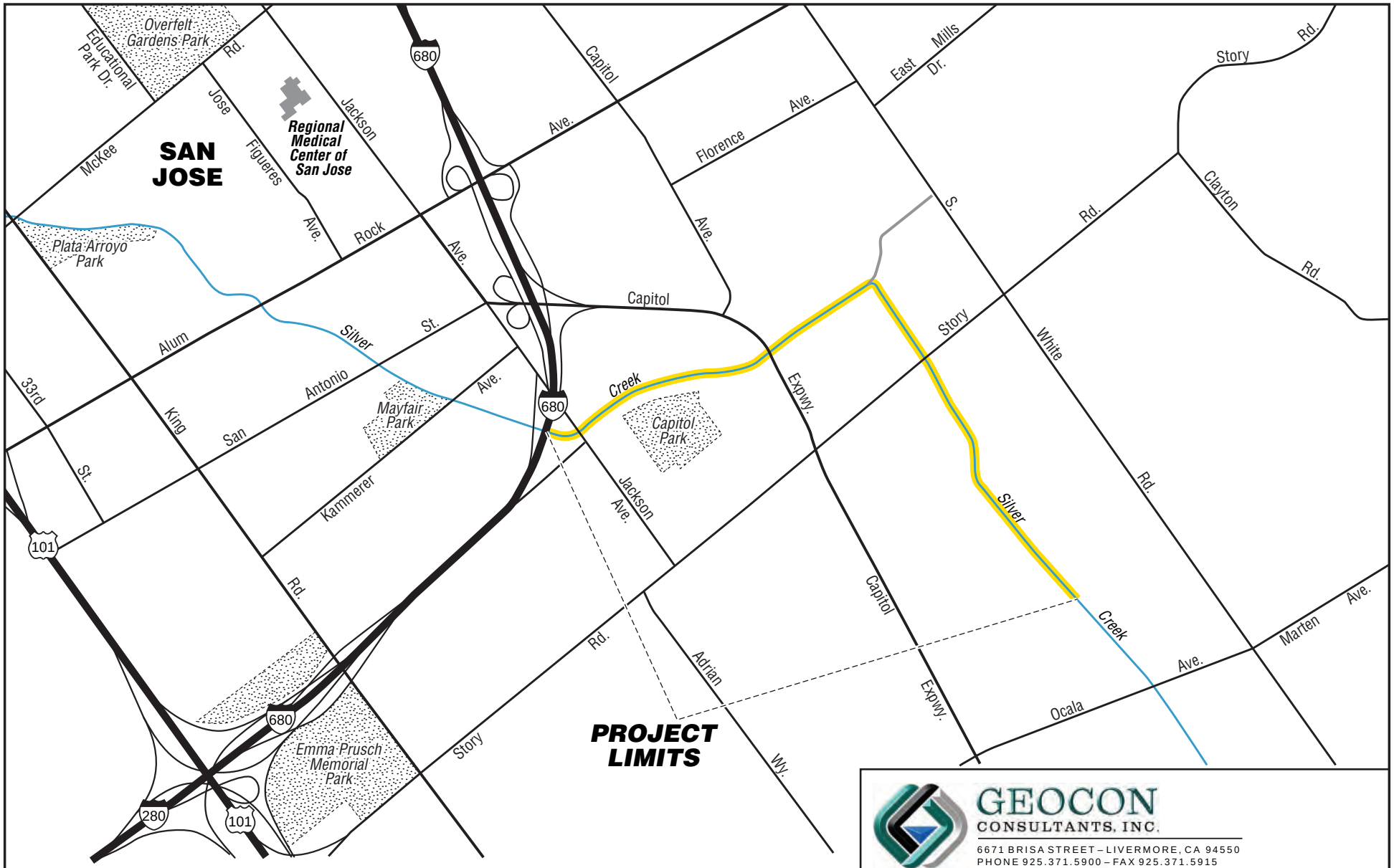
Data are shown in units of milligrams per liter (mg/l)

< = Not detected above the stated laboratory reporting limit

MCLs = Maximum Contaminant Levels, Title 22, CCR, Division 4, Chapter 15, Article 4, September 12, 2003

ESLs = Environmental Screening Levels, Table F, SFRWQCB, Revised May 2008

--- = Not analyzed or No standard



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Lower Silver Creek – Reaches 4, 5 and 6A Flood Protection

San Jose, Santa Clara County, California

VICINITY MAP

E8505-06-01	January 2010	Figure 1

APPENDIX 3B-8

LSC 4-6 CONSTRUCTION WORK PLAN

LOWER SILVER CREEK REACHES 4-6A
FLOOD PROTECTION PROJECT

Project No. 40264008

CONSTRUCTION PHASE WORKPLAN

Approved By:

Al Gurevich Unit Manager Watershed Capital Division	Date

Prepared By:

Dennis Cheong, P.E.	Senior Project Manager
Steve Bui, P.E.	Program Manager
Eric Evans, P.E.	Project Manager

Capital Program Services Division

Santa Clara Valley Water District

Capital Program Services Division
Consistently delivering high-quality projects using best-in-class management and technical skills

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I. PROJECT BACKGROUND

A. Why Do This Project?

The Lower Silver Creek Project, extending from the confluence with Coyote Creek upstream to Lake Cunningham, was identified in the 1986 Benefit Assessment Program. The project, in conjunction with the Lake Cunningham Project, will protect the surrounding area from the one percent flood event, improve stream habitat values and improve fisheries potential. The Federal sponsor is the Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service.

The improvements for the Lower Silver Creek Reaches 4-6A Project extend from the upstream face of I-680 near Jackson Avenue to the upstream face of Moss Point Drive, north of Ocala Avenue. The total project length is approximately 9,000 lineal feet (1.7 miles).

B. History and Background

The NRCS was the lead agency in the development of the original 1983 Watershed Plan, which included the preparation and adoption of an Environmental Impact Report/Environmental Impact Statement (EIR/EIS) and an Engineer's Report in 1983. The original project (all reaches) included nearly 3.8 miles of concrete-lined trapezoidal channel, along with the reuse of existing structures and transitions. In 1989, the District prepared and submitted an application to the U.S. Army Corps of Engineers (USACE) for a Section 404 Permit for the project. There was great concern about the amount of concrete lining proposed in the original project. The 1983 plan was found to be unacceptable to the regulator agencies and to the environmental community.

Consequently the NRCS completed a Section 404(b) Alternatives Analysis and Plan Update in 1998, which replaced much of the concrete lining with vegetated block walls. The 1998 Plan was modified to include a low flow channel for fish passage and included Board-approved project enhancements that modified hydraulic and structural design criteria. The modified 1998 plan is the basis for the current design.

A new USACE Section 404(b) Permit application was submitted in April 1999. An environmental document was prepared which addressed the differences between the 1983 approved project and the new 1998 Plan. In October 2000, the District circulated an Initial Study/Negative Declaration/Environmental Assessment (IS/ND/EA) for public comment. The IS/ND/EA was adopted by the Board on December 19, 2000. In October 2001, the IS/ND/EA was amended to include project enhancements approved by the Board.

The Lower Silver Creek Flood Protection project is a multi-purpose project with a primary goal to provide flood protection to the watershed. In addition to the flood protection goal, the project is providing environmental enhancements by

eliminating some concrete U-Frame sections and replacing them with earthen banks for plantings and habitat creation.

In 2003, design work on Reach 4 was stopped at the 90% level due to lack of funding. During the same year, design work on Reaches 5 and 6 was completed at the nominal 100% level, though construction did not happen due to lack of funding. At that time, some value engineering improvements to Reaches 5 and 6 were deemed likely to be implemented, so it was expected that the design would be modified in the future rather than going straight to construction. Construction of Reaches 1 through 3 was completed in 2006.

In early 2009, funding from the American Recovery and Reinvestment Act became available for Lower Silver Creek Reaches 4 through 6. To take advantage of the 2009 summer creek construction season and promote the goal of economic stimulus and job creation, it was decided that Reach 6B "Early Grading" project will be constructed in the first phase. Improvements resulting from this project will reduce the total amount of excavation necessary for the future permanent channel improvements in Reach 6B.

Design of Reaches 4-6A began in November 2009 and was completed in June 2010. Bids are due on July 14, 2010 and construction is expected to begin in August or September 2010.

II. PROJECT OBJECTIVES

The goals, objectives and benefits of the project are to:

Ends Policy E-2, Article 2.2 – "There is a reduced potential for flood damages"

- Protect properties in the surrounding area from the one percent flood event.
- Obtain a Letter of Map Revision (LOMR) from FEMA. This interim project will not result in a change to the documented flood insurance map area, though it will facilitate a future project that is expected to qualify for a LOMR.

III. PROJECT CONSTRUCTION CRITERIA / CONSTRAINTS / ASSUMPTIONS

A. Criteria

- *Exceeding the following tolerances will trigger a re-evaluation of the project by the project owner:*
  - -- 1,158 calendar days for completion of Base Work (I-680 to North Babb Creek), followed by 1,096 calendar days for the maintenance period.
  - – Cost Tolerance: Construction cost increase in excess of extra work budget.

<u>Technical:</u>

- This project, in conjunction with past and future projects upstream and downstream of Reaches 4-6A, will provide one percent flood protection to properties within the Lower Silver Creek floodplain.

- Project consists of the following features:
    - Compliance with NPDES General Permit, including SWPPP preparation, installation of BMP's
    - Clearing and grubbing within the project limits, including the removal of trees, vegetation, sack concrete, and other miscellaneous items
    - Channel excavation and embankment, including construction of 1.5:1 slopes, and removal and replacement of unsuitable material, in order to increase the channel capacity (Approximately 107,500 cubic yards)
    - Construction and surfacing of a maintenance road along one side of the existing Lower Silver Creek within the project limits. (Approximately 122,370 square feet)
    - Street reconstruction where the channel crosses under public streets at five (5) locations: Jackson Avenue; Capitol Expressway; Story Road; Murtha Drive; and Moss Point Drive.
    - Construction of PCC access ramps from the streets onto the maintenance road (Approximately 24,200 square feet)
    - Construction of RCP and CMP storm drains and appurtenances, ranging in size from 15" to 54", including a 24" elliptical RCP
    - Modification of storm drain outfalls
    - Replacement and relocation of VCP, DIP and PVC sanitary sewer main, including two (2) sanitary sewer siphons, one being a bore and jack installation
    - Traffic control
    - Chain link and wood privacy fencing and chain link gates (Approximately 33,500 linear feet)
    - Cast-in-place reinforced concrete box culvert, five (5) total, at Jackson Avenue
    - Addition of one (1) Pre-cast reinforced concrete box culvert at Capitol Expressway
    - Addition of one (1) Pre-cast reinforced concrete box culvert at Story Road
    - Replacement of the Lyndale Pedestrian Bridge

- Drilled pier flood and retaining walls (Approximately 38,270 square feet)
- Cantilever retaining walls at access ramps (Approximately 18,310 square feet)
- Soldier pile retaining walls (Approximately 111,600 square feet)
- U-channel near Jackson Ave. (Approximately 10,350 square feet)
- Channel lining at North Babb Creek
- Channel lining at South Babb Creek
- ¼ Ton rock lining in certain locations of the Lower Silver Creek Channel (Approximately 20,400 cubic yards)
- Concrete lining in certain locations of the Lower Silver Creek Channel (Approximately 3,150 square feet)
- Grouted rock lining in certain locations of the Lower Silver Creek Channel (Approximately 1,080 cubic yards)
- 1.5:1 slope toe protection construct from ¼ ton rock (Approximately 710 cubic yards)
- Revegetation planting (Approximately 130,300 square feet)
- Landscaping planting (Approximately 370 vines & trees)
- Landscaping irrigation system
- Landscape maintenance which includes the maintenance during the landscape installation and the maintenance during a three-year establishment period following the landscape installation
- Other miscellaneous construction work and items necessary to satisfactorily complete the work.

- The project will be constructed per the contract documents.

<u>Regulatory:</u>

- Construction within the channel is limited to occur between April 15 and October 15.
- The project will comply with all regulatory permits.
- Water quality monitoring will be performed during construction activities that affect the actively flowing creek channel.
- Contractor must comply with all BMPs including BI-1, Mitten Crab Control Measures.

- Because construction is federally funded, the District and the Contractor must comply with the Davis-Bacon Wage Determinations (prevailing wages) and other federal requirements.

B. Constraints

Technical Constraints:

- The project will require additional right of way. Acquisition of necessary land is under way and expected to be complete by October 1, 2010.
- The project will comply with all project permit criteria.

Financial Constraints:

- The District has sufficient funding to complete construction of the Base Bid portion of the project (I-680 to North Babb Creek). Depending on bid results, the District may also be able to fund one or more Bid Additives, which cover additional creek improvements upstream of North Babb Creek.

Schedule Constraints:

- .Base Bid schedule milestones are as follows:

–

  - Milestone 1: Penrod Place work, including sanitary sewer relocation and PVC storm drain structure construction, including all roadway restoration, striping and other related work complete by May 1, 2011.
  - Milestone 2: Phase 1 Jackson Avenue work completed including Phase 1 traffic control totally removed and either Phase 2 traffic control installed or original condition restored by November 1, 2011.
  - Milestone 3: U-Channel between Interstate 680 and Jackson Avenue work complete by November 1, 2011.
  - Milestone 4: Phase 2 Jackson Avenue work completed by November 1, 2012 with Phase 2 traffic control remaining until either March 1, 2013 or the start of the Phase 3 Jackson Avenue work, whichever is later.
  - Milestone 5: Capitol Expressway work (all phases) complete, including removal of the Phase 4 traffic control and installation of permanent traffic markings and signs by November 1, 2012.
  - Milestone 6: All other work within the Base Work area, except for Jackson Avenue Phase 3 and Phase 4 work, complete by November 30, 2012.
  - Milestone 7: Phase 3 Jackson Avenue work completed including Phase 3 traffic control totally removed and installation of permanent traffic markings and signs by November 1, 2013.

- Milestone 8: Phase 4 Jackson Avenue work completed by December 1, 2013

- Bid Additive schedule milestones are as follows:
  - Bid Additive 1 (North Babb Creek up to, but not including Story Road), Milestone 1: All special structures work within the new channel (property line to property line) complete by December 2, 2013.
  - Bid Additive 2 (Story Road to Murtha Drive Centerline), Milestone 1: All special structures, work within the new channel and Story Road items of work within the travel way, complete by December 1, 2014.
  - Bid Additive 3 (Murtha Drive Centerline to Moss Point Centerline), Milestone 1: All special structures and work within the new channel complete by December 2, 2014.

- Liquidated damages for failure to complete work milestones before their respective deadlines are as follows:
  1. $600.00 per day for failure to complete all work of Base Work Milestone 1 on or before the date required.
  2. $1,000.00 per day for failure to complete all work of Base Work Milestone 2 on or before the date required.
  3. $1,000.00 per day for failure to complete all work of Base Work Milestone 3 on or before the date required.
  4. $1,000.00 per day for failure to complete all work of Base Work Milestone 4 on or before the date required.
  5. $1,000.00 per day for failure to complete all work of Base Work Milestone 5 on or before the date required.
  6. $1,000.00 per day for failure to complete all work of Base Work Milestone 6 on or before the date required.
  7. $1,000.00 per day for failure to complete all work of Base Work Milestone 7 on or before the date required.
  8. $1,000.00 per day for failure to complete all work of Base Work Milestone 8 on or before the date required.
  9. $1,000.00 per day for failure to complete all work of Bid Additive 1 Milestone 1 on or before the date required.

10. $1,000.00 per day for failure to complete all work of Bid Additive 2 Milestone 1 on or before the date required.

11. $1,000.00 per day for failure to complete all work of Bid Additive 3 Milestone 1 on or before the date required.

12. $700.00 per day, per each item, per occurrence, for failure to perform the items listed in Article 11.06.02. “Detailed Work Schedule” Item B.4. on or before the date shown in each calendar year of the construction or for exceeding the time limit given.

13. $500.00 per day, per each item, per occurrence, for failure to submit the Preliminary Schedule of Work, Detailed Schedule of Work, Schedule Updates, and Master Submittal List within the limits allowed.

Political Constraints:

- The project will have significant temporary traffic impacts, particularly at road crossings where major culvert work will take place. Existing chain link fence along the creek right of way will be replaced. This will affect some private residents who depend on District fence to secure their back yards. Where no chain link fence exists, new fence will be installed. Public outreach efforts are under way. Saturday work is allowed, and Sunday/Holiday work is allowed only if approved by the Engineer.

Operational Constraints:

- Design work for the project was completed by a consultant, Ruggeri-Jensen-Azar (RJA). Construction management will be performed by District staff, with as-needed support from consultants.
- All permit requirements must be met.

C. Assumptions

- Excusable inclement weather days (rain days) during construction are as follows:

January	18
February	16
March	10
April	4
May	3
June	0
July	0
August	0
September	0
October	4
November	9

December	11

- No Hazmat material in project area

IV. PROJECT CONSTRUCTION SCOPE OF WORK

Refer to Section IIIA of this document for a description of major construction work tasks under this contract. Construction management of the project will be performed by District staff. Consultants of the Coyote Watershed Program (CWP) will support District staff in this role by participating in and supporting public outreach efforts, reviewing technical submittals and RFIs (if necessary), and providing other construction management support as requested by District staff.

Project Management During Construction

Project Management

- Update Project Plan; Update Construction Phase Work Plan (including project schedule and cost) as needed. (Task 1811).
- Update CIP and prepare budget. (Task 1811).
- Attend staff and owner meetings, perform project filing, prepare and track routing of Board agenda items. (Task 1821).
- Review/track invoices for purchase orders and agreements. Collect project financial data using financial reports. (Task 1831).
- Prepare budget adjustments and change management documents. (Task 1851).
- Prepare project close-out activities as outlined in QMS procedures and work instructions. (Task 1911).

Construction

Real Estate (Task 1521)

Partial acquisition of land from a total of three residential properties at Story Road and Murtha Road is necessary for construction of maintenance ramps at these two street crossings. It is expected that these acquisitions will be complete by October 1, 2010.

Partial acquisition of land from two public parcels (from the County of Santa Clara and Caltrans) is underway via encroachment permit processes, with completion expected in late 2010.

Partial acquisition of land from a private business (Home Depot at Story Road) is also underway, with completion expected in late 2010.

Preconstruction Wildlife Surveys (Task 1677)

The Contractor is required to hire a third party biologist to perform preconstruction wildlife surveys and implement appropriate measures to ensure that all wildlife-related aspects of the regulatory permits are met, which the exception of fish relocation. These

measures may include setting up nesting exclusion devices (such as netting at culverts), placing fencing around bird nests, and relocating turtles.

Dewatered portions of the channel shall undergo fish relocation by District staff. The Contractor shall provide at least two persons to assist with the relocation work. More information is contained in the Contract Specifications under Section 22.04.02 Temporary Water Diversion.

Quantity Measurement Surveys (under the Mobilization bid item)

The Contractor's independent surveyor is responsible for performing pre-construction staking, pre-construction earthwork quantity surveys, and post construction earthwork quantity surveys. The District will review and perform QAQC of this work. At a minimum it is recommended that District survey staff perform spot elevation checks during or immediately after the Contractor's pre- and post-excavation survey work.

Internal Preconstruction Meeting (Task 1611)

A meeting will be held prior to issuance of Notice to Begin Work to review the Construction Work Plan, discuss procedures during construction and review any potential or outstanding issues. The meeting has not yet been scheduled. .

Preconstruction Conference (Task 1611)

A preconstruction conference with the Contractor will be scheduled shortly after award and is likely to take place in late July or early August 2010. .. The Construction Manual - Section 6 (Attachment 1) outlines the process and responsibilities.

Technical Support Activities (Task 1631)

The CWP and design consultant RJA will provide as-needed technical support for contract document interpretation as well as technical submittal and RFI responses.

Contract Administration

Detailed information on the Construction Management Program (CMP) can be found on the District Internal Web Site at:
http://www.scvwd.gov/inhouse/cpsd_webpage/Construction_Program/index.htm

Inspection and Documentation (Task 1621)

Proper inspection and documentation of construction activities are vital to the successful administration of a construction contract. The lack of good documentation and record keeping can create confusion and weaken the District's case in any dispute or litigation with the Contractor.

Inspection and documentation are the responsibility of District's CMP staff. General procedures are found in the Construction Manual – Section 8 (Attachment 2).

Submittal Review (Task 1631)

A submittal is any item specified in the contract that must be approved by the District prior to installation or construction. A submittal may include items such as schedules, safety plans, shop drawings, supplies, brochures, operational and maintenance manuals, warranties, procedures, and other documents or materials.

Timely, expeditious and thorough review of submittals is necessary in order to keep the contract on schedule and avoid claims. For most submittals, the Engineer has 20 days after receipt of submittal to return it to the Contractor. Standard procedure for submittal review and tracking can be found in the Construction Manual – Section 7 (Attachment 3). See Appendix 3 for Submittal Review Flowchart. See Section IIIB of this document for liquidated damages associated with schedule-related submittals.

Requests for Information (Task 1631)

A Request for Information (RFI) is a document presented by the Contractor requesting clarification, information or guidance concerning some aspect of the contract documents. Standard procedures for responding to RFI's can be found in the Construction Manual - Section 8-VI (Attachment 2). See Appendix 4 for the RFI Flowchart.

Contract Changes (Task – based on specific item under discussion)

During the course of construction, situations may arise that require a change in the contract documents. Changes to the contract documents are made through a contract change order or an extra work order which may change the contract price, schedule of payments, completion date or the plans and specifications.

Procedures for evaluating and executing contract changes are found in the Construction Manual - Section 13 (Attachment 4). See Appendix 5 for the Contract Change Process.

Claims Management (Task – based on specific item under discussion)

A claim is a request by the Contractor for additional compensation as a result of a physical change or as a result of work being performed under more difficult conditions that cannot be resolved through the normal contract change process. The Construction Manual - Section 15 (Attachment 5) outlines procedures for the prevention, identification and resolution of contract claims. In addition, refer to Local Assistance Procedures Manual Chapter 16 for further requirements for Claims Management.

Pre-final and Final Inspections (Task 1621)

Prior to conducting the final inspection, a pre-final walk-through is conducted between the CMP field staff, design consultant RJA, and the appropriate operations staff to develop the final contract punch list items. Before the District accepts any part of a construction contract, a formal final inspection is conducted to determine whether a contract has been substantially completed in accordance with the contract requirements. The Construction Manual - Section 14 (Attachment 6) outlines the standard procedures for performing this final inspection.

As-Builts (Task 1608)

As-built drawings (record drawings) are the final drawings which have been updated to incorporate all changes during construction. The Contractor, under supervision of the CMP, is responsible for tracking changes to the contract plans in the field. Marked up drawings are then submitted to the design consultant RJA for creation of the formal set of Record Drawings. The procedure for developing as-built drawings is outlined in the CADD Standards Manual – Chapter 13 (Attachment 7).

V. PROJECT ORGANIZATION, ROSTER, ROLES AND RESPONSIBILITIES

Roles and Responsibilities of project team members are listed below. Refer to Appendix 6 for Project Organization Chart and Appendix 7 for Team Roster.

Project Owner – Liang Lee

- Communicate with CEO/Board, NRCS and external stakeholders.
- Authorize funding resource.
- Recommend approval of construction changes including the use of optional items and/or change orders that are outside the original scope of work, and change orders exceeding the budget for extra work (within executive limitations).
- Ensure customer satisfaction.

Coyote and Pajaro Watersheds Projects Unit Manager – Al Gurevich

- Ensure customer satisfaction.
- Oversee project team performance.

Senior Project Manager – Dennis Cheong

- Provide overall project management and delivery.
- Ensure coordination and conflict resolution.
- Monitor and control of project schedule, cost and scope.
- Prepare and present reports on project status to the Owner, Board, District departments, NRCS, outside agencies and the public.
- Initiate, recommend or approve contract changes.
- Evaluate the impact of contract changes on the project schedule and cost.
- Correspond and resolve issues with property owners, utility companies, regulatory, federal, state and local agencies.
- Manage communication with the public relative to activities that may affect them.
- Ensure implementation of Outreach Plan.
- Assist in resolving claims.
- Approve extra work.

- Approve alternative engineering solutions/accountable for timeliness of response.
- Approve agenda items for routing.

Project Coordinator – Susan Harris

- Prepare, organize and maintain project management data and information to produce management reports.
- Assist in preparation and updates to project plan, work plan, and other project management deliverables.
- Support management functions such as project audits, CIP updates, budgets and budget adjustments, board agenda items, project meetings, etc.

Coyote Watershed Program – RMC Water and Environment

- Track and maintain required District permits.
- Assist in the review of technical construction submittals and RFIs.
- Assist in the preparation of change order packages.
- Assist in the resolution of engineering problems arising during construction.
- Assist in re-engineering of work and preparation of change order packages, including revised drawings, specifications and cost estimate.
- Assist in the review of Contractor proposals for alternative means and substitution of materials.
- Assist in resolving claims.
- Assist with public outreach.
- Supervise the Design Consultant's preparation of the Record (as built) Drawings.

Design Consultant – Ruggeri-Jensen-Azar (RJA)

- Provide as-needed review of technical RFIs and submittals when requested by the Coyote Watershed Program.
- Prepare Record (as-built) Drawings, using red line markups provided by the Contractor and reviewed by the District and the Coyote Watershed Program.
- Provide Design Clarifications and assist in the review of potential change orders and claims as requested by the Coyote Watershed Program.

Construction Manager – Nelson Gonzales

- Provide day-to-day management of the construction contract, serving as the main point of contact with the Contractor.
- Act as "Engineer" per the contract specifications.

- Enforce contract requirements.
- Monitor contract schedule and cost.
- Coordinate construction activities with O&M staff.
- Monitor contract costs and administering extra work.
- Maintain District records for the construction contract in accordance with established procedures.
- Review contract submittals and RFI's.
- Approve progress payments to Contractor.
- Negotiate and administer contract change orders and extra work.
- Initiate construction Board agenda items.
- Recommend contract partial and final acceptance.
- Resolve all questions that arise as to:
  - the quality or acceptability of materials furnished
  - the work performed
  - rate of progress of the work
  - the interpretation of drawings and specifications
  - the acceptable fulfillment of the contract by the Contractor
- Analyze contract claims and making recommendations.
- Develop and administer claims avoidance procedures and preparing necessary documentation.
- Assist with public information events.
- See Construction Manual - Section 3 Attachment 8) and Administrative Policies and Procedures AD-9.10

Construction Inspector – (Designee of Roberto Pamintuan)

- Inspect construction contract in accordance with established procedures to ensure compliance with contract plans and specifications.
- Document daily construction activities.
- Develop monthly progress payment estimates based on field measured quantities.
- Act as "Engineer's representative" per the contract specifications.
- Recommend acceptance of rejection of work performed under contract.
- Monitor and document daily extra work activities.
- Address on-site public inquiries relating to construction operations.
- Review and track construction staking requests.

- Maintain draft as-built plans during construction.
- Review contract submittals and RFI's – convey technical submittals and RFIs to the Coyote Watershed Program.
- Process progress payments.
- Track construction Board agenda items.
- Monitor Contractor certified payrolls and insurance.
- Log and track Contractor submittals and RFI's.
- Maintain construction files.
- See Section 3 of the Construction Manual (Const Manual Section 3.pdf / Attachment 8) and Administrative Policies and Procedures AD-9.10.

QA/QC for Construction Phase

Discipline	**Staff**
Structural Engineering/Shoring	Eric Tsou
Geotechnical	Mohammad Khan
Hazmat, SWPPP	Uday Mandelkar
Wildlife Biologist	Melissa Moore
Surveys	Dan Gilleland

- Review submittals and RFI's for their particular area of expertise.
- Review and approve Contractor proposals for alternative means and materials in area of expertise.
- Assist with problem resolution during construction in area of expertise.
- Oversee consultant providing services in area of expertise.
- Provide support for their particular areas of expertise as needed.
- Provide environmental training to the Contractor's managerial and labor staff.

VI. COMMUNICATIONS

The official channel of communication between the Contractor and the District is through the Construction Manager. All communication with the Contractor shall be documented in writing. A copy of all correspondence with the Contractor shall be sent to the Senior Project Manager and the Coyote Watershed Program. Communication within the Project Team can be achieved by: phone/voicemail, e-mail, letters, briefings, meetings, bulletins, reports, and/or mail out update. Refer to E-mail Etiquettes below.

Communication with parties outside of the District should be handled by the SPM or CM for construction-related issues. See Attachment 9 for a complete list of agency names and contact information.

Communicator	Responsible For
Engineering Unit Manager – Tim Bramer	Communication between the Project Construction Team and the Executive Leadership Team.
Engineering Unit Manager – Al Gurevich	Communication between the SPM and DOO.
Senior Project Manager – Dennis Cheong	Communication between DOO and Project Owner and the Project Team. Communication with parties outside the District.
Construction Manager – Nelson Gonzales	Communication with the Contractor and Construction Inspection Team. Communication with parties outside the District for construction-related issues.
Coyote Watershed Team	Communication with the SPM, Construction Manager, and Project Team.
Project Team Members	Communicating information relevant to responsibilities of the Project Team.

Public Outreach (Task 1602)

Outreach Plan: The alignment extends along Lower Silver Creek from I-680 near Jackson Avenue to Moss Point Drive within a residential neighborhood setting in east San Jose. Traffic impacts to local residents will occur as well as Saturday work. Community outreach efforts include:

- If the entire project is awarded (Base Bid plus all Bid Alternates), five (5) project construction signs are to be installed along the project alignment at road crossings including Jackson Ave., Capitol Expressway, Story Road, Murtha Drive, and Moss Point Drive. A lesser number of signs will be installed if only the Base Bid and less than all Bid Alternates are awarded..
- Construction-update flyers in advance of all major construction activities.

E-Mail Etiquettes (Based on Yale University Library Netiquettes)

Send the right message

- Start with a strong subject line. Good descriptive subject line that identifies the message content enables your reader to file and retrieve your message later.
- Create single subject email messages whenever possible. Stick to the subject of your message.

- If your response to a “chain” message raises an issue unrelated to the original subject, revise the subject line to reflect the new issue. Better yet, start a new message.
- Limit the list of recipients and copy only to the people who are directly involved with the subject.
- Avoid sending messages to multiple administrative levels when communication on a single level is appropriate.
- Respond to opinion with evidence or facts that are relevant.

Key steps for writing effective email messages

- Use the inverted pyramid form of writing. Your most important statements should appear in the first paragraph. Follow up with supporting details.
- Limit sentence length to 20 words or two lines.
- Use bullets or numbers and short paragraphs whenever possible. The more succinct your message is, the more likely your email will be read, understood and acted upon.
- Use sub-topic headings within your email message, especially if the message is lengthy. Refer to the subtopics in your first paragraph. This will provide a helpful guide for your reader.
- Ask for an action. For example, let your recipient know what you need in order to complete a task. Put forth your recommendations or state the measures you will take in resolving a problem, for instance.

E-mail is not always the best method of communication

- Do not use e-mail to broadcast confidential matters.
- Communicate complaints or dissatisfaction directly to the individual. Refrain from sending complaints about individuals to third parties via email. Give an individual the courtesy of a phone or face-to-face conversation. This opportunity to clear up a misunderstanding is very important in promoting 2-way communication.
- Communicate highly complex information through other means. A telephone call or face-to-face conversation may reduce any misunderstandings.
- Negotiations usually need back and forth communication. If you find yourself responding more than three times on the same topic, choose an alternate form of communication.
- Break the cycle of message and response. A telephone call or personal conversation can do wonders in resolving difficulties.
- Resist the temptation to fire off a response.
- Read the original message again. You might be misinterpreting the message by the sender.
- Draft a response and let it cool off for a time before sending it.
- Re-read your message one last time before you send it.
- Watch the send button. Remember that any message you send is permanent.

Be responsive not reactive

According to the Rand Corporation, a non-profit institution that helps improve policy and decision making, one attribute of email that most distinguishes it from other forms of communication is its ability to evoke emotion in the recipient (Anderson and Shapiro, 1985).

Unlike telephone and personal conversations that fade with time, impulsive email responses can sit around in mailboxes, be printed out, circulated and acquire a level of importance that was never intended. This is a real barrier to effective and 2-way communication and can have a negative impact on work relationships and work productivity.

- Interpersonal cues that aid the face-to-face communication process, such as immediate feedback and the ability to judge body language are completely absent from e-mail.
- Without face-to-face communication, attempts at humor, irony, sarcasm, and wit are often misinterpreted. Some may view your joke as criticism.

VII. QUALITY CONTROL PLAN

The purpose of the Quality Control Plan is to ensure that the project is constructed in accordance with the construction contract documents and the design intent.

Construction management, including field inspection, shall be subject to the quality control measures set forth by the Construction Management Program (http://www.scvwd.gov/inhouse/cpsd_webpage/Construction_Program/index.htm) and its Construction Manual.

Only engineering support is subject to the following quality review requirements:

- Documents requiring review and sign-off include submittal review comments and any design changes (including changes to plans and specifications) during the construction.
- Submittal review comments and any design change (including changes to plans and specifications) shall be approved by the Construction Manager's designee before release to the Contractor.
- The construction manager should allow adequate time for review by the Construction Manager's designee. Advance notice of one week should be given before the beginning of any major design change. Prior notice is not required for the review of submittal comments.

VIII. CHANGE HISTORY

Date	Revision	Comments
8/11/10	1st Draft	

APPENDIX 1
PROJECT STATUS REPORT

Project Synopsis

A. PROJECT DESCRIPTION

See the Project Background section of this Work Plan for the Project Description.

B. SPECIAL REQUIREMENTS

Not used.

Other Agency Coordination

An interim City of San Jose (City) encroachment permit was obtained for the project to cover work activities and construction traffic on City streets. The Contractor is responsible for obtaining its own traffic haul route permit from the City.

See the Design to Construction Transition Report, attached to this Workplan, for more information.

Potential Issues

Not used.

C. WATER DISTRICT PARTICIPATION

The District is required to perform the following tasks:

- Relocate fish from dewatered channel segments, with help from the Contractor;
- Coordinate with utility owners who will be performing relocation work;
- Communicate with the public and other agencies (City, County, Caltrans) throughout the construction duration.

D. OTHER ACTIVITIES IN THE VICINITY

Project Administration

A. BOARD ACTIONS

The Board authorized advertising the Lower Silver Creek Reaches 4-6A Project on June 8, 2010. After bids are opened July 14, 2010, it is expected that the Board will authorize award of the contract on July 27, 2010..

B. LETTERS OF CLARIFICATION

Two addenda have been issued during the bidding process. A third is expected to be issued during the week of July 5-9, 2010. Addenda will be included as an attachment in Appendix A.

C. PRELIMINARY LIST OF PRE-CONSTRUCTION MEETING ATTENDEES

The list of Pre Construction meeting attendees will be available in the project management file.

D. PROJECT CONSTRUCTION SCHEDULE

The construction time limit is 1,158 calendar days for the installation period, followed by 1,096 calendar days for the revegetation and landscape maintenance period.

PERMITS

The following District-acquired permits are contained in Appendix C of the Specifications:

- SWRCB NPDES General Permit
- U.S. Army Corps of Engineers Permit
- RWQCB 401 Water Quality Certification and Discharge
- California Department of Fish and Game 1601
- City of San Jose Encroachment
- Santa Clara County Encroachment
- Caltrans Encroachment
- Migratory Bird Permits Memorandum

Utility Agreements

Utility agreements are in place for the relocation of existing utilities that conflict with the channel improvements. See the Design to Construction Transition Report for more information.

Right of Way Agreements / Easements

See Section IV of this document for right of way information.

Archaeological Monitoring

No specific archaeological monitoring was performed for the project.

Contamination Investigation

Hazardous and Materials Analyses was conducted for soils along the project. The reports are available at the Construction Engineering Unit.

Quantity and Cost Calculations

The Quantities calculations and Cost Estimate are available in the project management file.

APPENDIX 3C-1

DISTRICT STANDARD

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SPECIAL PROVISIONS

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Payment Bond for Public Works
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STANDARD PROVISIONS

STANDARD PROVISIONS

SECTION 1. DEFINITIONS

Whenever in these Specifications and other Contract documents the following abbreviations and terms or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:

ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISI	American Iron and Steel Institute
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
API	American Petroleum Institute
AREA	American Railway Engineering Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
AWG	American Wire Gage
AWPA	American Wood-Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
BAAQMD	Bay Area Air Quality Management District
CAEPA	California Environmental Protection Agency
CCR	California Code of Regulations
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
DHS	California Department of Health Services
HSC	California Health and Safety Code
IEEE	Institute of Electrical and Electronics Engineers
MSDS	Material Safety Data Sheet
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
RWQCB	California Regional Water Quality Control Board
SAE	Society of Automotive Engineers
SWRCB	California State Water Resources Control Board
UBC	Uniform Building Code
UL	Underwriters Laboratories
USEPA	United States Environmental Protection Agency
WCLB	West Coast Lumber Inspection Bureau
WWPA	Western Wood Products Association

Acceptance: The formal written acceptance by the District of a contract which has been completed in all respects in accordance with the Drawings and Specifications and any modifications thereof previously approved.

Addendum: A change in the Specifications or Drawings issued prior to the opening of Proposals.

Approved, Directed, Ordered, or Required: Whenever these words or their derivatives are used, it is the intent, unless otherwise clearly stated, that approval or direction by the Engineer is indicated.

Article: A numbered portion of a title section of the Specifications.

Bid: See Proposal, Article 3.03

Bidder: Any individual, firm, partnership, corporation, or combination thereof, submitting a proposal for the work contemplated, acting directly or through a duly authorized representative.

Board, Board of Directors: The Board of Directors of the District.

Certified Hazardous Materials Testing Laboratory: A laboratory certified by the California Department of Health Services to perform specific chemical and physical analysis for hazardous materials.

Certified Industrial Hygienist: A professional who is certified by the American Board of Industrial Hygienists as trained to evaluate safety and health hazards and determine safety measures necessary for personnel working under hazardous conditions.

Claim: A separate demand by the Contractor for (A) a time extension, (B) payment of money or damages arising from work done by or on behalf of Contractor pursuant to the Contract and payment of which is not otherwise expressly provided for or the Contractor is not otherwise entitled to, or (C) an amount of payment which is disputed by the District.

Code: The terms Government Code, Labor Code, etc. refer to codes of the State of California.

Construction Equipment: Equipment used for the performance of work but not incorporated into the project.

Contract: The written agreement between Contractor and District including the Notice to Bidders, Proposals, Drawings, Specifications, Contract Bonds, Contract change orders, and Addenda.

Contract Prices: The prices for the work set forth in a contract.

Contractor: The entity or person entering a contract with the District.

Controlling Item of Work: Any feature or combination of features of the work considered at the time by the Engineer, which if delayed, will delay the time of completion of a contract.

Days: Calendar days, unless otherwise designated.

***Designated Engineer**:* A Deputy Operating Officer of Capital Program Services, as identified in Article 13.01 of the Special Provisions.

District: The Santa Clara Valley Water District.

Drawings: The official drawings, working drawings, detail drawings, and supplemental drawings, or reproductions thereof, which show the location, character, dimensions, and details of the work to be done, and which are to be considered as part of a contract.

Engineer: The Designated Engineer, acting either directly, or through a properly designated representative, assumes all duties and responsibilities, and has all rights and authority, in accordance with the Contract Documents.

Equipment: Equipment incorporated or to be incorporated into the project.

Fixed Costs: Any necessary labor, material, and equipment costs directly expended on the item or items under consideration which remain constant regardless of the quantity of work done.

Hazardous Material: (A) Any substance, product, waste or other material of any nature whatsoever which is or becomes listed, regulated, or addressed pursuant to any federal, state or local statute, law, ordinance, resolution, code, rule, regulation, order or decree regulating, relating to, or imposing liability (including, but not limited to response, removal, and remediation costs) or standards of conduct or performance concerning any hazardous, toxic, explosive, corrosive, flammable, infectious, radioactive, carcinogenic, mutagenic or as otherwise dangerous waste, substance or material; (B) any substance, product, waste, or other material of any nature whatsoever whose presence in and of itself may give rise to liability under any of the above statutes or under any statutory or common law theory based on negligence, trespass, intentional tort, nuisance, strict or absolute liability or under any reported decisions of a state or federal court; (C) any substance without limitation, which contains petroleum or crude oil, including but not limited to, petroleum and petroleum products.

Hazardous Waste: Any substance or material, as defined in the California Hazardous Waste Control Act, Health and Safety Code Section 25, or the Resource Conservation and Recovery Act, 42 U.S.C. 6901 et seq.

Liquidated Damages: The amount stated in the Specifications, as provided in Government Code Section 53069.85, to be paid to the District or to be deducted from any payments due or to become due the Contractor for each day's delay in completing the whole or any specified portion of the work beyond the time allowed in the Specifications.

Materials: Materials incorporated or to be incorporated into the project.

Milestone: A specified portion of the work identified in the Contract as a Milestone.

***Milestone Completion**:* The date determined by the District when the Milestone is complete. Milestone Completion does not constitute Acceptance but does establish the completion date of the Milestone for the purpose of assessment of Liquidated Damages, if any, associated with the Milestone.

Personnel Protection: Equipment and procedures which minimize human exposure to regulated materials, hazardous materials, hazardous wastes, or unsafe situations.

Plans, Construction Plans: The Drawings.

Project: The erection, construction, alteration, repair, or improvement to be accomplished under the Contract.

Project Completion*:* Project Completion is the stage at which the whole work is complete per the Contract documents, and the Engineer has performed the final inspection and issued a Project Completion letter.

Reasonable Accuracy: Within the tolerances as shown on the Drawings or indicated in the Specifications.

Regulated Material: Any substance or combination of substances for which federal, state, or local regulations require special management, storage, disposal, or handling practices. This shall include, but not be limited to, materials defined as: Hazardous Materials and Waste; Designated Wastes (CCR, Title 23, Section 23-2522); and Special Waste (CCR, Title 22, Section 22-66195).

Remediation: Restoration of the contaminated soil, groundwater, or other materials to its pre-contaminated level or to a level acceptable to the District and local, state, and federal agencies.

Responsible Bidder: A bidder meeting the criteria set forth in District's Resolution No. 88-11.

Subcontractor: An entity or person contracting with the Contractor or another subcontractor to perform any portion of work.

Specifications: The directions, provisions, and requirements contained in the Standard Provisions, Special Provisions, and Technical Provisions.

Ton: 2,000 pounds avoirdupois.

Work: That which is constructed or done pursuant to the requirements of the Contract to accomplish the Project including but not limited to providing labor, materials, equipment, and information documentation.

SECTION 2. INTERPRETATION OF CONTRACT

2.01. Precedence of Contract

In resolving conflicting requirements between the Contract Documents order of precedence shall be as follows:

1. Change orders
2. Agreement
3. Addenda
4. Special Provisions
5. Technical Provisions
6. Drawings
7. Standard Provisions
8. State Specifications

With reference to the Drawings:

1. Figures govern over scaled dimensions
2. Detail drawings govern over general drawings

2.02. Clarification of Contract

All corrections of readily apparent errors or omissions in the Contract may be made by the Engineer when such corrections are necessary for the proper fulfillment of their intention as construed by the Engineer. The misplacement, addition, or omission of any word, letter, figure, or punctuation mark which has no substantive legal effect will in no way change the due spirit, intent, or meaning of these Specifications.

Any part of the work not shown on the Drawings or described in these Specifications but which is reasonably or ordinarily implied by either, shall be furnished and installed by the Contractor as if fully described in these Specifications and shown upon the Drawings.

Should it appear that the work to be done or any of the matters relative thereto is not sufficiently detailed or explained in the Specifications or on the Drawings, or if the Contractor discovers during the course of the work any discrepancies between the Contract Drawings and conditions in the field, or any errors or omissions in the Contract or in the layout given by stakes, points, or instructions, the bidder or Contractor shall apply in writing to the Engineer for such further explanations as may be necessary and shall conform to them as part of the Contract. In the event of any doubt or questions arising respecting the true meaning of the Contract, reference shall be made in writing to the Engineer, whose decision thereon shall be final. Any work done after such discovery until authorized by the Engineer, will be done at the Contractor's risk.

2.03. State Specifications and Plans

Unless otherwise stated, State Specifications and Plans referred to in these Specifications shall be the latest edition of the State of California Department of Transportation Standard Specifications and Standard Plans. When specifically stated to

follow the State Specifications and Plans for an item, the work set forth in these Contract documents shall be accomplished in accordance with the appropriate provisions and details of the State Standard Specifications and Standard Plans. Said Specifications and Plans are herein referred as the State Specifications and Plans and are by reference made a part of these Specifications the same as though set out in full. In the event of conflict between the State Standard Specifications or the State Standard Plans and the Standard, Special, or Technical Provisions of these Specifications or the Drawings, these Specifications and Drawings shall apply.

SECTION 3. PROPOSAL REQUIREMENTS AND CONDITIONS

3.01. Approximate Estimate

The quantities given in the Notice to Bidders, Proposal, and Contract forms are approximate only, being given as a basis for the comparison of Proposals, and the District does not, expressly or by implication, agree that the actual amount of work will correspond therewith, but reserves the right to increase or decrease the amount of any class or portion of the work, or to omit portions of the work, as may be deemed necessary or advisable by the Engineer.

3.02. Examination of Drawings, Specifications, and Site of Work

The bidder shall examine carefully the site of the work contemplated and the Proposal, Drawings, Specifications, and Contract forms therefor. The submission of a Proposal will be conclusive evidence that the bidder has investigated and is fully aware of the conditions and difficulties to be encountered, of the character, quality, and quantities of work to be performed and materials to be furnished, and of the requirements of the Proposal, Drawings, Specifications, and other Contract documents.

Where investigation of subsurface conditions has been made by the District in respect to foundation or other design, bidders may inspect the records of the District as to such investigation, including examination of samples and drill cores, if any. When logs of test boring showing a record of the data obtained by the District's investigation of subsurface conditions are made available, said logs represent only the opinion of the District as to the character of material encountered by it in its test borings and are made available only for the convenience of bidders.

Note that the District investigation of subsurface conditions is made for the purpose of design. The District assumes no responsibility whatever in respect to the sufficiency of test borings, or accuracy of the log of test borings, or other preliminary investigations, or of the interpretation thereof. There is no guarantee expressed or implied that the conditions indicated are representative of those existing throughout the work, or any part of it, or that unforeseen developments may not occur.

Making such information available to bidders is not to be construed in any way as a waiver of the provisions of Article 3.02, and bidders must satisfy themselves through their own investigations, analysis, and interpretations as to conditions to be encountered.

No information derived from such inspection of records or preliminary investigations made by the District, or from the Engineer, or from assistants, or from the maps, Specifications, profiles, or Drawings will in any way relieve the Contractor from any risk or from properly fulfilling all the terms of the Contract. Records of such preliminary investigations as may have been made by the District may be inspected at the office of the District, 5750 Almaden Expressway, San Jose, California 95118, or at such other locations as may be stated in the Notice to Bidders.

3.03. Proposal Form

The Proposal Form, when filled out by the Bidder and executed, shall be submitted as the Bidder's Proposal. All Proposals shall show the prices proposed in figures in the spaces provided, and shall be signed by the Bidder. The Bidder shall fill out all blanks in the Proposal Form as therein required.

Payment for the various items listed in the Proposal Form shall constitute full compensation for furnishing all plant, labor, equipment, appliances, and materials, and performing all operations required to complete all work in conformity with the Drawings and Specifications. All costs for work not specifically mentioned in the Proposal Form shall be included in the Contract prices for the items listed.

In the case of unit basis items, the amount set forth under the ―Total" column shall be the extension of the item unit price bid on the basis of the estimated quantity for the item.

In case of discrepancy between the item unit price and the total price set forth for the item, the item unit price shall prevail; provided, however, that if the amount set forth as an item unit price is ambiguous, unintelligible, or uncertain for any cause, or is omitted, or in the case of unit basis items, is the same amount as the entry in the ―Total" column, then the amount set forth in the ―Total" column for the item shall prevail in accordance with the following:

A. As to lump sum items, the amount set forth in the ―Total" column shall be the item price.

B. As to unit basis items, the amount set forth in the ―Total" column shall be divided by the estimated quantity for the item and the price thus obtained shall be the item unit price.

3.04. Queries on Bidding

Questions regarding the Specifications or Drawings or any other portion of the Contract, or any addendum thereto shall be directed to the Designated Engineer of the Santa Clara Valley Water District, 5750 Almaden Expressway, San Jose, California 95118, in writing. No interpretation of the meaning of the Specifications, Drawings, or other prebid documents will be made to any bidder orally. Any written queries received later than 10 days before the bid due date may not be answered.

3.05. Rejection of Proposals

Proposals may be rejected if they show any alterations of form, additions not called for, conditional bids, incomplete bids, erasures, or irregularities of any kind. Proposals in which the prices, in the opinion of the District, are unbalanced, may be rejected.

When proposals are signed by an agent, other than the officer or officers of a corporation authorized to sign contracts on its behalf, or a member of a partnership, a written authorization or Power of Attorney should be on file with the District prior to

opening proposals or submitted with the Proposal; otherwise, the Proposal may be rejected as irregular and unauthorized.

3.06. Proposal Guarantee

All proposals shall be presented under sealed cover and accompanied by one of the following forms of bidder's security; cash, a cashier's check, certified check, or a bidder's bond executed by an admitted surety, made payable to the District. The security shall be in an amount equal to at least 10 percent of the total Contract price in the Proposal. A proposal will not be considered unless one such form of bidder's security is enclosed with it.

A bidder's bond will not be accepted unless it substantially conforms to the bond form included with the Proposal form and is properly filled out and executed. If desired, the bond form included therein, properly filled out as directed, may be executed and used as the bidder's bond. Blanks conforming to this form may be obtained from the District.

3.07. Withdrawal of Proposals

Any proposal may be withdrawn at any time prior to the time fixed in the Notice to Bidders for the opening of proposals only by written request for the withdrawal of the Proposal filed with the Clerk of the Board of Directors. The request shall be executed by the bidder or duly authorized representative. The withdrawal of a proposal does not prejudice the right of the bidder to file a new proposal.

3.08. Joint Proposals

If two or more bidders desire to bid jointly on a project, they shall file an affidavit of joint venture with the District in the form approved by the District, and such affidavit of joint venture will be valid only for the specified project for which it is filed. If such affidavit of joint venture is not filed as aforesaid and approved by the District prior to the time for opening proposals on the specific project for which it is submitted, a joint proposal submitted by the same bidders may be disregarded.

3.09. Disqualification of Bidders

Submittal of more than one proposal form from an individual, firm, partnership, corporation, or a combination thereof under the same or different names, will not be considered. If there is reason for believing that collusion exists among the bidders, none of the participants in such collusion will be considered for award of this Contract.

3.10. Addendum

Addenda may be issued prior to opening of proposals and shall be deemed a part of the original Specifications and Drawings. All such additions or changes shall be considered by the bidder in preparation of the Proposal. Addenda will be sent to each bidder at the address indicated in the planholders' list.

3.11. Guaranty

The Contractor may be required to furnish a written guaranty covering certain items of material and equipment for varying periods of time from the date of acceptance of the Contract. The material and equipment to be guaranteed, the form of guaranty, and the time limit of the guaranty will be specified in the Special Provisions. Said guaranty shall be signed and delivered to the Engineer before final payment will be made. Upon completion of the Contract, the amounts of the Contract bonds required in Article 4.03 may be reduced to conform to the total amount of the Contract bid prices for the items to be guaranteed and this amount shall continue in full force and effect for the duration of the guaranty period.

Guarantee periods shall commence on the date equipment or material is placed into service at the direction of the District. In the event such items are not placed into service prior to partial or final acceptance of the project, the guarantee period will commence on the date of such acceptance.

3.12. Bid Protest

A. Any Bid protest relating to the form or content of the Bid documents must be submitted in writing to the Designated Engineer identified in Article 13.01 of the Special Provisions. The protest must be received before 5 p.m. of the third business day before the original date or extension thereto set for the Bid opening. Any potential Bidder who fails to submit a protest before the Bid opening deadline will be deemed to have waived any protest to the form or content of the Bid documents.

B. Any Bid protest unrelated to Article 3.12.A. must be submitted in writing to the Designated Engineer. The protest must be received before 5 p.m. of the third business day following Bid opening. The District's final decision on a protest will be issued in writing no later than 10 calendar days following receipt of the protest.

C. The protest document must contain a complete statement of the basis for the protest. The protest must refer to the specific portion(s) of the Bid documents that form the basis for the protest. The protest must include the name, address, and telephone number of the person representing the protesting party.

SECTION 4. AWARD OF CONTRACT

4.01. Award of Contract

The District reserves the right to reject or waive irregularities, in any and all proposals, or in the bidding procedures.

The Contract, if awarded, will be to a responsible bidder, submitting the lowest responsive bid. The award, if made, will be within 45 days after the opening of the proposals. If the lowest responsible bidder refuses or fails to execute the Contract, the award may be made to the second lowest responsible bidder. The award, if made, will be within 75 days after the opening of the proposals. If the second lowest responsible bidder refuses or fails to execute the Contract, the Contract may be awarded to the third lowest responsible bidder. The award, if made, will be made within 105 days after the opening of the proposals. The periods of time specified above within which the award of Contract may be made shall be subject to extension for such further period as may be agreed upon in writing between the District and the bidder concerned.

4.02. Return of Bidder Security

No later than sixty (60) days after the award of the Contract to the responsible bidder submitting the lowest responsive bid, the security of the unsuccessful bidder(s) will be returned, except for bidder's bonds and any guarantees which have been forfeited.

4.03. Contract Bonds

The Contractor shall furnish in the forms attached hereto, a performance bond and a payment bond executed by both the Contractor and the sureties, each equal to 100 percent of the contract sum.

Should any surety or sureties be deemed unsatisfactory at any time by the District, notice will be given the Contractor to that effect, who shall forthwith substitute a new surety or sureties satisfactory to the District. No further payment shall be deemed due or will be made under this Contract until the new sureties shall qualify and be accepted by the District.

4.04. Execution of Contract

The Contract Agreement must be signed by the responsible bidder submitting the lowest responsive bid and returned, together with the Contract bonds and insurance documents, within ten (10) days, of District's Notice of Contract Award letter, not including Sundays and legal holidays.

Formation of a Contract between the parties requires accomplishment of the following: (1) execution of the Agreement by Contractor; (2) submission by Contractor, and acceptance by District of the required Contract Bonds, and insurance coverages and documents; and (3) execution of the Agreement by District. No Contract is formed until these three elements have been accomplished to the satisfaction of the District.

4.05. Failure to Execute Contract

Failure to execute the Agreement after Contract award and to file acceptable bonds and insurance documents as provided herein, within 10 days, not including Sundays and legal holidays shall be just cause for the District's annulment of the award and forfeiture of the bidder's security.

SECTION 5. SCOPE OF WORK

5.01. Work to be Done

The work to be done consists of furnishing all labor, methods or processes, implements, tools, machinery, construction equipment, materials of any kind, and installed manufactured equipment, except as otherwise specified herein, to be furnished by the District or from sources provided by the District, which are required to construct in a good and workerlike manner all the work herein specified.

5.02. Final Cleanup

Before final inspection the Contractor shall clean the premises, and unless otherwise specified, remove all rubbish, excess materials, falsework, temporary structures, and equipment. All parts of the work shall be left in a neat and presentable condition to the satisfaction of the Engineer.

5.03. Change in Work

A. The District may, at any time or from time to time, order additions, deletions, or revisions in the work; these will be authorized by a written order issued by the Engineer and/or by a change order. Upon receipt of any such document, the Contractor shall promptly proceed with the work involved which will be performed under the applicable conditions of the Contract.

   Changes in the Contract price shall be determined in accordance with Article 5.04. Changes in the Contract time shall be determined in accordance with Article 5.05.

B. If the District and the Contractor are unable to agree as to the extent, if any, of an increase or decrease in the Contract price or an extension or shortening of the Contract time that would be required as a result of a written order, a claim may be made therefor as provided in Articles 5.08 or 5.09.

C. The Contractor shall not be entitled to an increase in the Contract price nor an extension of the Contract time with respect to any work performed that is not required by the Contract, except in the case of an emergency, and except in the case of uncovering work as provided in Article 9.07.

D. The District and the Contractor shall execute appropriate change orders covering:

   1. changes in the work which are ordered by the District pursuant to paragraph A above;

   2. changes in the Contract price and/or Contract time which are agreed to by the parties, or

   3. any other changes agreed to by the parties.

5.03.01. Allowable Quantity Variations

A. **General**: Increases or decreases in the quantity of a Contract item of work will be determined by comparing the actual pay quantity of an item of work with the approximate quantity in the listing of the bid items contained in the Proposal.

If the actual pay quantity of an item of work varies from the approximate quantity by 25 percent or less, payment will be made for the actual quantity of work performed at the Contract unit price listed in the Proposal.

If the actual pay quantity of an item of work varies from the approximate quantity by more than 25 percent, in the absence of an executed Contract Change Order specifying the compensation to be paid, the compensation payable to the Contractor will be determined in accordance with Article 5.03.01.A.1, or Article 5.03.01.A.2.

1. ***Increases of More Than 25 Percent***: If the actual pay quantity of an item of work exceeds the approximate quantity by more than 25 percent, the amount of work in excess of 125 percent of the approximate quantity will be paid for by adjusting the Contract unit price. Such adjustment of the Contract unit price will be the positive or negative difference between the Contract unit price and the actual unit cost of the total pay quantity of the item. At the sole option of the Engineer, the actual unit cost of the work involved in such excess will be determined in accordance with Article 5.04.01.C.2 (by mutual acceptance of a lump sum amount) or Article 5.04.01.C.3 (cost of work, based on time and materials).

If the cost of an item of work includes fixed costs, the fixed costs will be deemed to have been recovered by the Contractor by the payments made for 125 percent of the approximate quantity at the Contract unit price for the item and in computing the actual unit cost, the fixed costs will be excluded.

When the compensation payable for the quantity of work performed in excess of 125 percent of the approximate quantity is less than $5,000 at the Contract unit price, no adjustment in the Contract unit price will be made unless requested in writing by the Contractor within 14 days from the date the Contractor became aware, or should have reasonably become aware, of the increase in quantity.

2. ***Decreases of More Than 25 Percent***: If the actual pay quantity of an item of work is less than 75 percent of the approximate quantity, an adjustment in compensation will not be made unless the Contractor makes a request in writing within 14 days from the date the Contractor became aware, or should have reasonably become aware, of the decrease in quantity. If the Contractor makes a request, the actual pay quantity of said item of work performed will be paid for by adjusting the Contract unit price. Such adjustment of the Contract unit price will be the positive or negative difference between the Contract unit price and the

actual unit cost of the total pay quantity of the item, including fixed costs. At the sole option of the Engineer, payment for the actual quantity of work will be made in accordance with Article 5.04.01.C.2 (by mutual acceptance of a lump sum amount) or Article 5.04.01.C.3 (cost of work based on time and materials).

Payment for the actual pay quantity of such item of work will in no case exceed the payment which would have been made for the performance of 75 percent of the approximate quantity of such item at the Contract unit price.

B. **Eliminated Items**: If any Contract item of the work is eliminated in its entirety, payment will be made to the Contractor for the actual cost incurred in connection with the eliminated Contract item if incurred prior to the date of notification in writing by the Engineer of such elimination.

If acceptable material is ordered by the Contractor for an eliminated Contract item prior to the date of notification of such elimination by the Engineer, and if orders for such material cannot be canceled, payment for such material will be made at the actual cost to the Contractor. In such case, the material shall become the property of the District. If the materials can be returned to the vendor and if the Engineer so directs, the material shall be returned and the Contractor will be paid for the actual cost for returning the material.

The actual costs to be paid by the District to the Contractor in accordance with this Article will be computed in accordance with Article 5.04.02.

C. **Supplemental Contract Items**: Items noted as ―Supplemental" in the Proposal may be deleted entirely or in part at the sole discretion of the District. The provisions of Articles 5.03.01.A.1., 5.03.01.A.2, and 5.03.01.B shall not apply to ―Supplemental Contract Items."

5.04. Change in Contract Price

5.04.01. General

A. The Contract price constitutes the total compensation payable to the Contractor for performing the work. All duties, responsibilities, and obligations assigned to or undertaken by the Contractor to perform the work shall be at the Contractor's expense without change in the Contract price.

B. The Contract price may only be changed by a change order. Any request for an increase in the Contract price shall be based on written notice delivered by the Contractor to the Engineer promptly, but in no event later than 10 days after the date of the occurrence of the event giving rise to the request and stating the general nature of the request. Notice of the amount of the request with supporting data shall be delivered within 45 days after the date of the occurrence, unless the Engineer allows an additional period of time to ascertain more accurate data in support of the request, and shall be accompanied by the

Contractor's written statement that the amount requested covers all amounts (direct, indirect, and consequential) to which the Contractor is entitled as a result of the occurrence of the event. No request for an adjustment in the Contract price will be valid if not submitted in accordance with this Article.

C. The value of any work covered by a change order or of any request for an increase or decrease in the Contract price shall be determined in one of the following ways:

1. Where the work involved is covered by unit prices contained in the Contract documents, by application of unit prices to the quantities of the items involved; or

2. By mutual acceptance of a lump sum, which may include an allowance for overhead and profit not necessarily in accordance with Article 5.04.04; or

3. On the basis of the cost of work (determined as provided in Articles 5.04.02. and 5.04.03.) plus a Contractor's fee for overhead and profit (determined as provided in Article 5.04.04.)

5.04.02. Cost of Work (Based on Time and Materials)

A. **General**: The term "cost of work" means the sum of all costs necessarily incurred and paid by the Contractor for labor, materials, and equipment in the proper performance of work. Except as otherwise may be agreed to in writing by the District, such costs shall be in amounts no higher than those prevailing in the locality of the project.

B. **Labor**: The cost of labor used in performing work by the Contractor, a subcontractor, or other forces, will be the sum of the following:

1. The actual wages paid plus any employer payments to or on behalf of workers for fringe benefits, including health and welfare, pension, vacation, and similar purposes. The cost of labor may include the wages paid to foremen when it is determined by the Engineer that the services of foremen do not constitute a part of the overhead allowance.

2. There will be added to the actual wages as defined above, a percentage set forth in the latest "Labor Surcharge and Equipment Rental Rates" in use by the California State Department of Transportation which is in effect on the date upon which the work is accomplished. This percentage shall constitute full compensation for all payments imposed by State and Federal laws including, but not limited to, workers' compensation insurance and Social Security payments.

3. The amount paid for subsistence and travel required by collective bargaining agreements.

4. For equipment operators, payment for the actual cost of labor and subsistence or travel allowance will be made at the rates paid by the Contractor to other workers operating similar equipment already on the work, or in the absence of such labor, established by collective bargaining agreements for the type of workers and location of the extra work, whether or not the operator is actually covered by such an agreement. A labor surcharge will be added to the cost of labor described herein in accordance with the provisions of subsection 2 of Article 5.04.02.B herein, which surcharge shall constitute full compensation for payments imposed by State and Federal laws, and all other payments made to on behalf of workers other than actual wages.

C. **Materials**: The cost of materials used in performing work will be the cost to the purchaser, whether Contractor or subcontractor, from the supplier thereof, except as the following are applicable:

1. Trade discounts available to the purchaser shall be credited to the District notwithstanding the fact that such discounts may not have been taken by the Contractor.

2. For materials secured by other than a direct purchase and direct billing to the purchaser, the cost shall be deemed to be the price paid to the actual supplier as determined by the Engineer. Markup, except for actual costs incurred in the handling of such materials, will not be allowed.

3. Payment for materials from sources owned wholly or in part by the purchaser shall not exceed the price paid by the purchaser for similar materials from said sources on extra work items or the current wholesale price for such materials delivered to the work site, whichever price is lower.

4. If, in the opinion of the Engineer, the cost of material is excessive, or the Contractor does not furnish satisfactory evidence of the cost of such material, then the cost shall be deemed to be the lowest current wholesale price for the quantity concerned delivered to the work site, less trade discount. The District reserves the right to furnish materials for the extra work and no claim shall be made by the Contractor for costs and profit on such materials.

D. **Equipment**: The Contractor will be paid for the use of equipment at the rental rate listed for such equipment specified in the current edition of the Department of Transportation publication entitled, ~~L~~abor Surcharge and Equipment Rental Rates," which is in effect on the date upon which the work is accomplished. Such rental rates will be used to compute payments for equipment whether the equipment is under the Contractor's control through direct ownership, leasing, renting, or another method of acquisition. The rental rate to be applied for use of each item of equipment shall be the rate resulting in the least total cost to the District for the total period of use. If it is deemed necessary by the Contractor to use equipment not listed in the foregoing publication, an equitable rental rate for

the equipment will be established by the Engineer. The Contractor may furnish cost data which might assist the Engineer in the establishment of the rental rate.

1. The rental rates paid, as above provided, shall include the cost of fuel, oil, lubrication supplies, small tools, necessary attachments, repairs and maintenance of all kinds, depreciation, storage, insurance, and all incidentals. Operators of equipment will be separately paid for as provided in subsection 4 of Article 5.04.02.B.

2. All equipment shall be in good working condition and suitable for the purpose for which the equipment is to be used.

3. Before construction equipment is used on the extra work, the Contractor shall plainly stencil or stamp an identifying number thereon at a conspicuous location, and shall furnish to the Engineer, in duplicate, a description of the equipment and its identifying number.

4. Unless otherwise specified, manufacturer's ratings and manufacturer-approved modifications shall be used to classify equipment for the determination of applicable rental rates. Equipment which has no direct power unit shall be powered by a unit of at least the minimum rating recommended by the manufacturer.

5. Individual pieces of equipment or tools having a replacement value of $500 or less, whether or not consumed by use, shall be considered to be small tools and no payment will be made therefor.

E. **Owner-Operated Equipment**: When owner-operated equipment is used to perform work and is to be paid for as extra work, the Contractor will be paid for the equipment and operator as follows:

Payment for the equipment will be made in accordance with the provisions in Article 5.04.02.D. ~~E~~quipment."

Payment for the cost of labor and subsistence or travel allowance will be made at the rates paid by the Contractor to other workers operating similar equipment already on the project, or, in the absence of such other workers, at the rates for such labor established by collective bargaining agreement for type of worker and location of the work, whether or not the owner-operator is actually covered by such an agreement. A labor surcharge will be added to the cost of labor described herein, in accordance with the provisions in subsection 2 of Article 5.04.02(B), ~~L~~abor."

To the direct cost of equipment rental and labor, computed as provided herein, will be added the markup for equipment rental and labor as provided in Article 5.04.04, ~~C~~ontractor's Fee."

F. **Equipment Time**: The rental time to be paid for equipment on the work shall be the time the equipment is in productive operation on the work being performed

and shall include the time required to move the equipment to the new location and return it to the original location or to another location requiring no more time than that required to return it to its original location; except, that moving time will not be paid if the equipment is used on other than the extra work. Loading and transporting costs will be allowed, in lieu of moving time, when the equipment is moved by means other than its own power. No payment will be made for loading and transporting costs when the equipment is used at the site of the extra work on other than the extra work. The following shall be used in computing the rental time of equipment on the work:

1. When hourly rates are listed, any part of an hour less than 30 minutes of operation shall be considered to be ½-hour of operation, and any part of an hour in excess of 30 minutes will be considered 1-hour of operation.

2. When daily rates are listed, operation for any part of a day less than 4 hours shall be considered to be ½-day of operation.

3. Rental time will not be allowed while equipment is inoperative due to breakdowns or Contractor caused delays.

G. **Cost of Work Documentation**: The Contractor shall furnish the Engineer Daily Extra Work Reports on a daily basis covering the direct costs of labor and materials and charges for equipment whether furnished by the Contractor, subcontractor, or other forces. The District will provide the Extra Daily Work Report forms to the Contractor. The Contractor or an authorized agent shall sign each Daily Extra Work Report. The Daily Extra Work Report shall provide names and classifications of workers and hours worked; size, type, and identification number of equipment; and the hours operated. Copies of certified payrolls and statement of fringe benefit shall substantiate labor charges. Valid copies of vendor's invoices shall substantiate material charges.

The Engineer will make any necessary adjustments. When these reports are agreed upon and signed by both parties, they shall become the basis of payment for the work performed, but shall not preclude subsequent adjustment based on a later audit.

The Contractor shall inform the Engineer when extra work will begin so that the District inspector can concur with the Daily Extra Work Reports. Failure to conform to these requirements may impact the Contractor's ability to receive proper compensation.

5.04.03. Special Services

Special services are defined as that work characterized by extraordinary complexity, sophistication, or innovations, or a combination of the foregoing attributes which are unique to the construction industry. The following may be considered by the Engineer in making estimates for payment for special services:

A. When the Engineer and the Contractor, by agreement, determine that a special service is required which cannot be performed by the forces of the Contractor or those of any of its subcontractors, the special service may be performed by an entity especially skilled in the work to be performed. After validation of invoices and determination of market values by the Engineer, invoices for special services based upon the current fair market value thereof may be accepted without complete itemization of labor, material, and equipment rental costs.

B. When the Contractor is required to perform work necessitating special fabrication or machining process in a fabrication or a machine shop facility away from the jobsite, the charges for that portion of the work performed at the offsite facility may, by agreement, be accepted as a special service and accordingly, the invoices for the work may be accepted without detailed itemization.

C. All invoices for special services will be adjusted by deducting all trade discounts offered or available, whether the discounts were taken or not. In lieu of the allowances for overhead and profit on labor, materials, and equipment specified in Article 5.04.04. herein, a single allowance of ten (10) percent will be added to invoices for special services.

5.04.04. Contractor's Fee

A. Work ordered on the basis of time and materials will be paid for at the actual and necessary cost as determined by the Engineer, plus allowances for overhead and profit which allowances shall constitute the "Contractor's Fee," except as provided in subparagraph B of this Article. For extra work involving a combination of increases and decreases in the work, the actual necessary cost will be the arithmetic sum of the additive and deductive costs. The allowance for overhead and profit shall include compensation for superintendence, bond and insurance premiums, taxes, all field and home office expenses, and all other items of expense or cost not included in the cost of labor, materials, or equipment provided for under Articles 5.04.02.B, C, D, and E, herein. The allowance for overhead and profit will be made in accordance with the following schedule:

Actual Necessary Cost	Overhead and Profit Allowance
Labor	33 percent
Materials	15 percent
Equipment	15 percent

B. Labor, materials, and equipment may be furnished by the Contractor or by the subcontractor on behalf of the Contractor. When all or any part of the extra work is performed by a subcontractor, the allowance specified in subparagraph A of Article 5.04.04 shall only be applied to the labor, materials, and equipment costs of the subcontractors to which the Contractor may add 5 percent of the subcontractor's total cost for the extra work. Regardless of the number of hierarchal tiers of subcontractors, the 5 percent increase above the subcontractor's total cost, which includes the allowances for overhead and profit

specified herein, may be applied one time only for each separate work transaction.

5.04.05. Compensation for Time Extensions

Adjustments in compensation for time extension will be allowed only for causes in Article 5.05.01.B.1 through Article 5.05.01.B.4 computed in accordance with Article 5.04 and the following. No adjustments in compensation will be allowed when District-caused delays to a controlling item of work and Contractor-caused delays to a controlling item of work occur concurrently or for causes in Article 5.05.01.B.5 through Article 5.05.01.B.6.

Compensation for idle time of equipment will be determined in accordance with the provisions in Article 5.04.02.E and Section 8-1.09 of the State Specifications.

5.05. Change of Contract Time

5.05.01. General

A. The Contract time may only be changed by a change order. Any request for an extension of the Contract time shall be based on written notice delivered by the Contractor to the Engineer promptly, but in no event later than 10 days after the date of the occurrence of the event giving rise to the request and stating the general nature of the request. Notice of the extent of the request with supporting data shall be delivered within 45 days after the date of such occurrence, unless the Engineer allows an additional period of time to ascertain more accurate data in support of the request, and shall be accompanied by the Contractor's written statement that the adjustment requested is the entire adjustment to which the Contractor has reason to believe it is entitled as a result of the occurrence of said event. No request for an adjustment in the Contract time will be valid if not submitted in accordance with the requirements of this Article.

The Contract time will only be extended when a delay occurs which impacts a controlling item of work as shown on the work schedules required in the Special Provisions. Time extensions will be allowed only if the cause is beyond the control and without the fault or negligence of the Contractor. Time extensions will also be allowed when District-caused delays to a controlling item of work and Contractor-caused delays to a controlling item of work occur concurrently. The Contractor will be notified if the Engineer determines that a time extension is not justified.

B. The Contract time will be extended in an amount equal to time lost due to delays beyond the control of the Contractor if a request is made therefor as provided in this Article. An extension of Contract time will only be granted for days on which the Contractor is prevented from proceeding with at least 75 percent of the normal labor and equipment force actually engaged on the said work, by said occurrences or conditions resulting immediately therefrom which impact a controlling item of work as determined by the Engineer. Such delays shall include:

1. Changes.

2. Failure of the District to furnish access, right of way, completed facilities of related projects, Drawings, materials, equipment, or services for which the District is responsible.

3. Survey error by the District.

4. Suspension of work pursuant to Articles 7.05(A) and 7.05(C).

5. Occurrences of a severe and unusual nature including, but not restricted to, acts of God, fires, and excusable inclement weather. An "act of God" means an earthquake, flood, cloudburst, cyclone, or other cataclysmic phenomena of nature beyond the power of the Contractor to foresee or to make preparation in defense against, but does not include ordinary inclement weather. Excusable inclement weather is any weather condition, the duration of which varies in excess of the average conditions expected, which is unusual for the particular time and place where the work is to be performed, or which could not have been reasonably anticipated by the Contractor, as determined from U.S. Weather Bureau records for the proceeding 3-year period or as provided for in the Special Provisions.

6. Act of the public enemy, act of another governmental entity, public utility, epidemic, quarantine restriction, freight embargo, strike, or labor dispute. A delay to a subcontractor or supplier due to the above circumstances will be taken into consideration for extensions to the time of completion.

5.05.02. Extensions of Time for Delay Due to Excusable Inclement Weather

A. The Contract time will be extended for as many days in excess of the average number of days of excusable inclement weather, as defined in Article 5.05.01.B.5., as the Contractor is specifically required under the Special Provisions to suspend construction operations, or as many days as the Contractor is prevented by excusable inclement weather, or conditions resulting immediately therefrom, from proceeding with at least 75 percent of the normal labor and equipment force engaged on critical items of work as shown on the schedule.

B. Should the Contractor prepare to begin work at the regular starting time at the beginning of any regular work shift on any day on which excusable inclement weather, or the conditions resulting from the weather prevents work from beginning at the usual starting time and the crew is dismissed as a result thereof, the Contractor will be entitled to a 1–day extension whether or not conditions change thereafter during said day and the major portion of the day could be considered to be suitable for such construction operations.

C. The Contractor shall base the construction schedule upon the inclusion of the number of days of excusable inclement weather specified in the Article titled

"Excusable Inclement Weather Delays," of the Special Provisions. No extension of the Contract time due to excusable inclement weather will be considered until after the said aggregate total number of days of excusable inclement weather has been reached; however, no reduction in Contract time would be made if said number of days of excusable inclement weather is not reached.

5.06. Changed Site Conditions

If any work involves digging trenches or other excavations below the surface, the Contractor shall promptly and before the following conditions are disturbed, notify the District in writing of any:

A. Material that the Contractor believes may be a regulated material that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law.

B. Subsurface or latent physical conditions at the site differing from those indicated in this Contract.

C. Unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract.

The District will promptly investigate the condition and if it finds that the conditions do materially so differ, or do involve regulated material, and cause a decrease or increase in the Contractor's cost of, or the time required for, performance of any part of the work, the District will issue a change order under the procedures described in this Contract. For regulated materials, the District reserves the right to use other forces for exploratory work to identify and determine the extent of such material and for removing regulated material from such areas.

In the event that a dispute arises between the District and the Contractor on whether the conditions materially differ or on the Contractor's cost of, or time required for, performance of any part of the work, the Contractor shall not be excused from any scheduled completion date provided for by this Contract but shall proceed with all work to be performed under the Contract. The Contractor shall retain any and all rights provided either by this Contract or by law which pertain to the resolution of disputes and protests between the contracting parties.

5.07. Cost Reduction Incentive

The Contractor may submit to the Engineer, in writing, proposals for modifying the Drawings, Specifications, or other requirements of the Contract for the sole purpose of reducing the total cost of construction as provided for in Section 5-1.14 of the State Specifications, wherein the words "State" and "Department" shall mean District.

5.08. Disputes

It is the intention of this Article that disputes between parties arising under and by virtue of the Contract be brought to the attention of the Engineer at the earliest possible time in order that the matters may be resolved, if possible, or other appropriate action promptly taken. Disputes are divided into four categories: notice, protest, potential claim, and claim. During the course of the project and up to receiving the proposed final estimate, the Contractor must submit a contract dispute in the form of a written notice, protest, or a potential claim to the Engineer.

Dispute Resolution Review (DRB) process, if required, shall be in accordance with Article 5.10 of these Specifications.

5.08.01. Protest

If the Contractor considers any work demanded to be outside of the requirements of the Contract, or considers any records or ruling or act or omission of the Engineers to be unfair, the Contractor shall immediately, upon such work being demanded, or such record or ruling being made, ask in writing for written instructions or decisions, whereupon the Contractor shall proceed without delay to perform the work or to conform to the record or ruling and, within 15 days after date of receipt of the written instructions or decisions, shall file a written protest with the Engineer stating clearly in detail the basis of the protest. Except for such protests as are made of record in the manner herein specified and within the time limit stated, the records, rulings, instructions, decisions, and acts or omissions of the Engineer shall be final and conclusive. Instructions and decisions of the Engineer contained in letters transmitting Drawings to the Contractor shall be considered as written instructions and decisions subject to protest as herein provided.

5.08.02. Notice of Potential Claims

Contractor is not entitled to additional compensation for any cause unless Contractor submits to the District a written Notice of Potential Claim as hereinafter specified.

The written Notice of Potential Claim must set forth the reasons for which Contractor believes additional compensation and/or time will or may be due, the nature of the costs and/or time involved, and, insofar as possible, the amount of the potential claim. The said notice as above required must have been submitted to District before Contractor performs the work giving rise to the potential claim for additional compensation and/or time, if based on an act or failure to act by District, or in all other cases within fourteen (14) days after the happening of the event, thing or occurrence giving rise to the potential claim.

Notice of Potential Claim shall be certified in accordance with Article 5.09.

Compliance with the foregoing shall not be a prerequisite to any claim that is based on differences in measurement or errors of computations as to Contract quantities.

5.09. Claims

Claims by the Contractor must be submitted to the Engineer on or before the date of final payment. Claims shall be in writing, shall specify the basis for each claim, shall refer to the applicable provision or provisions of the Contract, and shall show the method of computation and the actual amount claimed. The claim shall include documents necessary to substantiate the claim and to establish liability, causation, and damages. All other factual data, including documentation of actual costs pertaining to that claim, shall be submitted. Each issue contained in a claim must include documentation including background, chronology, Contractor's position, supporting documentation of merit, supporting documentation of damages, schedules (if appropriate) and productivity exhibits (if appropriate).

Claims must be certified using the following language:

I, , BEING THE (MUST BE AN OFFICER) OF_____(CONTRACTOR), DECLARE UNDER PENALTY OF PERJURY UNDER THE LAWS OF THE STATE OF CALIFORNIA, AND DO PERSONALLY CERTIFY AND ATTEST THAT: I HAVE THOROUGHLY REVIEWED THE ATTACHED CLAIM FOR ADDITIONAL COMPENSATION AND/OR EXTENSION OF TIME, AND KNOW ITS CONTENTS, AND SAID CLAIM IS TRUTHFUL AND ACCURATE; THAT THE AMOUNT REQUESTED ACCURATELY REFLECTS THE CONTRACT ADJUSTMENT FOR WHICH THE DISTRICT IS LIABLE; AND, FURTHER, THAT I AM FAMILIAR WITH CALIFORNIA PENAL CODE SECTION 72 AND CALIFORNIA GOVERNMENT CODE SECTION 12650, ET SEQ, PERTAINING TO FALSE CLAIMS, AND FURTHER KNOW AND UNDERSTAND THAT SUBMISSION OR CERTIFICATION OF A FALSE CLAIM MAY LEAD TO FINES, IMPRISONMENT AND/OR OTHER SEVERE LEGAL CONSEQUENCES.

The District, or their authorized representatives, shall have access, upon reasonable notice, during normal business hours, to Contractor and subcontractors' books, documents and accounting records, including but not limited to, bid worksheets, bids, subcontractor bids and proposals, estimates, cost accounting data, accounting records, payroll records, time sheets, canceled checks, profit and loss statements, balance sheets, project correspondence including but not limited to all correspondence between Contractor and its sureties and subcontractors/vendors, project files, scheduling information, and other records of the Contractor and all subcontractors directly or indirectly pertinent to the work of the Project; original as well as changed and claimed extra work, to verify and evaluate the accuracy of cost and pricing data submitted with any Claim for which additional compensation has been requested or notice of potential Claims has been tendered. Such access shall include the right to examine and audit such records, and make excerpts, transcriptions, and photocopies at District's cost.

The parties agree that in the event Contractor or any subcontractor fails to comply with this Article, the claim will not be considered by the District. Contractor agrees to impose upon its subcontractors by appropriate subcontract provision, the obligations of this Article of the Standard Provisions.

No claim shall be considered where there has been a failure to comply with the requirements relative to Protest and Notice of Potential Claims as written elsewhere in these Specifications. The presentation of a claim shall be an express condition precedent to the Contractor's recourse to: (A) informal conference; (B) nonbinding mediation, and (C) judicial arbitration to resolve disputes on construction claims of $375,000 or less, or court action upon the Contract for claim in excess of $375,000 in compliance with Section 20104 of the Public Contract Codes.

5.09.01. Claims Less Than Fifty Thousand Dollars

For claims of less than fifty thousand dollars ($50,000), the Engineer shall respond in writing to any written claim within 45 days of receipt of the claim, or may request, in writing, within 30 days of receipt of the claim, any additional documentation supporting the claim or relating to defenses or claims the District may have against the Contractor.

If additional information is thereafter required, it shall be requested and provided pursuant to this Article upon mutual agreement of the Engineer and the Contractor.

The Engineer's written response to the claim, as further documented, shall be submitted to the Contractor within 15 days after receipt of the further documentation or within a period of time no greater than that taken by the Contractor in producing the additional information, whichever is greater.

5.09.02. Claims From Fifty Thousand Dollars to Three Hundred and Seventy-Five Thousand Dollars

For claims greater than or equal to fifty thousand dollars ($50,000) and less than or equal to three hundred seventy-five thousand dollars ($375,000), the Engineer shall respond in writing to all written claims within 60 days of receipt of the claim, or may request in writing, within 30 days of receipt of the claim, any additional documentation supporting the claim or relating to defenses or claims the District may have against the Contractor.

If additional information is thereafter required, it shall be requested and provided pursuant to this Article, upon mutual agreement of the Engineer and the Contractor.

The Engineer's written response to the claims, as further documented, shall be submitted to the Contractor within 30 days after receipt of the further documentation, or within a period of time no greater than that taken by the Contractor in producing the additional information or requested documentation, whichever is greater.

5.09.03. Informal Conferences

If the Contractor disputes the Engineer's written response, or the Engineer fails to respond within the time prescribed, the Contractor may so notify the Engineer, in writing, either within 15 days of receipt of the Engineer's response or within 15 days of the Engineer's failure to respond within the time prescribed, respectively, and demand an informal conference to meet and confer for settlement of the issues in dispute. Upon

such demand, the Engineer shall schedule a meet and confer conference within 30 days.

If, following the meet and confer conference, the claim or any portion remains in dispute, the Contractor may file a claim pursuant to Chapter 1 (commencing with Section 900) and Chapter 2 (commencing with Section 910) of Part 3 of Division 3.6 of Title 1 of the Government code. For purposes of those provisions, the running of the period of time within which a claim must be filed shall be tolled from the time the Contractor submits his or her written claim pursuant to Article 5.09 until the time the claim is denied, including any period of time utilized by the meet and confer conference.

5.09.04. Civil Actions

The following procedures are established for all civil actions filed to resolve claims:

A. Within 60 days, but no earlier than 30 days, following the filing or responsive pleadings, the court shall submit the matter to nonbinding mediation unless waived by mutual stipulation of both parties. The mediation process shall provide for the selection within 15 days by both parties of a disinterested third person as mediator, shall be commenced within 30 days of the submittal, and shall be concluded within 15 days from the commencement of the mediation unless a time requirement is extended upon a good cause showing to the court.

B. If the matter remains in dispute, the case shall be submitted to judicial arbitration pursuant to Chapter 2.5 (commencing with Section 1141.10) of Title 3 of Part 3 of the Code of Civil Procedure, notwithstanding Section 1141.11 of that code. The Civil Discovery Act of 1986 (Article 3 commencing with Section 2016, of Chapter 3 of Title 3 of Part 4 of Code of Civil Procedure) shall apply to any proceeding brought under this subdivision consistent with the rules pertaining to judicial arbitration.

In addition to Chapter 2.5 (commencing with Section 1141.10) of Title 3 of Part 3 of the Code of Civil Procedure, (A) arbitrators shall, when possible, be experienced in construction law, and (B) any party appealing an arbitration award who does not obtain a more favorable judgment shall, in addition to payment of costs and fees under that chapter, also pay the attorney's fees on appeal of the other party.

5.10. Dispute Review Board (DRB)

A. When specified in the Special Provisions that a Dispute Review Board (DRB) process is required, the DRB process shall be in accordance with these Specifications.

5.10.01. General

A. A Dispute Review Board (DRB) is to assist in and facilitate the avoidance and timely, impartial resolution of disputes.

B. All disputes referred to the DRB shall be subject to the dispute resolution process herein described as a condition precedent to initiating a subsequent dispute resolution process such as arbitration or litigation for that dispute.

C. Except as explicitly otherwise provided, all disputes that are actionable under the provisions of the prime contract between the District and the Contractor may be referred to the DRB.

D. The DRB shall be utilized when dispute or potential claim resolution at the project level is unsuccessful. The DRB shall function until the day of acceptance of the Work by the District Board of Directors, at which time the work of the DRB will cease except for completion of unfinished dispute hearings and reports.

E. The Contractor shall include in all subcontracts that subcontractors and suppliers of any tier (a) agree to submit subcontractor claims to the Contractor in a proper form and in sufficient time to allow processing by the Contractor in conformance with the Dispute Review Board resolution specifications; (b) agree to be bound by the terms of the Dispute Review Board provisions to the extent applicable to subcontractor claims; (c) agree that, to the extent a subcontractor claim is involved, completion of all steps required under these Dispute Review Board special provisions shall be a condition precedent to pursuit by the subcontractor of other remedies permitted by law, including without limitation of a lawsuit against the Contractor; and (d) agree that the existence of a dispute resolution process for disputes involving subcontractor claims shall not be deemed to create any claim, right, or cause of action by any subcontractor or supplier against the District.

F. The DRB reports shall not be binding on the District or the Contractor, and shall be admissible in subsequent dispute resolution proceedings.

5.10.02. DRB Qualifications

A. Board members shall be experienced in the interpretation of contract documents and the resolution of construction disputes and in the type of construction to be performed.

B. The following definitions apply for the purpose of setting forth experience and disclosure requirements.

1. Party directly involved: The District or the Contractor of this Project.

2. Contractor includes all joint-venture partners individually.

3. Party indirectly involved: The construction manager, designers, architects, engineers, or other professional service firms or consultants, joint venture partners, subcontractors of any tier, and suppliers on this Project.

4. Financial ties: any ownership interest, loans, receivables or payables.

C. Eligibility:

1. Direct Employment:

   a. Current employees of any of the parties directly or indirectly involved are prohibited from serving as Board members.

   b. Prospective Board members who were past employees of one of the parties directly involved must obtain permission from the other party prior to appointment.

   c. Previous direct employment by one of the parties indirectly involved must be disclosed.

2. Consulting Assignments:

   a. Individuals who are employed in a consulting capacity by any of the parties directly involved are prohibited from serving as Board members.

   b. Prospective Board members who are currently employed as a consultant by one of the parties indirectly involved must obtain permission from the other party prior to appointment.

   c. Previous employment as a consultant by any party directly or indirectly involved must be disclosed.

3. Financial Ties:

   a. Individuals with financial ties to any of the parties directly involved are prohibited from serving as Board members.

   b. Current financial ties to any of the parties indirectly involved must be disclosed.

   c. Previous financial ties with any party, directly or indirectly involved must be disclosed.

4. Close Personal or Professional Relationships:

   a. Individuals with close personal or professional relationships with a key member of any party directly involved are prohibited from serving as Board members.

   b. Such current relationships with a member of any party indirectly involved in the contract must be disclosed.

   c. All past personal or professional relationships with a key member of one of the parties directly or indirectly involved must be disclosed.

5. All past and current service as a Board member on projects where any of the parties directly or indirectly involved in this contract were also involved must be disclosed.

6. No member shall have had substantial prior involvement in the Project, in the judgment of the District and the Contractor.

D. Ongoing Responsibilities: While serving as a Board member on the DRB, no member shall participate in any discussion contemplating the creation of an agreement or making an agreement with any party directly or indirectly involved in the contract regarding employment or fee-based consulting services, or any other business arrangement after the contract is completed.

5.10.03. Establishment of the DRB

A. The District and the Contractor shall jointly participate in the evaluation and selection of prospective nominees for the DRB.

B. The District and the Contractor shall provide to the DRB nominees a list of the construction manager, designers, architects, engineers, professional service firms, consultants, joint-venture partners, subcontractors, and suppliers involved, or likely to be involved in the Project, with a listing of key personnel of each. DRB nominees shall provide the following, pursuant to the above requirements and in addition to the nominee's full name and contact information, to both parties:

1. Resume showing construction experience qualifying the person as a DRB member.

2. Resume showing past DRB participation, if any. List each DRB assignment separately, indicating the name and location of the Project, dates of DRB service, name of owner, name of contractor, contract value, nominating party if applicable, names of the other Board members and the number of disputes heard.

3. Disclosure statement describing past, present, and anticipated relationships, including indirect relationships through the nominee's full-time employer, if any, to the Project, and with all parties directly and indirectly involved in the contract. Disclose close professional or personal relationships with key members of all these parties.

4. Disclosure is a continuing obligation of all Board members throughout the life of the contract.

C. The District and the Contractor shall then have three weeks to solicit and receive information from prospective candidates, and another two weeks to review and to jointly agree on the final selection of the three members to serve on the DRB. In the event that all three members were not selected from the initial pool of nominees, the process shall be repeated.

D. If the DRB Chair has not already been appointed as part of the selection process, then as soon as is practicable the Board members shall nominate the Chair and submit the nominee's resume and request approval by the District and the Contractor.

5.10.04. DRB Meetings

A. The DRB will visit the project site and meet with representatives of the parties at periodic intervals and at other times requested by the parties.

B. Each meeting shall consist of an informal discussion and a field observation of the work in progress. The discussion and field observation shall be attended by personnel of the District and the Contractor.

5.10.05. Dispute Resolution

A. Prior Good-Faith Negotiation:

1. The District and the Contractor shall enter into good-faith negotiations to settle a dispute before referring such dispute to the DRB.

2. These good-faith negotiations shall be founded on the principle of full and timely disclosure of each party's position to the other party, including the exchange of pertinent supporting records, analyses, expert reports, and similar documentation, and shall proceed without delay following the inception of the dispute. Such good-faith negotiations may involve the solicitation and rendering of a DRB advisory opinion as described herein.

B. Dispute Referral:

1. A dispute may be referred to the DRB by either the District or the Contractor. The dispute referral shall be made in writing to the DRB Chair with a copy concurrently provided to the other Board members and the other party.

2. If the contract stipulates a precedent dispute resolution process prior to referral to the DRB, and if one party fails to meet or adhere to the time requirements set forth under the contract for this process, the other party may then refer the dispute to the DRB. In the event that the contract does not specify such precedent process, or specifies a precedent process without time requirements, either party may refer the dispute to the DRB after passage of a reasonable period of time without progress toward a negotiated settlement and the DRB will determine if the dispute should be heard.

3. The dispute referral shall concisely define the nature and specifics of the dispute that are to be considered by the DRB and the scope of the recommendation requested.

4. The DRB Chair shall confer with the parties to establish a due date for delivering pre-hearing submittals, and a date, time, and location for convening the DRB hearing. Hearings shall be convened at the next periodic meeting, unless the parties agree to a shorter or longer period.

C. Pre-Hearing Submittal:

1. The District and the Contractor shall each prepare a pre-hearing submittal and transmit it to all three members of the DRB and the other party. The pre-hearing submittal, comprising of a position paper with such backup data as is referenced in the position paper, shall be tabbed, indexed, and the pages consecutively numbered.

2. Both position papers shall, at a minimum, contain the following:

   a. A joint statement of the dispute, and the scope of the desired report, placed in a prominent location. The language of this joint statement shall summarize in a few sentences the nature of the dispute. If the parties are unable to agree on the wording of the joint statement of dispute, each party's position paper shall contain both statements, and identify the party authoring each statement.

   b. The basis and justification for the party's position, with reference to contract language and other supporting documents for each element of the dispute. In order to minimize duplication and repetitiveness, the parties may identify a common set of documents that will be referred to by both parties and submit them in a separate package.

   c. When the scope of the hearing includes quantum, the referring party shall include a schedule impact analysis and full cost details, calculated in accordance with methods set forth in the contract. This requirement does not apply if the report is to be made for entitlement alone or for entitlement with guidelines for quantum.

3. The number of copies, distribution requirements, and time for submittal will be established by the DRB and communicated to the parties by the Chair.

D. DRB Hearings:

1. The District will arrange for or provide hearing facilities at or near the site.

2. Attendance:

   a. The District and Contractor shall both limit attendance at the hearing to personnel directly involved in the dispute and

participants in the good-faith negotiations that were conducted prior to submittal to the DRB except as noted below.

b. Prior to the date established for the hearing, each party shall provide a list of proposed attendees to the DRB and to the other party. In the event of any disagreement, the DRB shall make the final determination as to who attends the hearing.

c. Attorneys shall not participate in the hearing. Attorneys representing the parties are permitted to attend dispute hearings, provided that prior permission is obtained from the other party.

d. At DRB hearings regarding claims by a subcontractor, including pass-through claims by a lower tier subcontractor or supplier, against the Contractor which are actionable by the Contractor against the District, the Contractor shall require and ensure that each subcontractor involved in the dispute have presented an authorized representative with actual knowledge of the facts underlying the subcontractor claims.

3. The conduct of the hearing shall be established by the DRB according to their operating procedures and generally consistent with the following guidelines:

a. The party who referred the dispute to the DRB shall present its position first, followed by the other party.

b. Both parties shall be allowed successive rebuttals, assuring a full and adequate opportunity to present their position, and to rebut the opposing party's position, until, in the DRB's opinion, all aspects of the dispute have been fully and fairly covered.

c. The DRB shall be fully prepared to, and may at any time, ask questions, request clarifications, or ask for additional data and/or job records.

d. Either party may request that the DRB direct a question to, or request a clarification from the other party. The DRB shall determine at what point in the proceedings such requests may be made and if they will be granted. In general, the DRB will not allow one party to be questioned directly by the other party.

e. In difficult or complex cases, additional hearings may be necessary to facilitate full consideration and understanding of the dispute.

f. The DRB, in its discretion, may allow introduction of arguments, exhibits, handouts, or documentary evidence that were not included in that party's pre-hearing position paper and have not

been previously submitted to the other party. In such cases the other party will be granted time to review and prepare a rebuttal to the new material.

E. Failure to Prepare a Pre-Hearing Submittal or Attend a DRB Hearing:

1. In the event that either party fails to deliver a pre-hearing submittal by the date established by the DRB, the DRB shall, at its discretion, determine whether the hearing shall proceed as originally scheduled, or whether additional time shall be provided and a new date established. On the final date and time established for the hearing, the DRB shall proceed with the hearing utilizing the information that has been submitted.

2. In the event that some or all of the representatives of either party fails to appear at the appointed time of a DRB hearing, the DRB shall proceed with the hearing. The hearing shall take place as if all party representatives were in attendance, and the DRB shall consider all evidence brought before it and hear testimony from those party representatives that are present.

F. Use of Outside Experts:

1. By the District or Contractor:

a. A party intending to offer an outside expert's analysis at the hearing shall disclose such intention in writing to the other party and to the DRB no less than 30 days prior to the due date for delivering the pre-hearing submittal. The expert's name and a general statement of the area of the dispute that will be covered by his or her testimony shall be included in the disclosure.

b. Upon receipt of the above disclosure, the other party shall have the opportunity to secure the services of an outside expert to address or respond to those issues that may be raised by the other party's outside expert. The disclosure requirements shall be the same as that specified above, except the time requirement is 10 days.

c. The cost for securing outside expert services shall be borne by the party securing such services.

2. By the DRB:

a. Prior to arranging for outside experts, the DRB shall obtain prior approval from the District and the Contractor by providing:

(1) A statement explaining why the expert assistance is needed.

(2) An estimate of the cost of the expert assistance.

(3) A disclosure statement, in accordance with the requirements of 5.10.03.B.2 herein, using the criteria established in 5.10.02.C herein.

(4) A confidentiality statement, consistent with the DRB's such agreement, executed by the proposed expert.

b. The Contractor and the District shall equally bear the cost of the services of the outside expert employed by the DRB.

G. DRB Report:

1. The DRB's recommendations for resolution of a dispute will be formalized in a written report with format as determined by the DRB and signed by all Board members. The report should consist of a concise description of the dispute, short statements of each party's position, findings as to the facts of the dispute, discussion and rationale for the recommendation(s), and the recommendation(s). The report shall be submitted concurrently to the parties, as soon as possible after completion of the hearing as agreed by all parties.

2. If the DRB cannot arrive at a unanimous report, the Board shall prepare minority findings and recommendation(s), which, together with the majority findings and recommendation(s) shall comprise the DRB report. The report shall identify the issues of disagreement, along with the reasons for disagreement.

3. Clarification:

a. Either party may request clarification of a report within 10 days following receipt of the report. Within a reasonable period of time, the DRB shall provide written clarification to both parties.

b. Requests for clarification shall be submitted in writing simultaneously to the DRB and to the other party.

c. Only one request for clarification per dispute from each party will be allowed.

4. Reconsideration:

a. Either party may request reconsideration of a report, within 10 days following receipt of the report, when new information is obtained or developed that was not known at the time of the hearing, or when, in the party's opinion, the DRB misunderstood or failed to consider pertinent facts of the dispute. Within a

reasonable period of time, the DRB shall provide written reconsideration to both parties.

b. Requests for reconsideration shall be submitted in writing simultaneously to the DRB and to the other party.

c. The Board will not entertain requests for reconsideration that amount to a renewal of prior argument or additional argument based on facts available at the time of the hearing.

d. Only one request for reconsideration per dispute from each party will be allowed.

5. Acceptance:

a. The District and the Contractor shall submit their written acceptance or rejection of the report concurrently to the other party and to the DRB within 14 days of receipt of the report or following receipt of responses to requests for clarification or reconsideration.

b. Failure by either party to accept or reject within the specified period shall be construed as acceptance of the report by that party.

c. Acceptance by the District of a report on entitlement only, or on entitlement with guidelines for quantum, does not obligate the District to any particular quantum amount.

H. Advisory Opinions:

1. An advisory opinion serves as a method for potentially avoiding a DRB hearing. It is not intended to replace the dispute resolution process specified herein, but may be implemented as part of the good faith negotiations conducted between the parties.

2. When mutually agreed by the District and the Contractor, the DRB may, at its discretion, provide an advisory opinion on any issue.

5.11. Escrow Bid Documents

A. When required by the Special Provisions, Escrow Bid Documents shall be prepared and submitted as specified herein.

5.11.01. Introduction

A. The Escrow Bid Documents shall include complete documentation of all backup information used in the preparation of the Contractor's bid prices for this Project, as described below. The Escrow Bid Documents of the successful bidder will be

held in escrow for the duration of the Contract or until all claims are resolved, whichever is later.

B. The Escrow Bid Documents are, and shall always remain, the property of the Contractor, subject to joint review by the District and Contractor, as provided herein.

C. The District stipulates and expressly acknowledges that the Escrow Bid Documents, as defined herein, constitute trade secrets.

1. This acknowledgement is based on the District's express understanding that the information contained in the Escrow Bid Documents is not known outside the bidder's business, is known only to a limited extent and by a limited number of employees of the bidder, is safeguarded while in the bidder's possession, and is extremely valuable to the bidder's competitors by virtue of its reflecting bidder's construction strategies, assumptions and intended means, methods, and techniques of construction.

2. The District acknowledges that the bidder expended substantial sums of money in developing the information included in the Escrow Bid Documents and further acknowledges that it would be difficult for a competitor to replicate the information contained therein.

3. The District further acknowledges that the Escrow Bid Documents and the information contained therein are being provided to District only because it is an express prerequisite to award of the Contract.

4. The District further acknowledges that the Escrow Bid Documents include a compilation of information used in the bidder's business, intended to give the bidder an opportunity to obtain an advantage over competitors who do not know or use the contents of such information.

5. The District further agrees to safeguard the Escrow Bid Documents against disclosure to the fullest extent permitted by law.

D. The successful bidder agrees, as a condition of award of the Contract, that the Escrow Bid Documents constitute all of the information used in the preparation of its bid for this work, and that no other bid preparation information shall be considered in resolving disputes or claims. The successful bidder also agrees that nothing in the Escrow Bid Documents shall change or modify the terms or conditions of the Contract Documents.

5.11.02. Purpose

A. The Escrow Bid Documents will be used solely to assist in the settlement of disputes and claims. They will not be used for pre-award evaluation of the Contractor's anticipated methods of construction nor to assess the Contractor's qualifications for performing the work.

5.11.03. Format and Contents

A. The bidders may submit the Escrow Bid Documents in their usual cost estimating format: a standard format is not required. However, sufficient detail shall be included to ensure that the Escrow Documents enable complete understanding and proper interpretation of their content.

B. The Escrow Bid Documents shall clearly itemize and separate the estimated cost of performing each bid item contained in the bid. Bid items should be separated into sub-items consistent with the Schedule of Values format to present a detailed cost estimate. Crews, equipment, estimated quantities, and the rate of production shall be detailed. Increments of cost shall include, but not be limited to, such items as direct labor, permanent materials, supplies, consumables, subcontracts, equipment charges, and allocations of overheads and profit. Plant, equipment, and indirect costs should be detailed. All costs included in the bid prices must be specifically identified and the methods of application described.

C. The Escrow Bid Documents shall include all quantity take-offs, calculations of rates of production and progress, copies of quotes from subcontractors and suppliers, and memoranda, narratives and all other information used by the bidder to arrive at the prices contained in its bid.

5.11.04. Submittal

A. The Escrow Bid Documents shall be submitted by the three apparent low bidders in a sealed container separate from their proposal no later than 8 A.M. on the first Monday, or Tuesday if Monday is a holiday, following the bid opening day. Each container shall be clearly marked on the outside with the bidder's name, date of submittal, project name, and the words "Escrow Documents."

B. The Escrow Bid Documents shall be accompanied by a separate certification, signed by an individual authorized by the bidder to execute the bidding proposal, stating that the material in the Escrow Documents constitutes all of the documentary information used in preparation of this bid, and that he/she has personally examined the contents of the Escrow Documents container and has found that the documents in the container are complete.

C. The Escrow Bid Documents of the apparent successful bidder will be opened and examined by an appointed member of the District in the presence of the bidder before the Contract is awarded. The apparent successful bidder and applicable subcontractors as stated in paragraph G below shall attend this examination.

D. This examination is to ensure that the Escrow Bid Documents are legible and complete. It will not include a review of, or constitute approval of, proposed construction methods, estimating assumptions or interpretations of Contract Documents. The examination will not alter any condition or term of the Contract. Should the examination indicate that any data is incomplete or missing, the bidder shall supply the missing information within 24 hours or such other time as is mutually agreeable.

E. The timely submittal of complete Escrow Bid Documents is an essential element of the bidding process and a prerequisite to contract award. Failure to provide the necessary Escrow Bid Documents will be sufficient cause for the District to reject the bid as non-responsive.

F. If the Contract is not awarded to the apparent successful bidder, the Escrow Bid Documents of the bidder next to be considered for award shall be processed as described above. The Escrow Bid Documents of the unsuccessful bidders will be held in escrow until such time that they are returned unopened upon execution of the Contract by the successful bidder.

G. If any bidder's proposal is based upon subcontracting any part of this work, each subcontractor, whose total subcontract price exceeds the percentage of the total bid price specified in the Special Provisions, shall provide separate Escrow Bid Documents to be included with those of the bidder. Such documents shall be opened and reviewed in the presence of the subcontractor only in the same manner and at the same time as the review described above for the apparent successful bidder.

H. It is the District's policy, in accordance with State law, that new subcontractors are not accepted after award. However, if the Contractor wishes to lawfully change a subcontractor or lawfully issue an additional subcontract for any portion of this work after award and the District grants a specific exception to this policy, the District retains the right to require the new subcontractor to submit Escrow Bid Documents before the new subcontract is approved.

5.11.05. Storage

A. Upon completion of the examination, receipt of the apparent successful bidder's Escrow Bid Documents will be acknowledged in writing by the District and the documents will be placed in escrow, for the life of the Contract, at an escrow firm within the greater Santa Clara County area chosen by the District. The District will pay for storage and maintenance of the Escrow Bid Documents.

5.11.06. Examination

A. The Escrow Bid Documents may be examined at any time deemed necessary by either the District or the Contractor in order to assist in the settlement of disputes and claims.

B. An examination of the Escrow Bid Documents is subject to the following conditions:

1. As trade secrets, the Escrow Bid Documents are proprietary and confidential.

2. The District and Contractor (and any subcontractor, to the extent Escrow Bid Documents are required by a subcontractor) shall each designate in writing to the other party and seven (7) days prior to any examination,

representatives who are authorized to examine the Escrow Bid Documents. With the consent of both the District and the Contractor, members of the Disputes Review Board may participate in the examination of the Escrow Bid Documents. No other person shall have access to the Escrow Bid Documents.

3. Access to the Escrow Bid Documents may take place only in the presence of a duly designated representative of both the District and Contractor. If the Contractor fails to designate a representative or appear for joint examination on seven (7) days notice, then the District representative may examine the Escrow Bid Documents upon an additional three (3) days notice.

5.11.07. Final Deposition

A. The Escrow Bid Documents will be returned to the Contractor after the work has been completed and accepted and all claims and disputes involving this work have been settled. The Contractor will thereupon be required to waive, in writing, any right to lodge further claims involving this work.

5.12. Partnering

5.12.01. Partnering Relationship

A. The District intends to encourage the foundation of a cohesive partnership with the Contractor and its principal subcontractors and suppliers for this Project, and will promote the formation of a partnering relationship with the Contractor in order to effectively complete the Contract to the benefits of both parties.

B. The purpose of the partnering relationship is to maintain a cooperative communication and to mutually resolve conflicts at the lowest responsible management level. It is intended to result in agreements which establish an environment of cooperation between all parties and will allow the Contract requirements to be achieved effectively and efficiently by both the Contractor and the District.

C. The Contractor may request the formation of such a partnering relationship by submitting a request in writing to the Engineer after approval of Contract. If the Contractor's request for partnering is approved by the Engineer, scheduling of a partnering workshop, selecting the partnering facilitator and workshop site, and other administrative details shall be as agreed by both parties.

5.12.02. Implementation

A. If approved, the partnering initiative is to be implemented prior to the preconstruction conference. The Contractor and the Engineer will initiate one two-day partnering development seminar/team building workshop prior to the preconstruction conference. A one-day partnering workshop will be held at every one to two months during construction, or as when needed, as determined by the

Engineer and Contractor. Both parties will make arrangements to determine attendees at the workshop, agenda of the workshop, duration, and location. Persons required to be in attendance will be the Engineer and/or the Engineer's authorized agents and key project personnel; the Contractor's authorized representative, on-site project manager and key project supervision personnel of both the prime and principal subcontractors and suppliers; and other personnel as deemed necessary by the District and Contractor.

B. The District will obtain and pay for the services of a partnering facilitator and a meeting room. All other costs associated with the partnering workshops will be borne separately by the party incurring the costs, such as wages and travel expenses, and no additional compensation will be allowed therefore.

C. The establishment of a partnering relationship will not change or modify the terms and conditions of the Contract and will not relieve either party of the legal requirements of the Contract.

5.13. Dust Control

During the performance of all work under this Contract, the Contractor shall assume all responsibility for dust control and shall furnish all labor, equipment, and means required to carry out proper and efficient measures wherever and whenever dust control is necessary to prevent operations from producing dust damage and nuisance to persons and property. Any claims resulting therefrom shall be borne solely by the Contractor.

5.14. Excavation Safety Plans

Attention is directed to Section 6705 of the Labor Code concerning trench excavation safety plans. Excavations five (5) feet or more in depth shall not begin until the Contractor has submitted and the Engineer has returned indicating ~~"In~~ Receipt Of" the Contractor's detailed plan for worker protection from the hazards of caving ground during such excavations. The plan may be reviewed by the Engineer for completeness in accordance with federal, state, and local regulations. The Engineer will not be responsible for reviewing the accuracy of assumptions, data and information used, and procedures contained in the plan or the adequacy thereof. Such plans shall show the details of the design of shoring, bracing, sloping, or other provisions to be made for worker protection during such excavation. The plan shall not allow the use of shoring, sloping, or a protective system less effective than that required by the Construction Safety Orders; and if such plan varies from the shoring system standards established by the Construction Safety Orders, the plan (including calculations) shall be prepared, signed and stamped by an Engineer registered as a Civil or Structural Engineer, and by an Engineer registered as a Geotechnical Engineer, in the State of California.

Such plans shall be accompanied by a copy of the Permit to Excavate that has been issued by the Division of Occupational Safety and Health as required by Labor Code Section 6500 and following.

This Article shall be applicable regardless of Contract price.

5.15. Asbestos-Related Work

The Contractor's attention is directed to Section 7058.5 of the Business and Professions Code which states that from and after January 1, 1987, no Contractor shall engage in asbestos-related work, as defined, who is not certified by the Contractor's State License Board to do so.

The Contractor's attention is also directed to Section 6501.5, and following, of the Labor Code relative to asbestos-related work and to provisions of the General Industry Safety Orders of Title 8 of the Code of Regulations and to the BAAQMD's Regulation 11, Rule 2.

5.16. Substitutions

If a specific means, method, technique, sequence, or procedure of construction is indicated in or required by the Contract Documents, the Contractor may furnish or utilize a substitute means, method, sequence, technique, or procedure of construction acceptable to the Engineer, if the Contractor submits sufficient information to allow the Engineer to determine that the substitute proposed is equivalent to that indicated or required by the Contract Documents.

The Engineer will respond in writing to the Contractor within 10 days indicating the time necessary to evaluate each proposed substitute. The Engineer will be the sole judge of acceptability, and no substitute will be ordered, installed, or utilized without the Engineer's prior written acceptance, which will be evidenced by either a change order or an approved shop drawing. The District may require the Contractor to furnish at the Contractor's expense a special performance guarantee or other surety with respect to any substitute.

The Engineer will record time required by the Engineer and the Engineer's consultants in evaluating substitutions proposed by the Contractor and in making changes in the Contract Documents occasioned thereby. Regardless of whether or not the Engineer accepts a proposed substitute, the Contractor shall reimburse the District for the charges of the Engineer and Engineer's consultants for evaluating each proposed substitute.

Cost or time impacts to other items of Contract work which are caused by any Contractor initiated request for substitution, whether anticipated or unforeseen, shall be the responsibility of the Contractor.

Contractor's attention is directed to Article 10.10 – Equal, Sole or Single Source, and Substitutions.

SECTION 6. LEGAL RELATIONS AND RESPONSIBILITY

6.01. Laws to be Observed

The Contractor shall remain informed of and in compliance with applicable existing and future federal, state, county, and municipal laws, ordinances, rules and regulations, including but not limited to, those cited herein.

6.02 Equal Opportunity Requirements

The Santa Clara Valley Water District is an equal opportunity employer and requires its contractors to have and adhere to a policy of equal opportunity and non-discrimination. In the performance of the Contract, the Contractor will comply with all applicable federal, state, local laws and regulations, and will not discriminate against any subcontractor, employee, or applicant for employment, in the recruitment, selection for training including apprenticeship, hiring, employment, utilization, promotion, layoff rates of pay, or other forms of compensation, or against any other person, on the basis of race, color, religion, ancestry, gender, national origin, age (over 40), marital status, medical condition (including cancer), pregnancy, parental status, the exercise of family care leave rights, political affiliation, sexual orientation, gender identity, special disabled veteran status, Vietnam Era veteran and all other Veteran status, or because of a physical or mental disability (including HIV and AIDS). The Contractor's policy must conform with applicable state and federal guidelines including the Federal Equal Opportunity Clause, ~~"~~Section 60-1.4 of Title 41, Part 60 of the Code of Federal Regulations," Title VII of the Civil Rights Act of 1964 as amended; the American's with Disabilities Act of 1990; the Rehabilitation Act of 1973 (sections 503 and 504); California Fair Employment and Housing Act (Government Code section 12900 et. Seq.); California Labor Code sections 1101and 1102.

6.03. Employment of Labor

In the employment of labor in the performance of the Contract, the District desires that the Contractor and all subcontractors shall, wherever possible, give first consideration to residents of the District.

6.04. Prevailing Wages

A. The Work to be performed pursuant to this contract is ~~"~~public works" subject to California Labor Code Section 1771, et. seq. and the applicable implementing regulations. The General Prevailing Wage Rates issued by the California Department of Industrial Relations may be adjusted by the State during the term of this contract. Notwithstanding any other provisions of this Contract, Contractor will not be entitled to any adjustment in compensation in the event there are adjustments to the General Prevailing Wage Rates.

In accordance with provisions of Section 1773 of the Labor Code, the Director of the Department of Industrial Relations has ascertained the general prevailing rate of wages and employer payments for health and welfare, pension, vacation, and similar purposes available to the particular craft, classification, or type of workers employed on the work. These rates are set forth in the latest determination

obtained from the Director, which is on file in the office of the Clerk of the Board of Directors and incorporated herein by reference the same as though set out in full. The rates are also available on the State of California Department of Industrial Relations website at http://www.dir.ca.gov.

The Contractor shall forfeit as a penalty to the District, $50 for each day, or portion thereof, for each worker paid less than the stipulated prevailing rates for any public work done under the Contract by the Contractor or by any subcontractor in violation of the provisions of the Labor Code, particularly Sections 1770 through 1780, inclusive.

B. Each contractor and subcontractor shall keep an accurate payroll record, showing the name, address, Social Security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee by him or her in connection with the public work. The payroll records shall be certified and shall be available for inspection at all reasonable hours at the principal office of the Contractor in accordance with the provisions of Section 1776 of the Labor Code.

Contractor and each Subcontractor must, pursuant to California labor Code §1776, submit a certified weekly payroll within ten (10) Days after the Owner's request for submission of certified weekly payroll records. The certified payroll must include the date of actual payment of wages for each worker employed on the project and a breakdown of each payment including all fringe benefits included in such wage for each worker.

Pursuant to California labor code §1776, in the event that the Contractor fails to comply with the 10-day submission deadline, the contractor must forfeit twenty-five dollars ($25) for each calendar day, or portion thereof, of each worker, until strict compliance is effectuated.

The Contractor shall inform the District of the location of the payroll records, including the street address, city, and county, and shall, within 5 working days, provide a notice of a change in location and address. The responsibility for compliance with payroll record requirements imposed by said Section 1776 of the Labor Code is on the prime Contractor.

C. The Contractor must submit certified weekly payroll(s) in support of the monthly request for payment as required in Article 8.03. Certified weekly payroll(s) must be submitted within 10 calendar days from the progress payment end date. Payroll(s) shall contain the full name, address, and Social Security number of each employee, his or her correct classification, rate of pay, daily and weekly number of hours worked, itemized deductions made, and actual wages paid. They shall also indicate apprentices and ratio of apprentices to journeymen. The employee's address and Social Security number need only appear on the first payroll on which his or her name appears. The payroll shall be accompanied by a "Statement of Compliance" signed by the employer or agent indicating that the payrolls are correct and complete and that the wage rates contained therein are

not less than those required by the Contract. The –Statement of Compliance" shall be on forms furnished by the District or on any form with identical wording. The Contractor shall be responsible for the submission of copies of payrolls of all subcontractors.

The District will take all actions reasonably necessary to enforce the prevailing wage requirements of this contract including retaining progress payment funds not supported by certified payroll(s).

Retentions for failure to submit satisfactory payrolls are in addition to all other retentions provided for in the Contract.

D. The Contractor and each subcontractor shall preserve their respective payroll records for a period of 4 years from the date of filing a Notice of Completion and Acceptance under the Contract.

The work of installing, assembling, repairing or reconditioning, or other work of any nature on machinery, equipment, or tools used in or upon the work, is considered a part of the work to be performed under the Contract and any laborers, workers, or mechanics working on such machinery, equipment, or tools, are subject to all of the requirements relating to labor set forth in the Contract.

The construction, erection, and operation of material production, proportioning, or mixing plants from which material is used wholly on the Contract or on contracts under the supervision of the District, shall be considered a part of the work to be performed under the Contract and any laborers, workers, or mechanics working on such plants shall be subject to all of the requirements relating to labor set forth in the Contract.

6.05. Hours of Labor

Eight hours' labor constitutes a legal day's work. The Contractor shall forfeit as a penalty to the District, $25 for each worker employed in the execution of the Contract by the Contractor or by any subcontractor for each day during which such worker is required or permitted to labor more than 8 hours in violation of Labor Code Sections 1810 to 1815, inclusive, except as provided for under Labor Code Section 1815.

6.06. Apprentices

The Contractor's attention is directed to the provisions in Sections 1777.5, 1777.6, and 1777.7 of the Labor Code concerning the employment of apprentices by the Contractor or any subcontractor.

Section 1777.5 requires the Contractor or subcontractor employing persons, as defined, in any apprenticeable occupation to apply to the joint apprenticeship committee which is nearest the site of the public works project and which administers the apprenticeship program in that trade for a certificate of approval. The certificate will also fix the ratio of apprentices to journeymen that will be used in the performance of the Contract. The

ratio of work performed by apprentices to journeymen in such cases shall not be less than 1 hour to 5 hours, except when the committee finds that any one of the following conditions is met:

A. In the event unemployment for the previous 3-month period in the project site area exceeds an average of 15 percent, or

B. In the event the number of apprentices in training in such area exceeds a ratio of 1 to 5, or

C. If there is a showing that the apprenticeable craft or trade is replacing at least one-thirtieth of its journeymen annually through apprenticeship training, either (1) on a statewide basis, or (2) on a local basis, or

D. If assignment of an apprentice to any work performed under a public works contract would create a condition which would jeopardize his/her life or the life, safety, or property of fellow employees or the public at large, or if the specific task to which the apprentice is to be assigned is of such a nature that training cannot be provided by a journeyman.

The Contractor is required to make contributions to funds established for the administration of apprenticeship programs if the Contractor employs registered apprentices or journeymen in any apprenticeable trade on such contracts and if other contractors on the public works site are making such contributions.

The Contractor and any subcontractor shall comply with the requirements of Sections 1777.5 and 1777.6 in the employment of apprentices.

Information relative to apprenticeship standards, wage schedules, and other requirements may be obtained from the Director of Industrial Relations, ex officio the Administrator of Apprenticeship, San Francisco, California, or from the Division of Apprenticeship Standards and its branch offices.

6.07. Permits and Licenses

The Contractor shall procure all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the prosecution of the work, except as provided in the Special Provisions.

6.08. Patents and Copyrights

The Contractor shall assume all costs including any costs of defense arising from the use of any copyrighted composition, secret process, patented or unpatented invention, article, equipment, device, or appliance manufactured, furnished, or used in the performance of the Contract, including their use by the District, unless otherwise specifically stipulated in the Specifications.

6.09. Public Safety

The Contractor shall be solely and completely responsible for conditions of the jobsite including safety of all persons and property during the performance of the work, except from District's sole negligence or intentional misconduct. Contractor's compliance with this requirement is not limited to normal working hours.

At all times the Contractor shall provide for public safety and convenience. The Contractor's operations shall be conducted so as to offer the least possible obstruction and inconvenience to the public along with the greatest safety to the public. At no time shall the Contractor have more work underway than can be prosecuted with proper regard to these considerations to the public.

The Contractor shall furnish, erect, and maintain such fences, barriers, lights, and signs and provide such flagging and guards as are necessary in the opinion of the Engineer or public agency having jurisdiction, to give adequate warning to the public of the construction and of any dangerous condition to be encountered as a result thereof.

6.10. Accident Prevention

The Contractor shall comply with the California Occupational Safety and Health Act (Labor Code Section 6300 et seq.) and Title 8 of the Code of Regulations, and will also take, or cause to be taken, such additional measures as may be necessary for the prevention of accidents.

Prior to commencement of work the Contractor shall (1) submit proposals in writing for effectuating provisions for accident prevention, and (2) meet in conference with the Engineer to discuss and develop mutual understandings relative to administration of an overall safety program.

During the performance of work under the Contract, the Contractor shall institute controls and procedures for the control and safety of persons visiting the jobsite.

The Contractor shall maintain an accurate record of, and shall report to the Engineer in writing, exposure data and all accidents resulting in death, traumatic injury, occupational disease, or damage to property, materials, supplies, or equipment incident to work performed under the Contract.

The Engineer will notify the Contractor of any noncompliance with the foregoing provisions. The Contractor shall, after receipt of such notice, immediately take corrective action. If the Contractor fails or refuses to comply immediately, the matter will be referred to the proper authority. No part of the time lost due to any stop order issued by proper authority shall be made the subject or claim for extension of time or for extra costs or damages by the Contractor.

Compliance with the provisions of this Article by subcontractors will be the responsibility of the Contractor.

6.11. Explosives and Stream Pollution

When the use of explosives is necessary for the prosecution of the work, the Contractor shall not endanger life or property.

All explosives shall be stored in accordance with the provisions of Division XI of the Health and Safety Code and applicable county and city ordinances.

Attention is called to the necessity of obtaining a permit from the Department of Fish and Game of the State of California in advance of use of underwater explosives. Attention is directed to the Fish and Game Code relating to stream pollution, particularly Section 5650.

6.12. Fires

The Contractor shall obtain any necessary fire permits from the properly constituted authority and comply with all regulations of the BAAQMD.

6.13. Interference With Fire Hydrants, Highways, and Fences

The Contractor shall conduct operations as not to close or obstruct any portion of any highway, road, or street, or prevent in any way free access to fire hydrants until permits have been obtained therefor from the proper authorities. If any highway required to be kept open shall be rendered unsafe by the Contractor's operations, the Contractor shall make such repairs or provide such temporary guards as shall be acceptable to the authorities having jurisdiction and to the Engineer. Any highway or street maintenance or repair work required by local authorities in connection with necessary operations under the Contract shall be performed by the Contractor at the Contractor's own cost and expense. Fences subject to interference shall be maintained as effective barriers consistent with the original intent but, upon approval of the Engineer, they may be moved or rearranged to facilitate prosecution of the work until the work is finished, after which they shall be restored to their original location in an equal or better condition that existed prior to rearrangement.

6.14. Preservation of Property

Due care shall be exercised to avoid damage to existing improvements, utility facilities, and adjacent property, real and personal. The fact that any existing underground improvement or facility is not shown on the Drawings shall not relieve the Contractor of responsibility to ascertain the existence of any underground improvement or facility which may be subject to damage by reason of the Contractor's operations.

Any damage to improvements or property, whether above or below the ground, private or public, within or adjacent to the project limits, arising from, or in consequence of, the performance of the Contract shall be repaired at once by the Contractor. If the Engineer requires such repair to be made prior to the execution or continued performance of any part of the work included in this Contract, the Engineer will so notify the Contractor who shall delay or discontinue the performance of that part of the work until the necessary

repair has been made. Such delay shall not be considered unavoidable, and no extension of time for completion of the Contract will be allowed therefor.

When ordered by the Engineer to make any such repair, the Contractor shall start work thereon within four (4) hours and shall prosecute the same with diligence to completion. Upon failure of the Contractor to so comply with such order, or upon the Contractor's failure to make immediate emergency repairs reasonably determined by the Engineer to be necessary in the best interests of the public, the Engineer shall have authority to cause such repair to be made and to deduct the costs thereof from any money due, or which may become due, the Contractor.

In an emergency affecting the safety of life or property including adjoining property, the Contractor shall act to prevent, to the extent possible, such threatened loss or injury, whether or not instructed to do so by the Engineer.

6.15. Contractor's Responsibility for Work

Until the formal acceptance of the work, the Contractor shall have the charge and care of the work and of the materials to be used therein, and shall bear the risk of injury, loss, or damage to any part thereof by the action of the elements or from any other cause, whether arising from the execution or from the nonexecution of the work. The materials to be used in the work include both those furnished by the District and those furnished by the Contractor, including materials for which the Contractor has received partial payment as provided in Article 8.03.

6.16. Indemnification

The Contractor shall defend, indemnify and save harmless the District and its Directors, officers, employees, and agents from liability, loss, suits, actions, or claims brought for or on account of violation of laws, ordinances, rules or regulations, or injury, damage, or loss including death caused by acts or omissions of the Contractor, its employees, or agents.

6.17. Contractor's Insurance

6.17.01. General

No Contract between the parties is formed until all insurance required by this Article has been obtained and such insurance and insurers have been approved by the District. The insurance procured by Contractor for the benefit of Santa Clara Valley Water District shall not be deemed to release or limit any liability of Contractor. Damages recoverable by Santa Clara Valley Water District for any liability of Contractor shall, in any event, not be limited by the amount of the required insurance coverage. Any delay in the commencement of work beyond the date of the first chargeable day in the Notice to Begin Work, caused by the Contractor's failure to comply with the insurance requirements specified in these Specifications, is the responsibility of the Contractor. Failure by the Contractor to maintain all required insurance at all times during the performance of this Contract, and until acceptance by the District, shall, at the discretion of the District, result in temporary suspension of work in accordance with Article 7.05

and shall not be a basis for a time extension. Contractor's insurance shall be primary with respect to any other insurance which may be carried by Santa Clara Valley Water District.

The District has the right to require Contractor to provide complete, certified copies of all required pertinent insurance policies, including endorsements affecting the coverage required by the Agreement.

The specific insurance requirements and coverages shall be in accordance with the Special Provisions.

6.17.02. Insurance on Work and Materials

The Contractor shall secure and maintain such direct damage insurance against such perils as the Contractor may deem necessary to protect the work called for in this Contract, including work completed, material in place or to be used in the performance of this Contract, and such other miscellaneous items as may be necessary to the performance of this Contract.

6.18. Payment of Taxes

Except as otherwise specifically provided in the Special Provisions, the Contract prices shall include full compensation for all current and future taxes which the Contractor is required to pay, whether imposed by federal, state, or local government, and no tax exemption certificate or any other document designed to exempt the Contractor from payment of tax will be furnished to the Contractor by the District.

6.19. Cooperation With Others

The District reserves the right to do other work on or near the project. The Contractor shall cooperate with others and conduct work so as to facilitate work by the District or others and prevent delay, additional expense, or hindrance thereto. The Contractor shall request from, and exchange with others, Drawings, data, and information as necessary to insure proper completion of the project and work of others. The Contractor shall furnish copies of correspondence and Drawings exchanged with other contractors to the Engineer.

The Contractor shall conduct, adjust, correct, and coordinate work with work of others so that the project shall be free of defects.

6.20. Property Rights in Materials

Nothing in the Contract shall be construed as vesting in the Contractor any right of property in the materials used after they have been attached or affixed to the work or the soil, or after payment has been made for 90 percent of the value of materials delivered to the site of the work, whether or not they have been so attached or affixed. All such materials shall become the property of the District upon being so attached or affixed or

upon payment of such 90 percent of the value of materials delivered by the Contractor on the ground and not used, as provided in Article 8.03.

6.21. Rights in Land and Improvements

Nothing in these Specifications shall be construed as allowing the Contractor to make any arrangements with any person to permit occupancy or use of any land, structure, or building within the limits of the Contract for any purpose whatsoever, either with or without compensation, in conflict with any agreement between the District and any owner, former owner, or tenant of such land, structure, or building.

6.22. Title to Materials Found on the Work

The title to all water and to the right to the use of all water, to all soil, stone, gravel, sand, minerals, and all other materials developed or obtained in the excavation or other operations by the Contractor or any subcontractor, or any of their employees, and the right to use or dispose of the same, are hereby expressly reserved by the District, and neither the Contractor, nor any subcontractor, nor any of their employees shall have any right, title, or interest in, or to any part thereof; neither shall they, nor any of them, assert or make any claim thereto. The Contractor may be permitted to use in the work, without charge, any such materials which meet the requirements of these Specifications.

6.23. Trespass

The Contractor shall be responsible for all damage or injury which may be caused on any property by trespass by the Contractor, any subcontractor, or their employees in the course of their employment, whether the said trespass was committed with or without the consent or knowledge of the Contractor.

6.24. Subcontracting

The Contractor shall comply with Subletting and Subcontracting Fair Practices Act commencing with Section 4100 of the Public Contract Code. Violations shall subject Contractor to penalties described in the Act.

In accordance with Section 4107 of the Public Contract Code, the Designated Engineer is an authorized officer to act for the Board for the purposes of consenting to a substitute subcontractor.

6.25. Tunnel Construction Safety

Attention is directed to Labor Code Sections 7950 and following, concerning tunnel safety. The Contractor shall notify the Division of Occupational Safety and Health and the Engineer before any initial construction may be started at any tunnels. A prejob safety conference, to be arranged for by the Contractor, shall be held for all underground operations. The Engineer shall be notified of the time and place of such conference. The tunnel classification prepared by the Division of Occupational Safety and Health shall be prominently posted at the site by the Contractor. The District will obtain this

classification prior to the request for bids, whenever possible, and make it available to the Contractor.

6.26. Assignment of Antitrust Claims

Sections 4550 through 4554 of the Government Code pertaining to the assignment of antitrust claims are incorporated herein in full by this reference.

6.27. Burial Sites

Pursuant to Ordinance Code Section B6-18 of the County of Santa Clara and requirements of Public Resources Code Section 5097.94 and Health and Safety Code Section 7050.5, upon discovering or unearthing any burial site as evidenced by human skeletal remains, the person making such discovery shall immediately notify the County Coroner. The Contractor shall also notify the Engineer. The Contractor shall immediately secure the site and protect any human remains from further disturbance.

Upon determination by the County Coroner that the remains are Native American, the Coroner will contact the California Native American Heritage Commission and the County Coordinator of Indian Affairs. No further excavation or disturbance within 30 feet of the site or of any nearby area reasonably suspected to overlie adjacent remains may be made except as authorized by the California Native American Heritage Commission and/or the County Coordinator of Indian Affairs.

The Contractor is advised that if burials are encountered, it may be necessary to suspend work on the project in order to comply with the above requirements. Payment for a delay of more than 1 working day for each occurrence will be made in accordance with Article 5.04 and Article 5.05.

6.28. Delay Due to Archeological Discovery

The Contractor is advised that if archeological artifacts are encountered, it may be necessary to suspend work on the project in order to comply with this Article.

Work in areas where artifacts are found shall be restricted or stopped as directed by the Engineer until proper protocols are met.

Work at the location of the find shall halt immediately within 30 feet of the find. If an archaeologist is not present at the time of the discovery, the Engineer will contact an archaeologist for identification and evaluation pursuant to Section 21083.2 of the Public Resources Code, Section 15126.4 of the California Code of Regulations (California Environmental Quality Act [CEQA] Guidelines), and the mitigation measures of the project CEQA document. If the archaeologist determines that the artifact is not significant, the Engineer will authorize the Contractor to resume construction.

If the archaeologist determines that the artifact is significant, the archaeologist will determine if the artifact can be avoided and, if so, will detail avoidance procedures. The Contractor shall comply with these avoidance procedures.

If the artifact cannot be avoided, the archaeologist will develop within 48 hours an Action Plan which will include provisions to minimize impacts and, if required, a Data Recovery Plan for recovery of artifacts in accordance with Public Resources Code Section 21083.2 and Section 15126.4 of the CEQA Guidelines.

The Contractor shall delay work until the Action Plan and, if required, the Data Recovery Plan, are approved by the Engineer. Once the Action Plan and the Data Recovery Plan are approved, the Contractor shall comply with the requirements of these plans.

Payment for a delay of more than 1 working day for each occurrence will be made in accordance with Article 5.04 and 5.05.

6.29. Noise Pollution and Vibration

A. The Contractor shall be responsible for ensuring that noise produced by construction activities does not exceed the applicable local noise ordinance standards and is in compliance with the performance standards set forth in the Special Provisions.

B. At a minimum, the Contractor shall exercise precautionary measures listed below. Installation of these measures shall in no way relieve the Contractor of the responsibility of compliance with the noise criteria.

1. Air compressors and internal combustion engines shall be in good operating condition that meet or exceed original factory specifications and shall be equipped with high-grade mufflers, air-inlet silencers, where appropriate, and noise suppressers.

2. All mobile or fixed noise producing machinery and equipment, including ~~p~~package" equipment such as fans, cranes, arc-welders, air compressors, electrical operators and the like, shall be suitably housed, enclosed, shielded, equipped with noise control features, or muffled to meet the noise limits specified in the Special Provisions.

3. All mobile or fixed noise producing equipment used by the Contractor that is regulated for noise output by local, state, or federal law shall comply with such regulation while in use. This shall include vehicles licensed for use on public highways.

4. Electrically-powered equipment instead of pneumatic or internal combustion powered equipment shall be used, where feasible.

5. The use of noise-producing signals, including horns, whistles, alarms, and bells shall be for safety warning and emergency purposes only.

6. No music system including personal or vehicle radio, tape, or CD players or the like shall be audible at the Project right of way line.

7. Trucks or other mobile equipment shall not use engine decompression (~~J~~ake Brakes") for deceleration on grades, where feasible.

C. The Contractor shall take all necessary precautions during its operations to limit peak particle velocities from vibratory compaction or percussion equipment so that they do not become a public nuisance or result in property damage.

D. Any equipment causing incompliance with the noise or vibration criteria shall be removed from the job site as directed by the Engineer.

6.30. Air Pollution

A. Attention is directed to the BAAQMD and California Air Resources Board regulations. No burning will be allowed on this Project. Idling of internal combustion engines shall be held to an absolute minimum. All vehicles with internal combustion engines shall be fitted with spark arresters.

B. Rapid-cure cutback asphalt shall not be used in accordance with BAAQMD, Regulations 8, Rule 15.

C. Asbestos-containing serpentine material, as defined in the BAAQMD, Regulations 11, Rule 14, and 17 CCR 93106, shall not be used for surfacing.

D. Except as provided by law, idling of heavy duty diesel trucks with gross vehicular weight ratings of greater than 10,000 pounds shall be no more than 5 minutes per 13 CCR 2485.

6.31. Spillage and Dust

A. Care shall be taken to prevent spillage when hauling is done. Spillage resulting from hauling operations along or across any public traveled way shall be removed immediately by the Contractor. The Contractor shall pay all expenses for removal of spillage.

B. Dust nuisances originating from the Contractor's operations either inside or outside the right of way shall be controlled at the expense of the Contractor in accordance with Article 5.10.

C. The Contractor shall provide all necessary precautionary measures to control dust and to prevent spillage on public traveled ways. At a minimum, the Contractor shall provide the measures listed below. Implementation of these measures shall in no way relieve the Contractor of the responsibility to comply with these Specifications.

1. Active maintenance areas, unpaved access roads, and staging areas shall be kept sufficiently moist, and watered as necessary, or shall be applied with non-toxic soil stabilizers, to control dust generation.

2. Trucks hauling sediments and other loose material shall be covered and shall maintain at least 6 inches of freeboard.

3. Tailgates of trucks shall be sealed.

4. If deemed necessary, trucks shall be brushed down before leaving the site.

5. Paved site access roads shall be swept using vacuum powered street sweepers when visible soil material is carried onto the roadway.

6. Water the excavation and grading activity during high winds, or suspend the activity, if necessary, to control dust.

7. Inactive areas shall be sprayed with soil stabilizer or seeded to avoid erosion or dust.

8. Exposed stockpiles shall be watered, enclosed, covered, or sprayed with soil stabilizers.

9. Traffic speeds within the project right of way shall be limited to 15 mph. For off-site restriction, comply with local agencies' requirements.

10. Sandbags or other bank protections shall be installed to prevent silt runoff to roadways.

D. Contractor shall immediately remedy any spillage and dust nuisance or deficiency arising from, or in consequence of Contractor's failure to perform the work specified in these Specifications.

E. Upon the Contractor's failure to make timely remedies determined by the Engineer to be necessary and in the best interests of the public, the Engineer may employ private or public work forces and equipment to perform the work. The actual cost of employing such forces and equipment shall be doubled and then subtracted from the monies due, or that may become due, the Contractor. Such action(s) taken by the Engineer shall not preclude the District from taking other actions as deemed appropriate, and shall not relieve the Contractor of responsibility to comply with these Specifications.

6.32. Traffic Control

A. Traffic control shall consist of all work and materials necessary to maintain safe vehicular, pedestrian, and cyclist traffic during construction and to perform "best management practices" to mitigate high peak and high volume construction traffic, prevent idling and queuing, establish site access limitations and mitigation

measures, identify haul routes, and provide overall control of all construction traffic entering and exiting and operating within the project site.

B. All traffic control work shall be performed in accordance with the requirements of the local agency having jurisdiction and the State Specifications. If required, the Contractor shall prepare a traffic control plan in accordance with these Specifications, and submit to the Engineer and the local agency having jurisdiction for review in advance of the work at the site.

C. The Contractor shall cooperate with the local agency having jurisdiction relative to handling traffic around the construction area. The Contractor shall make his/her own arrangements relative to keeping the working area clear of parked vehicles to maintain sight visibility and access to adjacent properties. Existing road signs shall not be blocked at any time.

D. Truck traffic and haul routes shall be in compliance with local permits and ordinances. The Contractor shall obtain, at Contractor's expense, any required ―Haul Route Permit" from the local authority having jurisdiction for transporting to and from the project site construction materials and disposal of surplus materials.

E. The Contractor shall conduct his/her operations and schedule cleanups to cause the least possible obstruction and inconvenience to traffic, pedestrians, cyclists, and adjacent property owners.

F. Damage done by the Contractor during the course of his/her work to adjacent city, town, county, or private property shall be repaired or replaced in kind and as directed by the Engineer.

G. Personal vehicles of the Contractor's employees, and the Contractor's equipment and vehicles shall not be parked on the traveled way, shoulders, medians or lanes which have not been approved for closure, at any time. When entering or leaving roadways carrying public traffic, the Contractor's equipment, whether empty or loaded, shall in all cases yield to public traffic and shall travel in the direction of the traffic. Flaggers and traffic signs may be required to control this activity. No driveways or private roads shall be blocked. Safe access must be maintained for pedestrian traffic throughout the work areas at all times.

H. Those parts of public streets, rights of way, and sidewalks that are occupied by the Contractor shall be immediately vacated by him/her and returned to public use when his/her use thereof is no longer necessary for the construction work.

I. Attention is directed to Section 7-1.08, ―Public Convenience"; Section 7-1.09, ―Public Safety," and Section 12, ―Construction Area Traffic Control Devices," of the State Specifications and Article 6.09, ―Public Safety," of these Standard Provisions Specifications. Nothing in these Specifications shall be construed as relieving the Contractor from his/her responsibility as provided in said Section 7-1.09, ―Public Safety," of the State Specifications.

J. The Contractor shall coordinate with the appropriate local agencies having jurisdiction to receive their approval in the event any temporary lane closures on public streets are needed for the Contractor's operation. Any such traffic signing and flaggers as approved by the local agencies for said lane closure shall be in place prior to closing the lane to traffic.

6.33. Water Quality

A. The Contractor shall meet all applicable regulatory requirements to ensure that any discharges to surface waters will not cause violation to the State water quality objectives or violation of regulatory permits issued by regulatory agencies.

B. The Contactor shall prevent water quality degradation of water bodies and/or storm drains. Water quality is measured in terms of pollution substances, turbidity, dissolved oxygen, pH, and temperature.

C. Oily, greasy, or sediment laden substances or other materials that originate from the Contractor's operation and may degrade the quality of surface water or adversely affect aquatic life, fish, or wildlife shall not be allowed to enter, or be placed where they may later enter, any reservoir, river, creek, or stream.

D. The Contractor shall comply with the requirements of the following permits, where applicable, as specified in the Special Provisions:

1. State Water Resources Control Board (SWRCB) National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities.

2. U.S. Army Corps of Engineers CWA Section 404 Permit and Regional Water Quality Control Board/State Water Resources Control Board CWA Section 401 Water Quality Certification.

3. Other individual RWQCB NPDES Permits.

4. Department of Fish and Game 1602 Stream Bed Alteration Agreement.

6.34. Regulated Material Management

A. Regulated material includes, but not be limited to, hazardous material and hazardous waste.

B. The Contractor is responsible, and shall obtain all required permits and pay all fees and taxes, for satisfying the requirements of any regulatory agency for the storage, monitoring, usage, transportation, safety, reporting, or any other requirements regarding the management of regulated materials on and off the project site(s).

C. The Contractor shall not allow regulated materials to spill on District property or easements or other public or private right of way. Any spillage of regulated

materials resulting from the Contractor's operation shall be removed immediately by the Contractor at the Contractor's expense.

D. The Contractor shall immediately notify the Engineer of any potentially hazardous materials or hazardous waste encountered at the work site and shall take all necessary action to prevent exposure of personnel until all material is identified and proper action can be taken.

6.34.01. Storage of Regulated Materials

A. Prior to the storage or use of any regulated materials, the Contractor shall submit to the Engineer a "Regulated Materials Storage and Use Plan" (Plan). The Plan shall include: an inventory of all regulated materials to be stored or used at the project site (which equals or exceeds any of the following separate material phases: 55 gallons liquid, 200 cubic feet of compressed gas, or 500 lbs. solid); the maximum quantity of materials to be stored; the purpose of the materials; the MSDS for each material; a detailed description of how the materials will be stored (including secondary containment where required by applicable regulatory agencies); a site plan drawn to scale; storage area maps drawn to scale; a detailed description of how the materials will be monitored; a detailed description of how wastes from the materials will be stored and/or disposed; and a detailed description of the procedures to be followed in the event of an uncontrolled release of the regulated materials.

B. The Plan shall be submitted to the Engineer for review, in accordance with Article 9.02, and acceptance at least 30 days prior to the storage or use of any regulated materials. The Plan shall be updated and submitted to the Engineer by the Contractor upon the addition of new regulated material not listed previously or a 100 percent (or greater) increase in quantity of a regulated material which is listed in the Plan.

6.34.02. Regulated Material Discharges or Releases

A. The Contractor is responsible for all discarded or abandoned material, including regulated materials and hazardous wastes, generated as a result of the Contractor's operations unless specifically noted otherwise in these Specifications. The Contractor's attention is directed to Article 5.06.

B. In the event of a discharge or release of a regulated material from the Contractor's operation, the Contractor is responsible for notifying the proper authorities, providing containment of the material, identifying the contaminants, investigating the extent of all contaminants, removing contaminated materials, disposing of contaminated materials, and verifying the removal of all contaminated materials. These activities shall be performed to the satisfaction of the Engineer at the Contractor's cost. The Contractor shall perform any work and provide any and all documentation required by the District and federal, state, and local agencies. The Contractor shall provide copies of all correspondence and reports related to these activities to the Engineer. All work performed to

accomplish these activities shall be in accordance with federal, state, and local regulations.

C. In the event of a discharge or release of regulated material, the Contractor shall notify the Engineer immediately. Immediate notifications may be verbal. The Contractor shall submit a detailed written report to the Engineer within 24 hours of the discharge or release. The written report shall include: a description of events leading to the discharge or release; action taken to prevent or control the discharge or release; a description of the discharge or release; the quantity of material discharged or released; method used to determine quantity discharged or released; type of material discharged or released; MSDS for the material(s) involved; a description of the area affected by the discharge or release; agencies notified and date and time of notification; and status of the cleanup. The report shall also include the proposed investigation, cleanup, and verification sampling activities.

D. All expenses incurred by the Contractor as a result of or to remedy the discharge or release of regulated materials shall be borne solely by the Contractor and no additional compensation will be made therefor. The Contractor shall be responsible for signing the Nonhazardous Waste Manifests and the Hazardous Waste Manifests and paying the State Superfund fees, the generator's fees, and other costs of disposal of these wastes unless specifically stated otherwise in these Specifications. The Contractor shall be identified as the owner and generator of the wastes associated with unauthorized releases or discharges.

6.34.03. Hazardous Waste

A. The Contractor shall manage the hazardous wastes generated from this operation in accordance with the Specifications below:

1. Labeling: The Contractor shall completely fill out and affix a ―Hazardous Waste" label to each hazardous waste container for the Contractor's operations. Each ―Hazardous Waste" label shall contain, at a minimum, the word ―HAZARDOUS WASTE," information on the generator (i.e., name, address, phone number), EPA identification number for the waste stream, EPA, and/or California waste code, waste accumulation starting date, identification, and content of the waste, the physical state of the waste (i.e., solid or liquid), and the hazardous property (i.e., flammable, toxic, corrosive, reactive, or other). If the primary container is placed inside a secondary container, then the Contractor shall also prepare and affix another ―Hazardous Waste" label on the secondary container.

2. Secondary Containment: The Contractor shall provide appropriate secondary containment for all storage areas for hazardous materials and hazardous wastes. In the case of an installation with one primary container, the secondary containment shall contain at least 110 percent of the volume of the primary container. In the case of an installation with multiple primary containers, the secondary containment shall contain 150 percent of the volume of the largest container or 10 percent of the

aggregate internal volume of all primary containers in the storage facility—whichever amount is greater. If the storage facility or storage system is open to rainfall, then the secondary containment must be able to additionally accommodate the volume of a 24-hour rainfall as determined by a 25-year storm history.

3. Accumulation Time Limit: The Contractor shall properly haul and dispose of all hazardous waste within 90 days from the accumulation starting date identified on each ~~"~~Hazardous Waste" label or on the completion date of the Contract—whichever event comes first. The waste accumulation starting date for each waste stream begins when a first drop of the waste is placed in the container.

4. Hauling and Disposal of Waste: The Contractor shall be responsible for using appropriate hazardous waste haulers and disposing of all hazardous wastes in accordance with local, state, and federal regulations.

B. Waste Manifests: No later than 15 days after Contractor's request for final inspection, the Contractor shall submit copies of all Hazardous Waste Manifests signed by disposal facilities and certificates of disposal, to prove that Contractor has legally disposed such materials. Submit four (4) copies of each manifest.

6.35. Non-Regulated Materials

A. Non-regulated materials are any substance that is not required by any federal, state, or local regulations to have special management, storage, disposal or handling practices.

B. Non-regulated materials may be disposed at state-permitted, non-hazardous waste landfills.

C. For non-regulated material to be reused, or disposed on site or at a site other than a state-permitted landfill, the Contractor must obtain all required permits, agency approvals, property owner agreements, and pay all fees and taxes for all services and materials required in conjunction with the management, transportation, disposal and reuse of non-regulated materials.

6.35.01. Disposal at Other Than State-Permitted Landfills

A. The Contractor shall enter into an agreement with property owner, prior to disposal of materials, and submit a copy thereof to the Engineer, conveying a written consent from the property owner receiving the materials, providing:

1. A written authorization from property owner to accept materials at duly noting quantities, types of materials (soils, debris, etc.), and disposal property location address;

2 A written release from the property owner fully absolving the Santa Clara Valley Water District from any and all responsibility and legal liability

towards any damage to life, and environment in connection with the disposal of the materials on the property.

B. The Contractor shall provide:

1. Copies of all applicable regulatory agency permits, approvals, licenses, and environmental clearances;

2. Site-specific health and ecological risk assessment and/or compliance with applicable regulatory agency regulations or guidelines, including but not limited to the Environmental Screening Levels per the latest guidelines from San Francisco Bay Regional Water Quality Control Board (SFBRWQCB);

3. Copies of documentation of communication made by Contractor with appropriate regulatory agencies on evaluation of regulatory requirements and regulatory agency approvals for disposal of materials;

4. Copies of laboratory testing reports, if any, for the materials to be disposed.

C. Within 15 days after disposal of materials at property location, the Contractor shall submit an acknowledgement, duly signed by property owner, certifying date of receipt of materials including quantity and types of materials (soils, debris, etc.) received, to prove that Contractor has disposed materials at the location designated in the agreement.

D. Waste Manifests: No later than 15 days after Contractor's request for final inspection, the Contractor must submit copies of all Non-Hazardous Waste Manifests signed by disposal facilities and certificates of disposal, to prove that Contractor has legally disposed such materials. Submit four (4) copies of each manifest.

6.36. Imported Earthfill Material

A. The Contractor shall not import earthfill material that is contaminated with regulated materials.

B. If imported earthfill materials are, or are found to be, contaminated by regulated materials, the Contractor shall immediately remove the contaminated material and dispose of it in accordance with all applicable laws, ordinances, and regulations; conduct necessary sampling and monitoring to verify that all contaminated material has been removed; and verify to the satisfaction of the Engineer and/or appropriate regulatory agencies that any surrounding areas, materials, soils, or waters have not been impacted by the contaminated materials. The subsequent disposal of the contaminated material shall be the responsibility of the Contractor. No compensation will be made to the Contractor by the District for removal, disposal, replacement, chemical analysis, or any other

costs associated with the removal, disposal, and replacement of the contaminated material.

C. For each imported earthfill material to be used on the Project, the Contractor shall submit to the Engineer for review and acceptance, in accordance with Articles 9.02 and 19.01, an "Imported Materials Certification Form." Copies of the form are available from the Engineer. If the imported earthfill materials are to be obtained from more than one source, the Contractor shall submit a separate form for each source of earthfill material. This form shall be submitted for review and acceptance at least 30 days prior to the delivery of the earthfill material to the construction site.

D. The Engineer may obtain soil samples from the site and test them to monitor Contractor's compliance with these provisions.

6.37. Migratory Birds, Other Wildlife and Fish Species

A. The Contractor shall comply with all applicable federal and state laws, rules and regulations related to protection of migratory birds. The Contractor's attention is directed to the federal Migratory Bird Treaty Act (16 USC 703-712 50 CFR Part 21 and 50 CFR Part 10), and the California Department of Fish and Game Code Sections 2000, 3503, 3503.5, 3513, and 3800, that protect migratory birds, their nests, and their eggs from disturbance or destruction.

B. The Contractor shall ensure that birds are not allowed to nest in areas that may be impacted by the Project and shall not harm, or allow to be harmed, any migratory birds per provisions of all applicable statutes.

C. The contractor shall comply with all regulatory and permit requirements pertaining to other wildlife and fish species with the potential to occur within the project area.

6.38. Good Neighbor Requirements

A. The District is a public entity which takes seriously its responsibility to be a "Good Neighbor." Accordingly, the District seeks to perform its activities, including construction of its facilities, in a manner that takes into consideration the needs of the neighborhood, and is minimally disruptive.

B. The Contractor hereby acknowledges the critical importance of meeting the Contract requirements as set forth in these Specifications regarding the "good neighbor requirements", which include, but not be limited to: public safety, working hours, noise pollution and vibration, air pollution, spillage and dust, traffic control, parking restrictions, and storm water pollution.

C. The Contractor agrees to adhere to the above "good neighbor requirements" which relate to the lessening of the impact which the work being performed under this Contract, might otherwise have upon the surrounding neighbors. The Contractor acknowledges that its responsibility to observe the restrictions of this

Contract relating to the above requirements is significant, critical, and a material provision of this Contract. Therefore any breach of any applicable provision related to these requirements constitutes a material breach of this Contract which shall give rise to the right on the part of the District to immediately terminate this Contract, without any further showing of cause.

D. No decision, action or inaction on the part of the District with respect to one such violation may be deemed to be a waiver of any remedy available to the District in the event of any other violation of the provisions of this Contract, including the right to terminate this Contract at any time and at any stage of the work should a material breach occur.

SECTION 7. PROSECUTION AND PROGRESS OF WORK

7.01. Assignment

The performance of the Contract may not be assigned except upon the written consent of the Board of Directors. Consent will not be given to any proposed assignment which would relieve the original Contractor or surety of their responsibilities under the Contract.

The Contractor may assign moneys due, or to become due under the Contract, and such assignment will be recognized by the District, if given proper notice thereof, to the extent permitted by law, but any assignment of moneys shall be subject to all proper setoffs in favor of the District and to all deductions provided for in the Contract and particularly all money withheld, whether assigned or not, shall be subject to being used by the District for the completion of the work in the event that the Contractor should be in default therein.

7.02. Notice to Begin Work

The Notice to Begin Work will be issued by the Designated Engineer within 10 days after receipt of the signed Agreement, and approval by District of the Contract Bonds and insurance documents. Reference is made to Article 4.04.

7.03. Commencement of Work

The Contractor shall not begin work until receipt from the District of the Notice to Begin Work, and shall, upon receiving Notice, begin work within the time specified in the notice. The time specified in said Notice will allow a period of at least 10 days after the date of said Notice for commencement of work. After receipt of said Notice, the Contractor shall diligently prosecute the Work to completion. The Contractor shall provide, at least 24 hours in advance, written notice to the Engineer of the Contractor's intention to start Work and specify the date on which the Contractor intends to start.

7.04. Work Progress Schedule

If required by the Special Provisions, the bidder to whom the Contract is awarded shall, prior to execution of the Contract, submit a practicable work schedule to the Engineer, showing the order and dates within which the Contractor proposes to carry out the work.

If required by the Engineer, the Contractor shall submit supplementary work progress schedules to indicate approximately the percentage of work scheduled for completion at any time.

The progress schedule and supplementary progress schedules submitted shall be consistent, in all respects, with the time requirements of the Contract.

7.05. Temporary Suspension of Work

By written order to the Contractor, the Engineer may suspend the work wholly or in part for an indefinite period, or for such period as the Engineer may deem necessary, for any of the following reasons:

A. Weather conditions or other conditions which are unfavorable for the proper prosecution of the work;

B. Failure of the Contractor to carry out orders given or to perform any provisions of the Contract; or

C. The convenience and benefit of the District.

Such suspension shall be effective upon receipt by the Contractor of the written order suspending the work and shall be terminated upon receipt by the Contractor of the written order terminating the suspension.

If, under authority of (A) or (C) above, the Engineer orders a suspension of all or a portion of the work which is the current controlling operation, it will be cause for a time extension if it affects the controlling item of work.

7.06. Liquidated Damages

In case all the work called for under the Contract in all parts and requirements is not finished or completed within the number of days as set forth in the Special Provisions, it is agreed that damage will be sustained by the District, and that it is and will be impracticable and extremely difficult to ascertain and determine the actual damage which the District will sustain in the event of and by reason of such delay; and it is, therefore, agreed that the Contractor will pay to the District the sum set forth in the Special Provisions per day for each and every day's delay in finishing the work in excess of the number of days prescribed; and the Contractor agrees to pay said liquidated damages herein provided for, and further agrees that the District may deduct the amount thereof from any moneys due, or that may become due, to the Contractor under the Contract.

7.07. Termination of Control

Failure to supply an adequate working force or material of proper quality, or in any other respect to prosecute the work with the diligence and force specified by the Contract, is grounds for termination of the Contractor's control over the work and for taking over the work by the District.

7.08. Termination of Contract

The District may terminate the Contract at any time upon a determination that the same is in the best interests of the District. Upon such termination, the rights, duties, and obligations of the parties shall be as stated in Section 8-1.11 of the State Specifications, wherein the words "Director" and "Engineer" shall mean the Engineer, and the words "State" and "Department" shall mean District.

7.09. Contractor's Cost Data

The District or any of its duly authorized representatives shall, until the expiration of 4 years after filing the Notice of Completion and Acceptance under this Contract or any

subcontract under it, have access to and the right to examine any of the Contractor's or subcontractor's payrolls, records of personnel, invoices of materials, records of plant and equipment costs, and any and all other directly pertinent books, documents, papers, and records of such Contractor or subcontractors, involving transactions related to said Contract or subcontracts. In the event State or Federal funds are involved in the financing of the project, the State or Federal Government shall have the same rights of inspection as the District.

7.10. Coordination With Utilities

In general, the location of existing utility facilities as shown on the Drawings is approximate. This information has been obtained from utility maps furnished by the various agencies involved, and the District does not guarantee either the correctness of locations or the extent of such locations.

Service laterals, such as house sanitary, water, electrical, gas, cable TV, storm or telephone cables, or appurtenances, may not all be shown on the Drawings. Section 4215 of the California Government Code does not require public agencies to indicate the presence of service laterals or appurtenances whenever the presence of such utilities can be inferred from the presence of other visible facilities, such as buildings, meter boxes, or junction boxes, on or adjacent to the construction site. No changes in the Contract price or Contract time will be made due to the presence of unidentified or incorrectly located service laterals or appurtenances. It shall be the responsibility of the Contractor to ascertain the exact location of the utility facilities.

Unless otherwise indicated on the Drawings or specified in the Specifications, the Contractor shall maintain in service all utilities including house services, power, lighting, and telephone conduits, and any other surface or subsurface structure or facility of any nature that may be affected by the work; provided, however, that the Contractor, for convenience, may arrange with the owner to temporarily disconnect house service lines or other facilities along the line of the work. The cost of disconnecting and restoring such utilities shall be borne by the Contractor.

In the event that a main or trunk line utility facility is encountered which interferes with the work and is neither shown on the Drawings nor specified in the Specifications, the Contractor shall immediately notify the District in writing. The District will either have the appropriate utility company or public agency relocate the facility, or the District will direct the Contractor to relocate the facility in accordance with Article 5.03, Change in Work.

In the event that a main or trunk line utility facility is encountered which interferes with the work and which the Contractor believes is not shown on the Drawings or indicated in the Specifications with reasonable accuracy, the Contractor shall immediately notify the District in writing. Reasonable accuracy is defined as being within the tolerances noted on the Drawings. If the Engineer determines that the main or trunk line utility facility was shown on the Drawings or indicated in the Specifications with reasonable accuracy, the Contractor shall be solely responsible for relocation or removal, and no additional time will be granted nor will additional compensation be made for any additional work required. If the Engineer determines that the main or trunk line utility facility was not shown on the Drawings or indicated in the Specifications with reasonable accuracy, the

District will either have the appropriate utility company or public agency relocate the facility, or the District will direct the Contractor to relocate the facility in accordance with Article 5.03, Change in Work.

When a delay in the completion of the project is caused by the failure of the District or the owner of a utility facility to provide for removal or relocation of existing main or trunk line utility facilities which are not shown on the Drawings or indicated in the Specifications, or which are not shown on the Drawings or indicated in the Specifications with reasonable accuracy, the Contract time will be extended in accordance with Article 5.05, Change of Contract Time.

SECTION 8. MEASUREMENT AND PAYMENT

8.01. Measurement of Quantities

All work except work based on time and materials will be paid for at a contract price per unit of measurement and will be measured by the Engineer in accordance with the United States Standard Measures. Unless otherwise specifically provided, the Engineer will compute quantities by a method which, in the Engineer's opinion, is best suited to obtain an accurate determination. The weights of metalwork, pipe, and other metal parts to be paid for on the basis of weight, will be determined by the Engineer. The District will not provide scales for weighing material. The Engineer will determine the weight of each part or item in the most practicable manner and will use for that purpose manufacturer's weights, or in their absence, catalog weights or estimated weights, in that order; provided, that weights of nonmetallic coatings will be excluded.

8.02. Deductions From Payments

The District may, at its option and at any time, retain out of any amounts due the Contractor, sums sufficient to cover claims, filed pursuant to Section 3179 et seq. of the Civil Code.

8.03. Progress Payment

On the 25th of each month, the Contractor will prepare and submit to the District an estimate in writing of the total amount of work done; an estimate of the acceptable materials furnished and delivered by the Contractor to the jobsite and not used up to the date of such estimate, and the value thereof. The Contractor must also submit the certified weekly payroll(s) for the pay estimate period in accordance with Article 6.04.C. Each progress pay request is to include payment for work completed up to and including the 25th of the month. Acceptable materials shall be those materials which will become a part of the finished construction work. The basis for partial payments of lump sum or other unit Contract items will be determined by agreement between the Engineer and the Contractor.

Payment requests shall be submitted on an approved Contractor Monthly Progress Pay Estimate Summary sheet. The pay request submitted by the contractor shall contain a source document which provides back-up information on how the estimate was prepared. A source document is defined as the basic document used to record or calculate quantities. The source document must contain the appropriate Contract Bid Item, the location of the installation, the necessary measurement and/or calculations, and the name of the person preparing the document. Before any partial payment or the final payment is made, the Contractor shall submit satisfactory evidence that the Contractor is not delinquent in payments to employees or creditors (for example, subcontractors, suppliers, etc.) for labor and materials incorporated into the work. Request for payment of work performed on extra work shall be accompanied by the Daily Extra Work Report Form FC204w. The form shall be signed by both the District inspector and the contractor's representative.

A. Upon receipt of a payment request, the District shall review the payment request for the purpose of determining that the payment request is a proper payment request.

Any payment request determined not to be a proper payment request suitable for payment shall be returned to the Contractor no later than seven days, after receipt. A payment request returned pursuant to this paragraph shall be accompanied by a letter citing the reasons why the payment request is not proper. The following are examples of an improper payment request:

1. The item of work requested to be paid was not performed.

2. The work being requested to be paid has already been paid in previous Progress Pay Estimates.

3. The work performed and requested to be paid was not done in accordance with the contract (non-compliance).

4. The quality of the finished product is unacceptable.

5. The source documentation is inaccurate.

6. The Daily Extra Work Reports (for extra work) are not properly filled out.

B. If the District fails to make any progress payment within 30 days after receipt of an undisputed and properly submitted payment request from the Contractor, the District shall pay interest to the Contractor equivalent to the legal rate set forth in subdivision (a) of Section 685.010 of the Code of Civil Procedure.

C. The number of days available to the District to make a payment without incurring interest pursuant to this section shall be reduced by the number of days by which the District exceeds the seven-day return requirement set forth in paragraph A.

The District shall retain 10 percent of such estimated value of work done and 10 percent of the value of the materials so estimated to have been furnished and delivered and unused as aforesaid, and shall pay to the Contractor, while carrying on the work, the balance not retained as aforesaid, after deducting therefrom all previous payments and all sums to be kept or retained under the provisions of the Contract. However, at any time after 50 percent of the work has been completed, the contractor may request in writing that progress payments be made in full and no further retainage withheld. If the District finds that satisfactory progress has been made, the District may make any remaining progress payments in full for actual work completed, or may withhold any amount up to 10 percent thereof, as the District may find appropriate, based on the contractor's progress. No such estimate or payment shall be required to be made when, in the judgment of the Engineer, the work is not proceeding in accordance with the provisions of the Contract, or when, in the Engineer's judgment, the total value of the work done since the last estimate amounts to less than $1,000. No such estimate or payment shall be considered to be an acceptance of any defective work or improper materials. All progress estimates and payments shall be subject to correction in the final estimate.

At the request of the Contractor, the District will permit the substitution of securities or certificates of deposit equivalent to the amount of any monies withheld by the District as

above provided. The deposit shall, in that event, be with the District, or with a state or federal chartered bank in California as the escrow agent.

Alternatively, on written request of the Contractor, the District will make payments of the retention as it is earned directly to the escrow agent.

D. The Contractor shall bear the expense of the District and the escrow agent in connection with the escrow deposit made.

E. Securities or certificates of deposit to be placed in escrow shall be subject to approval of the District and, unless otherwise permitted by the escrow agreement, shall be of a value of at least equivalent to the amounts of retention to be paid to the Contractor pursuant to this Section.

F. When the District makes payment of retentions directly to the escrow agent, the Contractor may direct, subject to approval of the District, the investment of the payments into securities.

G. The Contractor shall enter into an escrow agreement satisfactory to the District, which agreement shall be substantially similar to that specified in Section 22300 of the Public Contract Code.

H. The Contractor shall obtain the written consent of the surety to such agreement.

8.04. Final Payment

As soon as practicable after completion of the work, the Engineer will prepare in writing and furnish to the Contractor the final estimate of the quantities of work done and all payments due under the Contract, which estimate will show deductions for prior payments and any other amounts to be retained under Article 8.02. The amount determined due, less the amount retained, will be paid. This retained amount will not be due or payable until 35 days after the completion of the work and the filing of Notice of Completion and Acceptance in the manner provided by law, and until after the Contractor has furnished the District a release of all claims by the Contractor against the District arising by virtue of this Contract, except such claims in definite amounts as the Contractor may specifically exempt from the operation of the release and the furnishing of any guaranty required by Article 3.11.

8.05. Scope of Payment

Payment for all items of work at the unit or lump sum price shall be considered as full compensation for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the item of work, and no additional allowance will be made therefor. Payment for items of work which are called for in the Specifications or shown on the Drawings but which are not separately identified in the Proposal form shall be compensated as part of the bid price of one or more of the items which are listed, and no additional allowance will be made therefor.

8.06. Acceptance of Final Payment Constitutes Release

Acceptance by the Contractor of final payment constitutes and shall be a release by the Contractor of all claims against the District, except disputed contract claims in stated amounts specifically excepted in writing.

SECTION 9. CONTROL OF WORK

9.01. Authority of Engineer

The Engineer shall decide all questions which may arise as to the quality or acceptability of materials furnished and work performed and rate of progress of the work, all questions which may arise as to the interpretation of the Drawings and Specifications, and all questions as to the acceptable fulfillment of the Contract on the part of the Contractor. The Engineer's decision shall be final. The Engineer shall have authority to enforce and make effective such decisions and orders which the Contractor fails to carry out promptly.

9.02. Submittals to be Furnished by the Contractor

The Drawings listed in the Specifications shall be supplemented by the Contractor with such submittals as may be required for the prosecution of the work and approval of equipment. Submittals may include shop detail drawings, fabrication drawings, falsework and formwork drawings, pipe layouts, and similar classes of drawings, calculations, specifications, product data, samples, manuals, spare parts, photographs, survey data, schedules, or similar items required to be submitted to the Engineer by the Contract Documents. These submittals shall be favorably reviewed by the Engineer before any work involving these submittals is performed. No change shall be made by the Contractor to any submittal after it has been favorably reviewed by the Engineer. Submittals shall contain all required detailed information at a reasonable scale with enough views to clearly show the work to be done or the item to be furnished, and shall be properly checked.

It is expressly understood, however, that Engineer's review of the Contractor's submittals shall not relieve the Contractor of any responsibility for accuracy of dimensions and details, or for mutual agreement of dimensions and details. The Contractor shall be solely responsible for agreement and conformity of submittals with the Contract Drawings and Specifications.

The sequence of submission of submittals shall be such that all information is available to the Engineer for review of each submittal as it is received. Five copies of each submittal shall be submitted. For submittals that require Engineer's review , one copy will be returned to the Contractor marked "No Exceptions," "Make Corrections as Noted," "Revise and Resubmit," or "Rejected" within 20 days after receipt. The Contractor shall make any necessary corrections and revisions to returned submittals and shall resubmit the submittals within 20 days after receipt. For items that are required to be submitted to the Engineer but which do not require review , one copy will be returned to the Contractor marked "In Receipt Of." The Contractor is responsible for furnishing submittals in sufficient time for approval action, including resubmittal, without delaying construction.

If a returned submittal is required to be resubmitted more than once due to Contractor's failure to comply with submittal requirements, the Contractor may be charged all costs associated with re-review of the submittal. The charges may be deducted from progress payment due or become due to the Contractor and shall be based on actual review hours recorded by the Engineer. The hourly rate of the Engineer, and/or Engineer's

consultant, shall be the actual wages times a multiplier specified in the Special Provisions.

9.02.01. Submittal Requirements

A. All submittals shall be clearly identified by reference to the Project name, specification section, article, paragraph, drawing number or detail as applicable. Submittals shall be well-organized, and shall be clear and legible and of sufficient size for clear presentation of data. Data submitted shall describe the materials, equipment, or other items to be furnished and, where applicable, the system in sufficient detail to indicate full compliance with the requirements of these Contract Documents.

B. All submittals shall be in the English language and customary American units (feet, inches, pounds, degrees Fahrenheit, etc.) Metric units may be provided in addition to customary American units.

C. All submittals and supporting data, catalogs, schedules, etc., shall be submitted as the instruments of the Contractor, who shall be responsible for their accuracy, completeness, coordination and conformance with the Contract Documents. These submittals may be prepared by the Contractor, subcontractors, or suppliers, but the Contractor shall review and ascertain that submittals meet all of the requirements of the Contract Documents, while conforming to structural, space and access conditions at the point of installation prior to submission to the Engineer. Designation of work ~~by~~ others," if shown in submittals, shall mean that the work will be the responsibility of the Contractor rather than the subcontractor of supplier who prepared these submittals. The Contractor shall ensure that there is no conflict with other submittals. The Contractor shall ensure coordination of submittals among the related crafts and subcontractors.

D. If the submittals show any deviations from the Contract requirements, the Contractor shall include with the submittal a separate written description of such deviations and the reasons therefor. The Engineer will respond in writing within 10 days indicating the time necessary to evaluate the deviations. If any deviations from the Contract requirements are not clearly noted and prominently identified on the submittal, the review of the submittal shall not constitute acceptance of such deviations.

E. The Contractor shall check all submittals before submitting them to the Engineer and shall certify on each transmittal letter and on each submittal that the submittal has been checked, is in compliance with the Contract Documents except as specifically noted, and that each deviation from the Contract Documents is specifically noted.

F. Submittals shall include:

1. A separate transmittal form shall be used for each specific item, class of material, equipment, and items specified in separate, discrete Specification Sections or Articles, for which a submittal is required.

Submittal documents common to more than one piece of equipment shall be identified with all the appropriate equipment numbers. Submittals for various items shall be made with a single form when the items taken together constitute a manufacturer's package or are so functionally related that expediency indicates checking or review of the group or package as a whole. The Specification Section or Article to which the submittal is related shall be indicated on the transmittal form.

2. A sequential number, in chronological order, shall be assigned for each submittal and shall be noted on the transmittal form. Submittal numbers shall have the following format: ~~"X~~XX.Y"; where ~~"X~~XX" is the sequential number (001 to 999) assigned by the Contractor, ~~"Y~~" is the resubmittal number (1 to 9). For each item submitted, the Contractor shall include the applicable Article number on the submittal and on the transmittal form.

3. A separate written description of deviations from the Contract Documents, if any.

4. The date of submission and the dates of any previous submissions.

5. The Project title and number.

6. Contractor identification.

7. The names of (as applicable):

   a. Subcontractor

   b. Supplier

   c. Manufacturer

8. Identification of the product, with the Specification Section or Article number, page and paragraph(s).

9. Field dimensions, clearly identified as such.

10. Relation to adjacent or critical features of the work or materials.

11. Applicable standards, such as ASTM.

12. Identification of revisions on resubmittals.

G. All resubmittals shall be accompanied by a memorandum or letter from the Contractor that responds to each written review comment provided by the Engineer in the previous submittal. Each response shall describe the corrective action taken or reason for Contractor's actions.

9.02.02. Submittal Review Procedures

A. Review of submittals has as its primary objective the completion of the work in full conformance with the Contract Documents, unmarred by field corrections, and within the construction time provided. In addition to this primary objective, submittal review as a secondary objective will assist the Contractor in its procurement of equipment that will meet all requirements of the Contract Documents, will fit the structures detailed on the Drawings, will be completed with respect to piping, electrical, and control connections, will have the proper functional characteristics, and will become an integral part of a complete operating facility.

B. The review of shop drawings, product data, and samples will be for general conformance with the design concept and Contract Documents. They shall not be construed:

1. as permitting any deviation from or non-compliance with the Contract requirements;

2. as relieving the Contractor of responsibility for any errors, including details, dimensions, and materials;

3. as approving departures from details furnished by the Engineer, except as otherwise provided herein.

C. The Contractor remains responsible for details and accuracy, for coordinating the work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.

D. If the Contractor submits an incomplete submittal, the submittal will be considered ―Rejected" and will be returned to the Contractor without review except that the Engineer may, at Engineer's sole discretion, elect to provide a list of, or mark the submittal indicating, some or all of the areas that are incomplete. A complete submittal shall contain sufficient data to demonstrate that the items comply with the Contract Documents; shall meet the minimum requirements for submissions cited in the technical specifications; and shall include any necessary revisions required for equipment other than first named manufacturer. The Engineer's determination whether a submittal is complete shall be final.

E. After review by the Engineer of each of the Contractor's submissions, the material will be returned to the Contractor with actions defined as follows.

1. NO EXCEPTIONS NOTED

The favorable review of submittal is subject to its compatibility with future submissions and additional partial submissions for portions of the work not covered in this submission. It does not constitute approval or deletion

of specified or required items not shown in the partial submission. The Contractor may proceed with the work shown in the submittal.

2. MAKE CORRECTIONS AS NOTED

   Same as 1, except that minor corrections as noted shall be made by the Contractor. Contractor may proceed with the work providing corrections have been made. Resubmission is not required.

3. REVISE AND RESUBMIT

   Rejected because of major inconsistencies or errors which shall be resolved or corrected by the Contractor prior to subsequent resubmission. The Contractor may not proceed with the work shown in the submittal.

4. REJECTED

   Submitted material does not conform to Drawings and Specifications in major respect., i.e.: wrong size, model, capacity, or material. The Contractor may not proceed with the work shown in the submittal.

5. IN RECEIPT OF

   The submittal does not require review by the Engineer.

F. Resubmittals will be processed in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention, in writing on the letter of transmittal and on resubmitted shop drawings by use of revision triangles or other similar methods, to revisions from previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the Contractor and if any such revisions are installed, all portions thereof that do not fully conform to the Contract Documents shall be corrected by the Contractor at its expense as required by the Engineer.

G. The favorable review of submittals (returned ―No Exceptions Noted” or ―Make Corrections as Noted”) shall be obtained from the Engineer prior to the fabrication, delivery, and construction of items requiring submittals.

H. The favorable review of all submittals (returned ―No Exceptions Noted” or ―Make Corrections as Noted”) shall apply in general design only and shall in no way relieve the Contractor for responsibility for errors or omissions contained therein. Favorable review shall not relieve the Contractor of its obligation to meet safety requirements and all other requirements of laws, nor constitute a change order authorization. Favorable review will not constitute acceptance by the District of any responsibility for the accuracy, coordination, and completeness of the submittals or the items of equipment represented on the submittals.

9.03. Drawings and Data to be Furnished by the District

The District may issue supplemental Drawings for the construction work under the Contract. These Drawings will show additional details as required for construction purposes. Installation instructions for District-furnished materials will be furnished if required.

9.04. Superintendence

The Contractor shall designate, in writing before starting work, an authorized representative who shall have complete authority to represent and act for the Contractor. Said authorized representative of the Contractor shall normally be present at the site of the work at all times while work is actually in progress on the Contract. During any period when work is suspended, arrangements acceptable to the Engineer shall be made for any emergency work which may be required.

Whenever the Contractor or an authorized representative is not present on any part of the work where it may be desired to give direction, orders will be given by the Engineer, which shall be received and obeyed by the superintendent who may have charge of the particular work in reference to which the orders are given. Any order given by the Engineer, not otherwise required by the Specifications to be in writing, will, on request of the Contractor, be given or confirmed by the Engineer in writing.

The Contractor shall designate, in writing, the names and telephone numbers of at least three representatives who could be contacted at any time in the event that an emergency occurs.

9.05. Character of Workers

Any subcontractor, or person employed by the Contractor or subcontractor, who fails or refuses to carry out the directions of the Engineer, or appears to the Engineer to be incompetent or to act in a disorderly or improper manner, shall be removed from the work immediately on the written request of the Engineer, and such person shall not again be employed on the work.

9.06. Layout of Work and Surveys

The Engineer will establish lines and grades required for proper execution of the work. The Contractor shall, without additional cost to the District, give such assistance and provide such drill holes, forms, ladders, spikes, nails, and lights as may be required by the Engineer in layout of work and surveys. The Contractor shall adjust construction operations at such points and for such reasonable time as may be necessary to assist in the layout of work and surveys.

The District will provide only the minimum of survey crew services essential to orderly performance of the work, and District survey crews will not be available at all times for the work under these Specifications.

When the Contractor requires stakes or marks, the Engineer shall be notified of such requirements a reasonable length of time in advance of starting operations that require such stakes or marks. In no event shall a notice of less than 5 working days be considered a reasonable length of time.

Where construction operations require removal of the District's stakes or other survey marks, the Contractor shall reference such points in an approved manner. Survey stakes or marks established by the District shall be preserved by the Contractor until their removal is authorized, and in case of their unauthorized destruction or removal by the Contractor's forces, they will be replaced at the Contractor's expense. Any cost to the District of replacing survey stakes or marks will be deducted from payments due the Contractor. Such cost will include a reasonable charge for use of District supplies, labor and equipment, plus overhead.

9.07. Inspection

The Engineer shall at all times have access to the work during its construction, and shall be furnished with every reasonable facility for ascertaining that the materials and the quality of performance are in accordance with the requirements and intentions of the Drawings and Specifications. All work done and all materials furnished shall be subject to the Engineer's inspection and approval.

The day-to-day inspection performed by the various inspectors employed by the District shall not constitute approval or ratification of work improperly done by the Contractor. The Engineer is the only person authorized to recommend acceptance or rejection of work and materials.

The presence or absence of an inspector during performance of the work shall not relieve the Contractor of any obligation to fulfill the Contract. It shall be the duty of the Contractor to see that all provisions are complied with in detail, irrespective of the inspection given the work during its progress by the Engineer or representatives of the Engineer. Any plan or method suggested to the Contractor by the Engineer or an inspector, but not specified or required, if adopted or followed in whole or in part, shall be used at the risk and responsibility of the Contractor; and the District and the Engineer will assume no responsibility therefor.

Should it be considered necessary or advisable by the District at any time before acceptance of the entire work to make an examination of work already completed by removing or tearing out same, the Contractor shall, on request, promptly furnish all necessary facilities, labor, and material. If such work is found to be defective or nonconforming in any material respect, due to the fault of the Contractor or subcontractors, the Contractor shall defray all the expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, an equitable adjustment shall be made in the Contract price to compensate the Contractor for the additional services involved in such examination and reconstruction and, if completion of the work has been delayed thereby, the Contractor shall, in addition, be granted a suitable extension of time.

Projects financed in whole or part with federal or state funds shall be subject to inspection at all times by the federal or state agency involved.

No portion of any work, installed materials, products, or equipment, shall be covered or concealed in any manner without first being inspected by the Engineer. Whenever the Contractor is ready to backfill, bury, cast-in-concrete, hide, or otherwise cover any work under this Contract, the Contractor shall notify the Engineer not less than one Work Day in advance to request inspection before beginning any such work of covering. Failure of the Contractor to notify the Engineer at least one Work Day in advance of any such inspections shall be reasonable cause for the Engineer to order a sufficient delay in the Contractor's schedule to allow time for such inspection. If any work, materials, products, or equipment is covered prior to inspection or the express approval of the Engineer, that work, materials, products, or equipment shall be uncovered at no additional cost to the District. All associated costs, including its impact on other portions of the work, shall be borne by the Contractor.

The Contractor shall not conceal any part of the work until record drawing information has been taken and recorded by the Contractor.

The Engineer, at District's cost, may attend scheduled off-site plants for inspection of equipment, materials, or software to be incorporated into the work. Should such inspection attended by Engineer be delayed, the Contractor shall reimburse the District for the actual salary costs of Engineer times the overhead rate specified in the Special Provisions and the actual cost of other direct costs incurred due to the inspection delay.

The Contractor shall accommodate inspection at the place of origin of materials, product, and equipment if specified or requested by the Engineer.

The Contractor shall provide safe passage and access for inspection of the work in any area. Off-site storage areas and warehouse facilities are also subject to inspection if payment for any equipment or materials stored at these locations is claimed for progress payment.

9.08. Defective and Unauthorized Works

All work which has been rejected shall be remedied or removed and replaced by the Contractor in an acceptable manner at no additional cost to the District.

Payment will not be made for any work done beyond the lines and grades shown on the Drawings or established by the Engineer, or any extra work done without written authority, and such work will be considered as unauthorized. Work so done may be ordered remedied, removed, or replaced.

If the Contractor should fail to comply promptly with any order of the Engineer made under the provisions of this Article, the Engineer may cause rejected or unauthorized work to be remedied, removed, or replaced, and the costs thereof to be deducted from any moneys due or to become due the Contractor.

9.09. Construction Equipment and Plant

The Contractor shall provide and use construction equipment and plant capable of producing the quality and quantity of work required. Construction equipment shall be identified by readily visible numbers. If ordered, Contractor shall remove unsatisfactory construction equipment and discontinue the operation of unsatisfactory plants.

9.10. Final Inspection and Acceptance of Work

When the work authorized by the Contract has been completed, the Engineer will make the final inspection. If the Engineer determines that the work has been completed, in accordance with the Contract, the Engineer will recommend that the work be accepted. The Contractor will be relieved of the responsibility imposed by Article 6.15 on the date of acceptance.

9.11. Use Prior to Acceptance

The District may take possession of, and use, all or part of the project prior to acceptance.

SECTION 10. CONTROL OF MATERIALS AND INSTALLED EQUIPMENT

10.01. Furnishing and Quality of Materials and Equipment

Contractor shall furnish materials and equipment as specified.

Only materials and equipment conforming to the requirements of the Contract shall be incorporated in the project. Except as otherwise specified or approved, materials and equipment shall be new and unused.

10.02. Source of Materials and Equipment

The Contractor shall furnish a list of sources of materials and equipment to the Engineer on a District form in sufficient time to permit proper inspection and testing of materials and equipment in advance of their use. Inspection and tests will be made and reports rendered, but it is understood that such inspections and tests shall not be considered as a guarantee of acceptance of any material or equipment which may be delivered later for incorporation in the work. No equipment or materials which, after approval, have in any way become unfit for use, shall be used in the work.

At the option of the Engineer, the source of supply of each of the materials shall be approved before the delivery is started. All materials proposed for use may be inspected or tested at any time during their preparation and use. After trial, if it is found that sources of supply which appeared satisfactory do not furnish a uniform product, or if the product from any source proves unacceptable at any time, the Contractor shall furnish approved material from other sources.

10.03. Product Data and Samples

The Contractor shall submit five copies of approval data for materials and equipment proposed for installation. Approval data shall consist of complete material and equipment lists accompanied by catalog data sheets, cuts, performance curves, diagrams, or similar descriptive material. Material and equipment lists shall give, in each case, the name of the manufacturer, trade name, catalog reference, size, finish, and all other pertinent data. It is intended that approval data should not include such materials as small pipe and small pipe fittings, conduit and conduit fittings, or tubing. The Contractor shall furnish operation and maintenance manuals or instructions if required by the Special Provisions.

The Contractor shall furnish without charge such samples as may be required.

10.04. Storage of Materials and Equipment

Materials and equipment shall be so stored as to ensure the preservation of their quality and fitness for the work. They shall be placed under cover when necessary and shall be stored in a manner that will facilitate prompt inspection.

10.05. Defective Materials

All materials not conforming to the requirements of the Contract shall be considered as defective and all such materials shall be rejected, whether in place or not. They shall be removed immediately from the site of the work, unless otherwise permitted by the Engineer. No rejected material, the defects of which have been subsequently corrected, shall be used unless approval in writing has been given by the Engineer. If the Contractor should fail to comply promptly with any order of the Engineer made under the provisions of this Article, the Engineer may cause defective materials to be removed and replaced, and the costs thereof to be deducted from moneys due, or to become due, the Contractor.

10.06. Trade Names and Alternatives

For convenience in designation on the Drawings or in the Specifications, certain equipment or materials to be incorporated in the work may be designated under a trade name, or the name of a manufacturer, and catalog information followed by the words ~~or~~ equal."

Whenever the Drawings or Specifications allow the use of alternative equipment or materials, the burden of proof as to the comparative quality or suitability of alternative equipment or materials shall be upon the Contractor who shall furnish, at the Contractor's own expense, three (3) copies of the complete description, information, and performance data showing the equality of the materials or equipment offered to those specified, and such other necessary or related information as may be required by the Engineer. The Engineer will be sole judge as to the comparative quality and suitability of alternative equipment or materials and such decision shall be final.

The Contractor, pursuant to Public Contract Code, Section 3400, shall have at least 35 days after award of the Contract for submission of data substantiating a request for a substitution of an ~~or~~ equal" item.

Cost or time impacts to other items of Contract work which are caused by any Contractor-initiated request for substitution, whether anticipated or unforeseen, shall be the responsibility of the Contractor.

10.07. Testing Materials

Unless otherwise specified in the Special Provisions or Technical Provisions or called for on the Drawings, the work shall be tested by the District or its authorized representative in order to determine compliance with the Drawings and the Specifications.

Whenever a reference is made to a specification or test designation, whether of the American Society of Testing Materials, the American Water Works Association, or any other authority, and the number accompanying the specification or test method representing the year of its acceptance or adoption is omitted, the reference shall mean the specification of test method in effect on the date of the Notice to Bidders.

Whenever said specification or test designation provides for test reports (such as certified mill test reports) from the manufacturer, copies of such reports, identified as to the lot of material, shall be furnished to the Engineer. The manufacturer's test reports shall supplement the inspection, sampling, and testing provisions, and shall not constitute a waiver of the District's right to inspect.

10.08. Plant Inspection

Materials and equipment which become a part of the completed work will be subject to inspection at the place of production or manufacture, at the shipping point, or at the site of the work. Materials and equipment requiring inspection at the place of production or manufacture will be designated by the Engineer. Where plant inspection is so designated, the Engineer shall be given 14 days' advance notice of the start of manufacture or production. The Contractor's purchase orders for materials and equipment, for which plant inspection has been designated by the Engineer, shall bear a suitable notation advising suppliers and subcontractors of inspection requirements.

The Engineer or an authorized representative shall have free entry at all times to such parts of the plant as concerns the manufacture or production of materials and equipment for the District. Adequate facilities shall be furnished free of charge to make the necessary inspection.

The District assumes no obligation to inspect materials or equipment at the place of manufacture or production, or at the shipping point.

10.09. District-Furnished Materials

Materials furnished by the District will be available at locations designated in the Special Provisions. They shall be loaded, unloaded, and hauled to the site of the work by the Contractor at the Contractor's expense. The Contractor shall be held responsible for all materials furnished, and shall pay all demurrage and storage charges.

10.10. Equal, Sole or Single Source, and Substitution

A. Specified Item: Material, equipment, product, thing, or service referenced in the Contract Documents that has been identified by specific brand, manufacturer, catalog number, or trade name.

B. Equal Items: Items, as referenced in these Contract Documents are those, which, to the Engineer's knowledge, meet the requirements of the Contract Documents and are considered equal to the specified items.

C. Substitutions: Substitutions are considered changes to the Contract.

D. Sole source/ single source: If the material or equipment specification lists only one manufacturer, catalog number, or trade name, and is followed by the designation ~~no~~ equal," ~~no~~ others acceptable," ~~no~~ alternatives allowed," ~~no~~ other manufacturers accepted," and similar language, then the material or equipment is designated to be a sole source item based on one or more of the

reasons stated in the Public Contract Code 3400 (b). No substitution of sole-source items will be allowed.

E. Whenever an item has been designated in the Contract Documents as described in paragraph A, such designations shall be deemed to be used for the purpose of facilitating the description of the Specified Item and shall be deemed to be followed by the words ~~or~~ equal," whether explicitly stated or not. Unless specifically noted to the contrary (see Paragraph D above), if only one manufacturer, catalog number, or trade name is listed, it is the only product known to the District that meets the requirements of the Contract Documents, but this does not preclude the provision of materials or equipment which are equal to the specified item.

F. Submission of Items which are proposed as equal to the Specified Items will be evaluated in accordance with the following provisions:

1. Burden of proof as to the submitted items being equal to the Specified Items is the responsibility of the Contractor.

2. The Contractor shall submit sufficient data, drawings, samples, literature, calculations, and all other information requested by District to demonstrate to the Engineer that the proposed items are equal to the Specified Items.

3. The Engineer's evaluation of the submitted items proposed as being equal to the Specified Items is based on, but not limited to, the following:

   a. performance;

   b. functionality, efficiency;

   c. durability

   d. life cycle costs;

   e. ease and economy of maintenance and operation;

   f. construction and physical characteristics as compared to the specified items, or as delineated in the Contract Documents;

   g. dimensional compatibility with the materials it combined to produce a unified design system;

   h. compatibility with products in use;

   i. all aspects of finished appearance including form, texture and color, that may affect other design elements.

   j. impacts to Project design, construction schedule, or construction sequencing

4. The Engineer will be the sole judge in this matter. In the event the Engineer rejects the proposed items, the Contractor shall submit the Specified Items.

G. Submission of Items which are proposed as substitutions of the Specified Items shall be subject to the following provisions:

1. All the provisions and evaluation criteria specified under Paragraph F above shall apply to the proposed substitutions.

2. Any additional provisions and/or criteria as deemed necessary by the Engineer.

3. The Contractor shall submit to the Engineer in accordance with Public Contract Code section 3400, no later than 35 days after the date of Notice to Begin Work, proposals for substitutions of Specified Items. At the sole discretion of the Engineer, District may give written consent to the submission of a request for substitution after the expiration of the thirty-five (35) day time limit.

4. Failure of the Contractor to submit proposed substitutions for review in the manner and time described above shall be sufficient cause for rejection by the Engineer of any substitutions otherwise proposed.

5. Substitution(s) of Specified Item(s) proposed by the Contractor may require modifications in the Project design, Project schedule, and/or construction sequencing. The Contractor shall identify all necessary project modifications required for the substitution(s). Necessary project modifications may include, but not be limited to, electrical, instrumentation, structural, mechanical, architectural, testing, engineering costs, and other related modifications.

6. The Contractor is responsible for all costs associated with the substitution(s), including submittal reviews and any project redesigns and modifications. Contractor refusal to accept any of these costs shall be just cause for disapproval of the substitution(s).

7. District will review and respond in writing to the Contractor's proposed substitution within twenty-one (21) days after receipt of all information District requires to make a final determination.

8. If the proposed items are accepted, 50 percent of all savings shall be credited to the District.

SPECIAL PROVISIONS

SPECIAL PROVISIONS GUIDELINES

12/24/2009

SPECIAL PROVISIONS GUIDELINES

FOREWORD

In FY 2004, the Capital Program Services Division initiated the Plans and Specifications Standardization Project (P&SS) to develop guidelines and standards for preparing construction contract plans and specifications. One of the objectives of P&SS is to further develop, expand and improve the existing guidelines for the preparation of the Special Provisions. The purpose of the Special Provisions Guidelines is to assist the specification writer in developing contract language to incorporate typical project requirements. The first Special Provisions Guidelines, dated 10/24/07, were issued in 2007.

These revised Special Provisions Guidelines replace the 10/24/07 version. Among the changes included in this version are:

1. The ~~"~~Work and Schedule of Work" provisions under Section 18 are moved to Section 11, which will be the first section in the Special Provisions;

2. The ~~"~~Water Quality," ~~"~~Solid Material Management," and ~~"~~Migratory Birds" provisions were moved from Section 17 to Section 18;

3. Several other provisions from the Special Provisions are moved to the Standard Provisions, among them include:

    a. Certain definitions under Section 12,
    b. Reference to State Specifications and Plans under Section 12,
    c. Dispute Review Board and associated languages under Section 13,
    d. Provisions related to noise, dust, traffic control, and regulated materials under Section 17,
    e. Materials and equipment substitutions under Section 19,
    f. Submittal review procedures and related languages under Section 19.

4. Other modifications include:
    a. Insurance provisions under Section 13,
    b. Extra work provisions were deleted under Section 20,
    c. Testing procedures and associated provisions under Section 21.

To help identify the changes, all revisions are marked with vertical lines on the left side of the page. Except for the changes associated with Sections 11 and 18, the numbering on other Sections and Articles remains unchanged.

The instructions are prepared to correspond to key provisions covered in the template. It is important that the spec writers review these instructions while preparing the Specials. The Special Provisions are organized into five major areas:

I. Work and Schedule of Work (Section 11)
II. Administrative Requirements (Section 12, Section 13, Section 14);
III. General Site Constraints (Section 15, Section 16);

IV. Permits, Regulations, and Environmental Constraints (Section 17, Section 18); and
V. Contract Administrative Procedures (Section 19, Section 20, Section 21)

Developing the project specific Special Provisions requires that the spec writer possess good knowledge of the Project, including all key requirements and constraints. Please note that the examples provided in the guidelines are just samples and are not intended to be used verbatim. The specification writer should review the project requirements and tailor the specification language to the specific requirements and needs of the project.

These revised guidelines are developed by the P&SS team with the collaborative efforts of staff from across the District and several members of the Technical Review Committee. The P&SS team continues to update and revise these guidelines. Since revisions are ongoing between releases, please consult with the P&SS team during the preparation of construction contract specifications. If you identify any issues that have not been addressed in the guidelines, or have any questions about the guidelines, please contact the PS&S team, or Cong Mai at cmai@valleywater.org or (408) 265-2607, extension 2041.

SPECIAL PROVISIONS INSTRUCTIONS

INTRODUCTION

The purpose of this instruction manual is to assist the specifications writer to develop the special contract conditions/provisions based on project types (flood protection, water supply and distribution, water treatment, or building projects) and the complexity and size of the project.

The use of the instruction manual should be in conjunction with the Special Provisions Template.

SPECIAL PROVISIONS

Construction contract specifications include Standard, Special, and Technical Provisions:

- Standard Provisions—general conditions applicable to most projects;
- Special Provisions—special or supplementary conditions that are project specifics; and
- Technical Provisions—direct work, materials, execution, and payment.

The special provisions are organized into five major areas:

- Work and schedule of work, including milestones and liquidated damage assessments (Section 11);

- Administrative requirements including District-furnished reports, office requirements, insurance, and coordination (Sections12, 13, and 14);

- General site constraints such as access, site conflicts, safety, and security (Sections 15 and 16);

- Environmental constraints and regulatory requirements such as CEQA, traffic, work hours, noise and dust, water quality, solid materials, and migratory birds (Sections 17 and 18);

- Contract administrative procedures including quality control, payment procedures, and close-out (Sections 19, 20, and 21).

Most items of work contained in the special provisions are considered indirect work and not paid as a bid item. If an item is extensive to the point where financial control is necessary (i.e., traffic control), it is advisable to include it in the technical provisions. Direct work (except for mobilization bid item) should be specified in the technical sections, and detailed on the drawings.

This instruction manual plus the instructions (in blue italic) and examples (in text box) in the special provision template assist the specification writer in developing contract language to incorporate typical project requirements. Certain requirements or procedures, while applicable

to multi-discipline projects, may not be suitable to flood protection projects. The opposite is also true.

Special provisions sections include articles, each designated with a number. Paragraphs under the article are numbered with a letter. Section and article numbers and title headings will not change. If an article does not apply, indicate ―Not Applicable" following the title heading; or, remove the title heading, and indicate ―Not Used" following the article number. Do not renumber sections and articles.

The specifications may be prescriptive based, performance based, or a combination of both. Performance specifications define an end result while prescriptive specifications describe the specific means and methods to achieve the result. Prescriptive specifications are not recommended unless the specified means and methods are the only way available to achieve the expected results.

For work to be performed by Contractor, use ―Contractor shall…;" by District, use ―District will…"

Keep It Simple and Short: Writing specifications is an art and not a science. Use simple language. Be clear, concise, and fair, and define the contract requirements clearly.

ADMINISTRATIVE REQUIREMENTS

Section 11 – Work and Schedule of Work

This section includes the summary of work, schedule of work, and the liquidated damages, fines, and bonus provisions for the work.

1. Summary of Work (Article 11.01)

   Most construction projects are related to flood protection facilities, or the conveyance, transmission, treatment, process, or storage of water, including the supporting facilities such as streets, bridges, buildings, utilities, communication, chemical storage and feed systems. Describe the major items of work quantitatively and qualitatively in terms of these components. Include a disclaimer that any quantities provided with the summary description are just estimates and the actual anticipated quantities are as reflected in the Bid Items Listing. Use this same summary description on the Notice to Prospective Bidders.

2. Time Allowance for Completion of Work (Article 11.04)

   It is difficult to determine exactly how long the construction ―should" take because the exact number of days depends on many variables, most of which are not known by the project team and some not known even by the bidders. These variables include at least the following: type and size of project, time of year that the contract is awarded, special materials needed (both natural [rock, etc.] and manufactured [pipe, valves, gates, etc.]), availability of fuel, threats of strikes (both contractor's staff and supplier's), unusual weather (droughts, floods), delays needed for the contractor to coordinate with other projects underway,

differences among contractor‘s equipment and construction techniques, skill of contractors, discovery of buried utilities not reported to the District, changed site conditions, Native American burial grounds, etc. The list is endless. The amount of time needed to construct a project varies among contractors just as the bids vary.

The time allowed for construction is determined by judgment aided by certain data compiled over the years. Determine how much time will be allowed for construction using the following steps:

- Estimate the first chargeable date. The best time to do this is when the project plans and specifications are in the final stage and ready to be advertised, meaning 99% complete. Note that the contract advertising and awarding period – from the time the Board advertises the project until the first chargeable date – is at least 3 months. Based on this information, the team will know the month when the first chargeable day begins.

- Using the guidelines in ―Excusable Inclement Weather Delays” below, estimate the number of excusable inclement weather days for work subjected to weather conditions (site work or flood control projects).

- Develop a construction schedule using Microsoft Project or similar software tools. The schedule will include anticipated construction activities, durations, activity dependencies, and the number of inclement weather days as appropriate.

- Account for additional time that may be required to manufacture specialty items, i.e., some items may require a lead time of 6 to 8 months.

- Add 1 to 3 months to the schedule, depending on the size of the project, to account for the uncertainties affecting the estimated construction duration.

Since the contractor needs at least a month to two months for ―lead time” items such as mobilization, acquiring permits, material deliveries, etc., the project team should generally not give less than 100 days even for the smallest of projects.

3. Contractor‘s Claim for Right to Finish Early (Article 11.04)

Unless stated otherwise in the contract documents, the Contractor may have the right to complete the work ahead of the contractual completion date, and will probably have a claim for damages for not being able to complete the work earlier due to the District‘s delay or interference. The Federal Board of Contract Appeals courts have held that a contractor may recover if the Contractor can prove:

- The Contractor intended to complete the work prior to the contract completion date.

- The Contractor‘s intended schedule was reasonable.

- The Contractor would have met its intended completion date but for the delay or interference of the owner.

Consider including the following language under Article ―Time Allowance for Completion of Work”: ―*The District is not required to accept an earlier (advanced) schedule, i.e., one that shows early completion date(s) but within the Contract time as specified in these Specifications. Time(s) for completion of work shall adhere to the Contract time(s) specified in these Specifications unless earlier time(s) of completion are requested by Contractor and agreed to by the District. Any such agreement shall be formalized by a change order in accordance with Article 5.05*.”

Per the Public Contract code, the provision ―No Damage for Delay Claim” is not valid.

To minimize Contractor‘s claim for delay damage, the Engineer‘s review of Contractor‘s schedule should be only for the general compliance with the Contract documents, not to approve the schedule, nor comment on the Contractor‘s means and methods.

4. Milestone (Article 11.04)

For certain projects, the District may take possession of specific portion(s) of the work prior to final project completion and acceptance. Each such specific portion of work is identified as a milestone. For examples:

A project that includes landscape installation and the plant establishment period could have the following milestones:

Milestone No. 1: completion of the landscape installation and other civil work;

Milestone No. 2: completion of entire Project including the landscape establishment period.

A pump building project may include two milestones:

Milestone No. 1: completion of the pump installation and all associated structural, mechanical, and electrical work that would make the pumps fully functional.

Milestone No. 2: completion of the exterior painting of the pump building.

Include the definition of milestones in specific terms. Specify elsewhere appropriate liquidated damage assessments for enforcement. Consult with Legal and Construction Units as necessary.

5. Milestone Completion (Article 11.04)

Specify time allowance, or date of completion, for each milestone. Include the liquidated damage assessments for enforcement under the ―Liquidated Damages" article.

6. Excusable Inclement Weather Delay (Article 11.05)

The following is a general chart indicating the number of excusable inclement weather days to be used on a flood control project. For either a flood protection or a water utility project, use this chart as a guideline for determining the excusable inclement weather days for their particular project. For example, if a project consists of working entirely within an enclosed building, no excusable inclement weather days should be allowed.

Month	**Excusable Inclement Weather Days**
January	*18*
February	*16*
March	*10*
April	*4*
May	*3*
June	*0*
July	*0*
August	*0*
September	*0*
October	*4*
November	*9*
December	*11*

7. Preliminary Schedule of Work (Article 11.06.01)

Determine the time window when Contractor should submit the preliminary schedule. Depending on project specifics, it could be 10 days to 21 days after the Board awards the Contract.

Determine the level of details of the preliminary schedule. For less complicated projects (i.e., flood protection), a graphic bar diagram showing the planned contract operations during the first 4 to 6 weeks is sufficient. For more complex projects, a detailed schedule showing the planned operations for the first several weeks may be needed.

Preliminary schedule may not be necessary for small projects.

8. Detailed Schedule of Work (Article 11.06.02)

Determine the time window when Contractor should submit the detailed schedule. Depending on project specifics, it could be within 10 days to 35 days of the first chargeable day of the Contract.

Determine the level of details for the detailed schedule of work. There are two alternatives. Alternative 1 requires a Critical Path Method (CPM) schedule and is intended for larger or complex projects where there is a complex relationship between activities. Alternative 2 is intended for smaller or less complex projects where a graphic bar diagram will suffice. In general, small projects are those that have a contract amount of less than $100,000 and a construction duration of 4 months or less. Whenever in doubt as to which alternative to use, consult the Construction Units.

The heart of a CPM schedule is the network diagram. ADM (Arrow Diagram Method) is a network diagramming technique in which activities are represented by arrows. The tail of the arrow represents the start and the head represents the finish of the activity. Activities are connected at points called nodes (usually drawn as small circles) to illustrate the sequence in which activities are expected to be performed.

PDM (Precedence Diagram Method) is a network diagramming technique in which activities are represented by nodes. The lines connecting nodes show dependencies (relationship) between them.

A Graphical Bar Diagram is constructed with a horizontal axis representing the total time span of the project, broken down into increments, and a vertical axis representing the tasks that make up the project. A Graphical Bar Diagram may or may not indicate task dependencies.

9. Liquidated Damages (Article 11.07)

Liquidated damages are a contractual stipulation of the damages to be paid to the District in the event of breach of Contract. They are generally related to controlling milestones which have a direct financial effect to the District (i.e., labor cost, cost of water).

If the Contractor fails to complete the work or designated portions thereof by the stipulated dates, the Contractor is financially liable to the District for a pre-agreed sum for each day beyond the specified completion dates that it takes the contractor to finish the work.

Liquidated damages may be used in the following cases:

- Contractor fails to complete the milestones and/or the Project by certain date as defined in the Contract
- Contractor fails to submit certain submittals by certain date
- Contractor extends the shutdown period of an operational facility beyond what is allowed in the Contract
- Contractor fails to comply with certain requirements in the Contract

Liquidated damages are not a ~~"p~~enalty" or punitive damages which are intended as punishment for wrong doing. In contract cases, a party generally cannot collect punitive damages, even if the contract itself prescribes such a consequence for breach.

In order for liquidated damages to be valid, the following two requirements must be met:

- It will be difficult to determine the amount of actual damages.
- The liquidated damages must be a reasonable forecast of the actual damages that could be expected.

For the successful imposition of liquidated damages, carefully document the calculation of the liquidated damages amount, and file it in the project files. The estimated amount of liquidated damages per day may be a function of many things. It can represent a loss of revenue, utility and permit extension fees and/or other losses keyed to daily costs of inspection and administration of the contract, or any other costs that can be reasonably identified. Consult with Operations for any potential loss of revenues and Construction Units for inspection-related costs.

Checklist of Delay Costs:

- Professional Fees: Designers, inspectors, attorneys, construction manager, consultants.
- Operating Costs: Increased operating expenses, decreased District staff labor productivity, extended security costs, maintenance/protection costs, extended District equipment rentals, additional moving expenses, extended use of DISTRICT construction facilities, increased project communication costs, extended District project management staff costs.
- Miscellaneous: Public inconvenience costs, court-ordered fines, permit costs, lost rental value, lost profits, lost revenue, lost window of opportunity.
- Replacement Facilities Costs: Rent, holdover penalties, storage costs.
- Financing Costs: Higher interest rates for construction loan, extended duration of construction loan, increased interest costs for permanent loan, lost interest revenue on invested funds.

See the write-up on the LD subject from the Office of District Counsel.

10. Contract Provisions Requiring Liquidated Damage Assessments (Article 11.07)

Determine the areas in the contract that require liquidated damage assessments. Following are typical areas where liquidated damage assessments are necessary:

- Contractor‘s failure to complete the Project;
- Failure to complete the milestone;
- Failure to submit schedules of work;
- Failure to submit certain construction submittals within the time required;
- Failure to comply with certain contract provisions;
- Contractor causing unplanned shutdown of operational facility: This may apply to projects with operational facilities such as treatment plant, pump stations, pipelines, outlet works, etc. List operational facilities and reference the Articles that specify the allowed shutdowns.

All liquidated damages must be assessed separately and independently.

Section 12—General Requirements

This section of the special provisions provides a definition of key terms, identifies reports (i.e., geotechnical, environmental, hazardous materials, and archaeological reports) or as-built drawings that may affect construction, and describes the design criteria associated with Contractor-supplied equipment.

1. Milestone and Milestone Completion (Article 12.02)

   The definitions of these terms are included in Section 1 of the Standard Provisions. Provide specific definitions for Milestones based on project requirements in Section 11.

2. Contractor‘s Site Investigation (Article 12.03)

   When appropriate and necessary, request contractors to verify the information either during the bidding process or during construction—be fair and reasonable in making the request. Asking bidders to conduct pre-bid investigation and verify subsurface conditions is unreasonable if contractors must submit bids in a few-week time frame.

3. District-Furnished Reports and Superior Knowledge Doctrine (Article 12.04)

   Based on the superior knowledge doctrine, the District, in procuring goods and services, has an implied contractual duty to inform a prospective contractor of information important to the successful completion of such contract and that the District is responsible for risks which a contractor has not fairly assumed. The District must disclose what it knows about the project that could affect the bids. The superior knowledge doctrine applies in situations where: (1) a contractor undertakes to perform work without vital knowledge of a fact that affects performance costs or duration; (2) the District was aware the contractor had no knowledge of and no reason to obtain such information; (3) any contract

specification supplied misled the contractor, or did not put him/her on notice to inquire; and (4) the District failed to provide the relevant information.

Provide, or inform of availability, information that would affect contractor‘s bidding or contractor‘s performance cost and duration as part of the contract documents. For example: soil boring logs and subsurface information for an underground construction project; as-built drawings of existing facilities that Contractor uses in preparing shop drawings, any other information the District gained from its ownership of a particular site or facility, etc. This information forms a basis for bidding, and for evaluation of change orders should differing site conditions take place.

Include in the bid documents, or inform of availability, the pertinent information so that prospective contractors can assess risks during the bidding process. For example: geotechnical baseline reports, hazardous material investigation reports, certain as-built drawings, etc.

Design engineers are generally responsible for the accuracy and completeness of the information they provide. Inform Contractor accordingly if the information provided is not complete or accurate (e.g., As-built drawings are provided for Contractor‘s reference only. The District does not warranty their completeness or correctness.) Include appropriate language to allow proper compensation should changes occur as a result of incomplete or inaccurate information. Do not include ambiguous or general disclaimers that make Contractor responsible for the discrepancy of information provided. These statements normally are disfavored and often ruled unenforceable by courts.

4. Differing Site Conditions

Type I Differing Site Condition (DSC) is defined as means subsurface or latent physical conditions at the site differing materially from those indicated in the Contract.

Type II Differing Site Condition (DSC) is defined as unknown physical conditions at the site of an unusual nature differing from those ordinarily encountered and generally recognized as to be inherent in work of the character provided for this Contract.

5. Geotechnical Report (Article 12.04.01)

The following is an excerpt from U.S. Department of Transportation, Geotechnical Engineering Notebook, Geotechnical Guideline No. 15 (http://www.fhwa.dot.gov/engineering/geotech/policymemo/gt-15.pdf) for disclosure of subsurface information to bidders:

Consideration should be given to the following:

- All pertinent subsurface information should be disclosed in the contract documents. The disclosure may take various forms but a summary of all disclosed subsurface information should be included. The summary

should be easily accessed by the bidders through the index sheet of the pertinent contract document.

- All bidders should be provided equal opportunity to access the same information.

- Factual subsurface data which is pertinent to the project subsurface conditions should be presented in an easily understood fashion on the contract documents. Extraneous factual data should not be presented in detail in the contract documents, but may be made available at a designated location and time for bidder inspection. Whenever possible, and particularly at wall or structure locations, factual data from subsurface explorations should be reproduced in a scaled profile. Pertinent soil test results should be extracted from the test forms and summarized. Pertinent information from comprehensive preconstruction test program reports should be excerpted for inclusion in the contract documents.

- Pertinent soil and rock-samples should be made available at a designated time and location for inspection by the bidders. The contract documents should contain a notice of sample availability.

- Interpretive subsurface information pertinent to the project subsurface conditions should be made available at a designated time and location for inspection by the bidders. Interpretive information should be clearly labeled to represent the opinion of qualified engineers or engineering geologists of the District and should not be a substitute for personal interpretations of the contractor.

- A geotechnical design summary report or geotechnical baseline report should be prepared by the District for complex projects which involve substantial underground work. These types of reports should be incorporated as part of the contract documents.

Additional activities, which can be incorporated into the contract to promote fairness between the District and contractors, include the following:

- Plan for a pre-bid meeting to discuss subsurface conditions.

- Include the differing site condition clause directly in the contract documents and list the appropriate page number where the clause can be found in the summary of subsurface information.

- Use specific plan notes to communicate experience with the type of subsurface condition at a specific project site to all prospective bidders. An example follows:

  ~~-~~Although boulders in large quantities were not encountered on this site in borings, which are numbered BAF-1 through BAF-4, previous projects in this area have found large quantities of boulders. Therefore, the Contractor should be expected to encounter substantial boulder quantities

in excavations. The contractor should include any perceived extra costs for boulder removal in this area in the bid price for Item xxx."

The purpose of the note is to share, with the bidders, information which the District has in its possession regarding the potential quantity of boulders at the site and state how the contractor should base the bid for excavation of the area. Also the term, "boulders," denotes a specific size of material to be removed, which is of a high degree of difficulty as compared to "cobbles." Boring logs can also be reviewed to determine if the soils were described as **with cobbles** (denoting only cobble—sized particles), **with boulders** (denoting only boulder-sized particles) or **with cobbles and boulders**. The exact number or size or hardness of boulders at a site cannot be determined with currently available exploration procedures. Special notes can help the bidders assess the risk and the need to develop bid prices to account for the risk.

- Specific disclaimer clauses can be used as plan notes to define what the agency considers factual data and what is subject to interpretation. The use of specific disclaimer clauses is preferred to the use of a general disclaimer clause which is often unenforceable. An example of a specific disclaimer would be a statement such as;

  "The boring logs for BAF-I through BAF-4 are representative of the condition at the location where each boring was made but conditions may vary between borings."

  This plan note serves to warrant that the agency used proper techniques to locate, drill, and log the borings which are shown on the contract plans. Soil conditions encountered at the warranted location of these boring which differ materially from those stated on the logs form the basis for a Type I DSC. Soil conditions between borings, which differ materially from those stated in the boring logs, may form the basis for a Type II DSC but not a Type I DSC.

6. Geotechnical Interpretive Reports (Geotechnical Design Summary Report, Geotechnical Baseline Report) (Article 12.04.01)

The GDSR or GBR contains the design engineer's geotechnical interpretations regarding anticipated conditions for design and construction. A typical GDSR contains not only the subsurface data but offer opinions on both anticipated ground behavior and construction difficulties. The function of the GDSR is not to simply repeat factual information contained elsewhere in the contract documents, but to describe the thought process that led to the design and specifications included in the plans. The geotechnical engineer or engineering geologist who develops the report should perform the geological interpretation necessary to accurately portray the subsurface conditions, and evaluate the geotechnical feasibility of the proposed construction project features. Experience indicates that the GDSR provides a more realistic portrayal of actual conditions likely to be encountered than the raw data reports (with little or no interpretation) which are commonly provided in contract documents. Many claims (and resulting

settlements) have been based on one or two words included (or omitted) on boring log descriptions that the contractor has subsequently maintained were key in his bid preparation. A clear statement of the conditions to be assumed during bid preparation will facilitate resolution of disputes in a more timely and cost-effective manner for both agency and contractor. A typical outline of a GDSR is included in the U.S. Department of Transportation, Geotechnical Engineering Notebook, Geotechnical Guideline No. 15 (http://www.fhwa.dot.gov/engineering/geotech/policymemo/gt-15.pdf). For additional information, see ASCE's Geotechnical Baseline Reports for Construction – Suggested Guidelines' of which a copy is available in the District's library (Call number TA712G462007c.1).

7. Other reports and as-built drawings (Articles 12.04.02, 12.04.03, 12.04.04, and 12.04.05)

List other project reports or as-built drawings, if available, that could have a material effect on bidding or construction of the project. Examples: Biological studies (i.e., fish surveys, migratory bird surveys); water quality data; hazardous materials investigation reports, or archeological study/evaluation and reports.

Certain information may need to be qualified as to limitations of use, such as historic reports or reports not under the control of District or design staff. Avoid the use of general disclaimers. See instruction regarding as-built drawings under item No. 3.

8. Delegation of Engineering and Design Responsibility to Contractor (Article 12.05)

Unless as noted below, do not delegate the engineering and design responsibility to Contractor. Contractors are chosen based on their low bids, not their design expertise. Engineers are in better position to perform the design, ensuring the design meets State and local standards, regulatory requirements, and neighborhood and special interests.

The design criteria listed under this Section are associated Contractor-supplied equipment, or structures that are an integral part of the specialized items requiring special manufacturing or proprietary knowledge. For example: chemical storage tanks, access stairways or platform between tanks, anchorage of mechanical and electrical equipment, etc.

Do not include design criteria that dictate or control Contractor's general means and methods, nor design criteria that may interfere with the Contractor's responsibility for maintaining a safe job site condition (i.e., design criteria for Contractor's temporary shoring, false work, coffer dams, etc.)

For work designed and installed by Contractor which District, or District's consultant, may not have the expertise or knowledge to review the adequacy of the design, consider having a peer review or require special warranty on the products. Example: Require a 30 year warranty for a roofing system.

For Contractor‘s design and fabrication of specific project components (such as chemical storage tanks, control panels, etc.), provide the specific design criteria in the applicable sections of the Technical Provisions

Section 13—Special Requirements

This section of the special provisions includes Contractor‘s logistics activities, District-furnished equipment, dispute resolution process, claims procedures, and insurance requirements.

1. Designated Engineer (Article 13.01)

   The Designated Engineer for projects managed by Capital Program Services Division is the Deputy Operating Officer of the CPSD.

2. Temporary Facilities (Articles 13.02, 13.03, 13.05 and 13.06)

   Specify an office for the Engineer or District‘s use. Smaller projects may not require an Engineer‘s office. Consult with Construction staff if necessary. Specify other temporary facilities required for the Contractor to conduct work such as project signs, staging area, Contractor‘s office trailer or temporary utilities. Payment for this work can be included in the mobilization bid item or considered incidental and included in the other items of work.

3. District-Furnished Materials (Article 13.07)

   If District will be furnishing equipment for the contract, responsibilities for transportation, inspection, testing, and installation of the equipment between the District and the Contractor should be clearly defined.

4. Assignment of Contract for District-Procured Materials (Article 13.07.01)

   For projects where District must execute a procurement contract with a third party, special circumstances may require that the District assign the contract to the Contractor and make the Contractor responsible for all provisions under that procurement contract. The process carries risks. The project team should carefully evaluate the risks vs. benefits of this process before making a decision.

   The following example is for District-procured materials where District has executed a procurement contract with a third party, and the procurement contract is assigned to the Contractor.

EXAMPLE:

A. District has executed a procurement contract with a third party (herein after -Supplier”) for early procurement of the following described items to be installed by Contractor:

   - One 66-inch butterfly valve and electric actuator assembly.

- Two 24-inch bypass valves and electric actuator assemblies.

B. Said procurement contract (a copy of which is contained in Appendix _) is hereby assigned to the Contractor as a part of the work in this Contract. Said assignment of the procurement contract to the Contractor shall be a condition of this Contract. As of the date of execution of the Agreement hereunder, all references in the procurement documents to the ―District" or the ―DISTRICT" shall mean the Contractor hereunder.

C. The Contractor shall be wholly responsible under the Contract for administration of said procurement contract, including payment therefore and for all expediting, quality assurance, delivery, site storage and installation and testing as specified. All costs of site storage, installation, safety, security, and protection both prior to and after installation until final acceptance of the work by the District, shall be the responsibility of the Contractor. No separate payment will be allowed therefore, and all costs shall be included by the Contractor as specified in Section ---.

D. The assignment of said procurement contract shall act to relieve the District from further obligation and liability under the procurement contract, and the rights, duties, and obligations of the District under said procurement contract shall become the rights, duties, and obligations of the Contractor.

The procurement contract with the third party must include a provision of assignment of contract as follows:

―This Contract will initially be executed in the name of the District and will subsequently be assigned by the District to District's Contractor. The Contractor will be selected and identified by the District subsequent to award of this Contract. As of the date the Supplier is notified of the award of the Construction Contract of the installation of the materials and equipment procured hereunder, as specified herein, references in this Contract to the District shall then mean the Contractor.

Within 10 days of the date of award of the Construction Contract, the Engineer will provide the Supplier written notification of assignment of this Contract, including the date of award and the assignee (Contractor) name, address, phone number, and contact person.

The assignment of this Contract shall act to relieve the District from further obligation and liability under the Contract, and the rights, duties, and obligations of the District under this Contract shall become the rights, duties, and obligations of the Contractor. The assignment shall include the transfer of Supplier's liability and obligation to Contractor for any damages resulting from delay as specified."

5. Maintenance of Record Documents (Article 13.11)

Preparing construction as-built drawings consists of two phases: field marking the changes on drawings by Contractor, and doing final drafting in the office by District. Contractor will be required to do the marked-up as-built drawings during construction. Because the District is the end user of the as-built drawings, make sure the Contractor prepares a high quality marked-up as-built. This includes: specifying minimum drafting quality standards (i.e., line work, level of details, etc.), District inspectors to prepare a separate as-built set to check against Contractor work, monthly review of Contractor's progress, withholding payments for lack of progress, etc. See attached guidelines for as-built mark-ups that should be included as an appendix in the Specifications.

6. Operation and Maintenance Documents (Article 13.10)

The extent of the required O&M document depends on the nature and scope of projects. The language provided in the template is intended for water utility projects that include new mechanical, electrical, and control equipment and systems. Consult with the Water Utility Operations Division if necessary. For flood protection projects, it is likely that no O&M or only certain O&M documents are required of the Contractor. However, during the planning and design stages of the project, the project team should develop, in consultation with Watershed Operations, an O&M manual for delivery to Watersheds Operations. Consult with Watersheds Operations to further discuss O&M requirements for flood protection projects.

O&M documents are required for individual pieces of equipment as well as complete packaged chemical feed systems. O&M documents for complete chemical feed systems include both O&M manual and the equipment maintenance data for each piece of equipment that makes up a system. Prepare the list based on the contract specifications and in consultation with the Asset Management Unit.

Consult with the Asset Management Unit in establishing the unit cost for each set of O&M document. In general, the unit cost depends on the following factors:

- Installation cost (including labor and materials) of the equipment or system relative to the cost of the project.
- Operation cost (including labor and materials) of the equipment or system.
- Maintenance cost (including labor and materials) of the equipment or system.
- Man hours required to put the document together.
- Impacts to treatment plant if the equipment or system breaks down.

The Contractor will be required to fill out the form ‗Equipment Summary Sheet' electronically. Provide an electronic copy of the form to the Contractor at the beginning of construction. The electronic form is currently residing with Word Processing.

7. Disputes Resolution, Escrow Bid Documents, and Partnering (Articles 13.13, 13.14 and 13.15)

The following link provides descriptions of Caltrans' dispute resolution process http://www.dot.ca.gov/hq/construc/manual2001/chapter5/chp5_4.pdf. The purpose of the disputes resolution process is to minimize the need for arbitration or litigation, and provide a mechanism for review and resolution of disputes and claims. Disputes are divided into four categories: notice, protest, potential claim, and claim. During the course of the project and up to receiving the proposed final estimate, the Contractor must submit a contract dispute in the form of a written notice, protest, or a potential claim to the Engineer. Disputes become claims when the Contractor lists them as exceptions to the proposed final estimate.

Notice: The Contractor submits a written notice when unforeseen conditions are encountered on the project that were not shown in the plans or detailed in the specifications.

Protest: The Contractor submits a written protest when a dispute concerns the terms or conditions of a contract change order or the determination of contract time.

Potential Claim: The Contractor submits a written potential claim when the Contractor believes additional compensation is due.

Claim: The Contractor submits a written claim for an unresolved dispute by listing it as an exception to the proposed final estimate.

The two alternative dispute resolution processes used to resolve potential claims are partnering and dispute review board. Partnering allows all parties and stakeholders to establish and maintain cooperative communication channels and mutually resolve conflicts at the lowest responsible level.

A dispute review board allows knowledgeable and experienced board members, not directly involved with contract, the opportunity to review and analyze a dispute and provide their recommendations. Although these recommendations are not binding, they are valuable in trying to resolve the dispute before it becomes a claim. For information regarding the Dispute Review Board, see the following link http://www.oles.com/publications/2005/Dispute%20Review%20Boards.pdf. Depending on the size and duration of the Contract, either mandatory or optional DRB contract provisions are included in the contract specifications. Once a DRB is established, resolution of disputes through the DRB process becomes a prerequisite for the Contractor to pursue a dispute as a claim or in arbitration.

The purpose of the Escrow Documents is to assist in the settlement of disputes and claims. Only certain projects require the disputes resolution and the escrow bid documents. Projects that are large (minimum construction cost 10 to 20 million dollar), or complicate in nature requiring a number of subcontractors, or include extensive subsurface work, tunneling, or unknown site conditions may require a disputes review board and escrow bid documents. For additional information, see http://www.drb.org/manual/1.4_final_12-06.pdf from the ‘Dispute Resolution Board Foundation Practices and Procedures‘ (http://www.drb.org/manual_access.htm).

Consult with others (Construction Unit, Legal) for recommendations as to the need of a DRB, the extent of subcontractor‘s involvement in the DRB process, the escrow documents, and partnering.

See the ‘Three-Party DRB Agreement Form - District, Contractor, and the DRB‘.

8. Insurance (Article 13.16)

Each construction project is unique; therefore, the Project Team must consult with the District‘s Risk Management Administrator as early as possible, preferably during the preliminary design phase, to determine the appropriate liability insurance coverages and requirements.

Section 14—General Coordination

This section of the special provisions includes meeting, coordination, and construction survey requirements.

1. Coordination Meetings (Article 14.01)

Various types of meeting are required to coordinate construction work including pre-construction meeting, progress meetings, and any special meetings (i.e., shutdowns, outage, utility tie-ins, etc.). Meeting logistics and responsibilities between the District and the Contractor should be clearly defined.

2. Integration and Coordination With District Operations (Articles 14.02 and 14.03)

To familiarize the Contractor with District facilities and operations where the construction work will occur, an overview of existing systems and facilities should be provided. Identifying requirements of an operational facility or system is also helpful in ensuring that the Contractor keep the District facility or system operational. Any work by District or others that will occur in the project vicinity during construction work should be identified and any coordination required of the Contractor should be specified.

3. Construction Survey (Article 14.04)

District typically establishes survey control points and provides certain staking services for construction projects. Consult with the Land Surveying and Mapping

Unit staff to determine the type of land surveying services required for the construction project.

4. Public Notification (Article 14.05)

Consult with the Office of Communications about the need for Public Notification and how it should be conducted. The District should do the public outreach. For certain linear projects such as pipeline construction where the execution of work is continuously moving or dynamic in nature, it may be appropriate to delegate certain public notification tasks to the Contractor. A Contractor with a detailed knowledge of his daily activities and progress can be effective and responsive in informing the public. The District could manage and oversee Contractor's public notification efforts, and approve his method and format of communication such as mail-outs, newsletters, notices, and signs.

GENERAL SITE CONSTRAINTS

Section 15—Work Constraints and Site Restrictions

This section of the special provisions includes work constraints that may impact or limit the Contractor's work. Work constraints should be identified so that the Contractor can plan around the constraints and schedule the work accordingly. Typical work constraints include utilities coordination, protection of existing facilities, rights of way, and access to job site.

1. General Work Constraints (Article 15.01)

List general work constraints that have not been described elsewhere that could impact the contract Work, such as schedule, work sequencing, coordination, site safety and security, access, District-furnished material delivery, neighborhood outreach, etc. If the constraints directly impact specific items of Work, describe them as part of the Work items.

For work that involves an operational facility, include requirements or restrictions necessary to minimize disruption of the facility and/or to ensure the facility remains operational during construction.

2. Existing Utilities (Article 15.02)

Not all underground utilities are shown or correctly shown on as-built drawings. To reduce the risks of damage and ensure safety of people, provisions for locating and protecting underground utilities and coordination with owners of utilities are included.

Contractors are responsible for protecting existing utilities shown on the drawings. If contractors request for temporary or permanent relocation of existing utilities for their conveniences, they should be responsible to make arrangement and bear the costs.

3. Utility Installation and Relocation (Article 15.02.03)

   Obtain all required permits and agreements for utility installation and relocation before advertising the project. For most utility agreements, the owners of the utilities furnish engineering and design and complete the work, and the District compensates the Utilities for performing the work. Contractors will be required to coordinate with the Utilities during construction, and perform certain tie-in work. If possible, arrange to have the utility relocation completed before construction.

4. Surveys of Properties in the Vicinity of the Work (Article 15.04.02)

   Determine if there are potential impacts (architectural and structural) to properties and structures in the vicinity of the work as a result of construction. Every effort should be made to avoid such impacts through design and construction methods. Heavy truck traffic, pile driving, demolition, and excavation are typical activities that may affect adjacent buildings, structures, or properties, or lead to a perception of project impacts. Where the nature of a project and its location indicate that there is a possibility of construction related damages to nearby properties, or a likely perception of such damage by property owners, it may be in the District‘s and Contractor‘s interest to conduct pre-construction structural surveys of selected properties.

   Pre-construction surveys document the conditions of existing facilities prior to commencement of construction work. This documentation will assist in evaluating whether any damage to the existing facilities resulted from the construction work.

5. Temporary Construction Easements (TCE‘s) (Article 15.05.03)

   Identify temporary construction easements that are required for the project and obtain all agreements prior to finalizing the contract documents. This is a lengthy process that includes preparation of maps and plat descriptions and negotiations with property owners. Ask for support and assistance from the Land Surveying & Mapping and Real Estate Services Units. Attach all TCE agreements in the appendix of the Specifications. If there are special conditions that must be met by Contractor, include them in the body of the Specifications.

Section 16—Safety and Security

This section of the special provisions includes the safety and security requirements for the construction contract. Evaluate the nature of construction and any associated hazards to ensure compliance with the relevant local, state, and federal laws and regulations. Project security requirements depend on the nature and location of the projects (i.e., security requirement would be different for a project inside a water treatment plant versus along a creek). Consult with District security unit staff for special security requirements.

1. Consult with Employee Health and Safety unit (EH&S) during the design of projects to identify health and safety issues, if any, and work with EH&S to

address these in the design and construction documents appropriately. The following information is provided by the EH&S unit. (Article 16.01)

Injury and Illness Prevention Program (IIPP): Every employer with more than ten employees in California is required to have a written IIPP. Every contractor and sub-contractor on a District project should be required to submit a copy of their IIPP for the District's review to ensure it meets all the pertinent requirements of 8 CCR 3203 (General Industry) (http://www.dir.ca.gov/Title8/3203.html), 8 CCR 1509 (Construction) (http://www.dir.ca.gov/Title8/1509.html) and/or 8 CCR 8406 (Tunneling) (http://www.dir.ca.gov/Title8/8406.html) as appropriate. These programs also require training for affected employees; training records should be reviewed by the District to ensure every contractor employee on the District jobsite has been appropriately trained.

Hazard Communication Program: Every contractor and sub-contractor on a District project whose employees will be handling or exposed to chemicals (or exposing other contractors, District employees or members of the public) should have a Material Safety Data Sheet (MSDS) for each such chemical. Each contractor and sub-contractor should also be contractually required to provide a copy of each such MSDS to the District for review prior to bringing the chemical on District property. MSDSs are just one part of a Hazard Communication Program; every contractor and sub-contractor should submit a copy of their Hazard Communication Program for the District's review to ensure it meets all the pertinent requirements of 8 CCR 5194 (http://www.dir.ca.gov/Title8/5194.html). This program also requires training for affected employees; training records should be reviewed by the District to ensure every contractor employee on the District jobsite has been appropriately trained.

Confined Space Program: Every contractor and sub-contractor on a District project whose employees will be working in or supporting work in a Confined Space (tanks, pipelines, manholes, some vaults, etc.) should have a Confined Space Program; every such contractor should submit a copy of their Confined Space Program for the District's review to ensure it meets all the pertinent requirements of 8 CCR 5157 (http://www.dir.ca.gov/Title8/5157.html) and/or 8 CCR 5158 (http://www.dir.ca.gov/Title8/5158.html) as appropriate. All entries into District confined spaces shall be coordinated with the District's Confined Space Program Coordinator, Peter Jackson, x2594. This program also requires training for affected employees; training records should be reviewed by the District to ensure every contractor employee on the District jobsite has been appropriately trained in confined space.

Respiratory Protection Program: Every contractor and sub-contractor on a District project whose employees will be wearing respiratory protective equipment should have a Respiratory Protection Program; every such contractor should submit a copy of their Respiratory Protection Program for the District's review to ensure it meets all the pertinent requirements of 8 CCR 5144 (http://www.dir.ca.gov/Title8/5144.html). This program also requires medical evaluation, fit testing and training for affected employees; training records should be reviewed by the District to ensure every contractor employee on the District jobsite has been appropriately trained in respiratory protection.

Lockout/Blockout/Tagout Program: Every contractor and sub-contractor on a District project whose employees will be participating in a Lockout/Blockout/Tagout operation should have a Lockout/Blockout/Tagout Program; every such contractor should submit a copy of their Lockout/Blockout/Tagout Program for the District's review to ensure it meets all the pertinent requirements of 8 CCR 3314 (http://www.dir.ca.gov/Title8/3314.html). When working on any District equipment, the contractor shall follow the District's Lockout/Blockout/Tagout Program. This program also requires training for affected employees; training records should be reviewed by the District to ensure every contractor employee on the District jobsite has been appropriately trained in Lockout/Tagout.

Hearing Conservation Program: Every contractor and sub-contractor on a District project whose employees will be exposed to loud noises or who will be wearing hearing protection devices should have a Hearing Conservation Program; every such contractor should submit a copy of their Hearing Protection Program for the District's review to ensure it meets all the pertinent requirements of 8 CCR 5097 (http://www.dir.ca.gov/Title8/5097.html). This program also requires baseline and annual audiometric testing and training for affected employees; training records should be reviewed by the District to ensure every contractor employee on the District jobsite has been appropriately trained in hearing conservation.

Asbestos, if there is serpentine rock and soil involved in a District project, may present significant occupational health and safety (to the public as well as employees) as well as environmental (handling, storage and disposal) issues. Lessons-learned from the Penitencia WTP handling of asbestos should be applied to the project.

Forklift operation by contractor and sub-contractor employees on a District project should only be allowed after review by the District of the employee's current forklift operating certificate from the employer, as required by 8 CCR 3668 at http://www.dir.ca.gov/Title8/3668.html.

Truck-Mounted Mobile Cranes with booms longer than 25 feet or a lifting capacity in excess of 15,000 pounds can only be operated by operators certified by the National Commission for the Certification of Crane Operators (NCCCO); if such cranes will be used on a District project, the District should verify the possession of a valid current certificate before a contractor or sub-contractor employee is permitted to operate a crane described above as required by 8 CCR 5006.1 at http://www.dir.ca.gov/Title8/5006_1.html.

Compactors, if used on a District project, require written operating procedures, and operators should have a current operating certificate as required by 8 CCR 4335 (at http://www.dir.ca.gov/Title8/4355.html). These documents should be made available for the District's review.

Fire Extinguishers may be on the project site, with an expectation that they will be used by contractor or sub-contractor employees. Documentation of such

employees‘ annual training as required by 8 CCR 6151 (at http://www.dir.ca.gov/Title8/6151.html) should be provided and verified by the District.

Diving Operations, including the contractor‘s or sub-contractor‘s ―Manual for Diving Safety” and other requirements of Cal/OSHA‘s Diving Safety Orders at http://www.dir.ca.gov/Title8/sb7g26.html, in support of a District project should be reviewed by the District.

Elevating Work Platforms and Aerial Devices (scissor lifts, JLGs, etc.) used by contractor and sub-contractor employees on a District project should only be allowed after review by the District of the employee‘s current training certificate from the employer.

Excavation/Trenching/Shoring, as described in 8 CCR 1541 (at http://www.dir.ca.gov/Title8/1541.html) etc, if implemented on a District project site, (separate from ―Tunnel” work) should involve a ―Competent Person” as defined. The document designating the on-site ―Competent Person” should be reviewed by the District.

For the excavation of any trench or trenches five feet or more in depth, California Labor Code Section 6705 requires Contractor to submit a detailed plan showing the design of the shoring, bracing, and sloping or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trench or trenches. If such plan varies from the shoring system standards, the plan shall be prepared by a registered civil or structural engineer. California Labor Code Section 6707 requires the Contract Documents of certain construction projects (i.e. pipeline, sewer, boring and jacking pits, or similar trenches or open excavations, which are five feet or deeper) to contain, as a bid item, adequate sheeting, shoring, and bracing, or equivalent method, for the protection of life and limb, which shall conform to applicable safety orders. See Labor Code Sections and 6705 and 6707 for more detail information.

A **Fall Protection Plan** as specified in 8 CCR 1671.1 (at http://www.dir.ca.gov/Title8/1671_1.html) may be required. The District should verify that the Fall Protection Plan is approved by a ―qualified person” and used under the supervision of a ―competent person.” The District should verify the documentation of such training for any contractor or sub-contractor employee exposed to fall hazards, as well as the immediate availability of fall-protection harnesses, lanyards, anchoring devices and other fall-protection hardware as appropriate.

Flaggers involved in Traffic Control as described in 8 CCR 1599 (at http://www.dir.ca.gov/Title8/1599.html) etc., shall be trained. The District should verify the current documentation of such training for any contractor or sub-contractor employee performing flagging operations.

Heat Illness Prevention involving outdoor workers involves training and other requirements in 8 CCR 3395 (at http://www.dir.ca.gov/Title8/3395.html). Said training and other requirements of 8 CCR 3395 (such as availability of

two gallons per day per person of drinking water) should be verified by the District.

Arc Flash Hazard – Although technically not required by Cal/OSHA (yet), if any person will be exposed to an arc flash hazard, District contracts should include reference to and require compliance with both the Cal/OSHA Low Voltage and High Voltage Electrical Safety Orders (http://www.dir.ca.gov/Title8/sub5.html) and NFPA 70E, 2009 (or later) Edition, ~~"~~Standard for Electrical Safety in the Workplace" (http://www.nfpa.org/aboutthecodes/AboutTheCodes.asp?DocNum=70E&cookie%5Ftest=1), which includes the latest industry best practices for prevention of Arc Flash Hazard.

2. Projects that involve hazardous waste operations will require Contractor to develop and implement a written Safety and Health Program and a site-specific Safety and Health Plan, and designate a Site Safety and Health Supervisor who has the responsibility and authority to develop and implement the site-specific safety and health plan and verify compliance, in accordance with Title 8 CCR Section 5192. (Article 16.02)

   The ~~"~~site safety and health plan" (also sometimes referred to in the regulation as a ~~"~~site-specific safety and health plan" or an ~~"~~employer's safety and health plan" - and sometimes referred to in the industry as a ~~"~~Health And Safety Plan" or ~~"~~HASP" for short) is only required by Cal/OSHA in its ~~"~~Hazardous Waste Operations and Emergency Response" regulation, in response to operations dealing with hazardous waste. Such a ~~"~~safety and health plan" is not required by any other Cal/OSHA regulation.

   Solely within the context of Cal/OSHA's ~~"~~Hazardous Waste Operations and Emergency Response" regulation, the ~~"~~safety and health plan" is required to be an integral part of an employer's written safety and health program (commonly called an ~~"~~Injury and Illness Prevention Program" or ~~"~~IIPP").

   It is technically incorrect to refer to an employer's ~~"~~Injury and Illness Prevention Program" as a ~~"~~safety and health plan" / ~~"~~health and safety plan" (or vice versa) – they are two different things.

   Since a ~~"~~site-specific safety and health plan" / ~~"~~site safety and health plan" / ~~"~~safety and health plan" is not required by Cal/OSHA regulation for any activity other than one involving hazardous waste, the Project Team should be very careful about not requiring such a plan for a project which does not involve hazardous waste.

3. District's review of Contractor's safety plans (i.e., excavation safety plans, site specific safety and health plans, trench excavation plans, injury and illness prevention program, etc.) (Article 16.02.03)

   See Memorandum from Anthony Fulcher to Nai Hsueh, Feb 20, 2007, *RLS-2006-0037: Reviewing Contractor's Safety Plans*. This memorandum discusses the extent to which the District should review Contractor's safety plans,

the District liability, and the Engineer responsibility associated with reviewing the Contractor's safety plans. District may review or comment on the plans whether they meet Cal/OSHA standards by citing the applicable regulation and providing a description of why that portion of the safety plan does not meet the requirements of that regulation. However, the District should not engage in an activity that may be perceived as assisting the Contractor in developing the methods or means of satisfying those requirements such as proposing modified or new procedures. If the Contractor procedures are deficient (i.e., do not meet Cal/OSHA standards), the Contractor must correct them or retain a qualified 3rd party to correct them.

The EH&S Unit, who is knowledgeable and experienced in the pertinent Cal/OSHA regulatory requirements, will provide review of contractor safety program documents, if any, listed above.

ENVIRONMENTAL CONSTRAINTS AND REGULATORY REQUIREMENTS

Section 17—Permits, Regulatory Requirements, Environmental Requirements

This section of the special provisions includes the regulations, permits and agreements, and the environmental requirements the Contractor is required to meet throughout the construction of the project.

1. District-Obtained Permits and CEQA Commitments (Article 17.01.01)

   The District is normally responsible for obtaining permits as a condition of the project from federal, state and local agencies.

   The typical permitting agencies and their associate functions include:

   - State Department of Health Services—managing drinking water standards
   - State Department of Fish and Game—managing resource habitat (1602 Streambed Alteration Agreement)
   - Division of Safety of Dams—having jurisdiction over the District dams.
   - Regional Water Quality Control Board—managing clean water in the State (Water Quality Certification under Section 401 of the Clean Water Act; Waste Discharge Requirements, or waiver thereof, under Porter-Cologne Water Quality Control Act)
   - U.S. Army Corps of Engineers—managing clean water in the US (404 Permit)
   - State Water Resources Control Board—issuing National Pollutant Discharge Elimination System General Permit for Storm Water Discharges Associated with Construction Activities).

- National Marine Fisheries Service and U.S. Fish and Wildlife Service—protecting these resources.

- San Francisco Bay Conservation and Development Commission (BCDC)—having jurisdiction over work in or near the Bay or shoreline.

- State Lands Commission; the Coast Guard

- County, Cities and Towns—issuing permits for work in their jurisdiction including building permits, fire permits, hazardous materials permits for chemical storage, and encroachment permits.

- Caltrans and other public agencies—issuing encroachment permits for work within the agency‘s right-of-way, including right of entry and temporary construction easement.

CEQA document for the project includes other commitments as well.

The permit conditions and CEQA requirements may include, but not be limited to, work hours, noise pollution, spillage and dust, traffic control, water quality, wildlife protection, construction schedule, and other post-construction activities. Determine how these conditions and requirements will be best addressed. Can they be (a) incorporated into the project design features, (b) implemented by Contractor during construction, or (c) performed by the District during and/or post construction. Incorporate the requirements to be implemented by Contractor into various articles of the Specifications or the Drawings appropriately. Referencing the permit in the specifications and stating that the Contractor is responsible for complying with the conditions of said permit is not acceptable.

As part of incorporating permit conditions into the specifications, the project team will:

- Review all the permits‘ conditions thoroughly and make sure the permits‘ conditions or provisions that are Contractor‘s responsibility are clearly conveyed to the Contractor in the Contract documents.

- Direct the Contractor‘s attention to these permits, and list them under this Article or others as appropriate. Attach copies of permits in the Appendix.

- Direct the Contractor‘s attention to, and/or clarify, those permit conditions or provisions that must be performed by the Contractor but not so clearly worded on the permit language.

- Clarify the permit conditions or provisions that may be obscure, ambiguous or unclear. Direct the Contractor to perform the specific option if the permit provisions include more than one option for compliance.

CPSD QMS W73008—Advertise/Bid Opening/Report of Bids/Award, requires all right of way acquisition (fee title, permanent easements, temporary construction easements), agency permits, utility agreements, and other agreements (joint use, cost sharing, MOU, etc) be secured prior to routing the agenda package for Board approval to advertise. Form F75102—Checklist for Project Advertising, must be completed and included in the agenda package. This form is for upper management to consider when signing off on the agenda item. If the project has not secured all ROW, permits and agreements required, the project will have to justify why before upper management signs off. Approving project advertisement without these items is by exception only. The Specification writer should inform the Contractor accordingly if there is possible extra work or change orders as a result of the late permit(s).

2. Contractor-Obtained Permits (Article 17.01.02)

The Contractor may be required to obtain certain permits for his operations. Most of these permits are issued by local jurisdictions, such as haul route or transportation permits.

If the Contractor performs certain engineering designs, he may be required to obtain approvals from local jurisdictions as well. For examples: A contractor who designs the Fire Alarm and Sprinkler Systems for a project facility must possess a specialized design license and must obtain a permit from the local jurisdiction for the systems‘ design and installation.

List permits required to be obtained by Contractor here. If necessary, indicate who is to pay permit fees. Normally, the District should pay, or reimburse the Contractor if he pays.

3. Operations Regulations (Article 17.01.03)

Describe other regulations that the project facilities will be operated under and the requirements that may affect the Contract work or Contractor‘s operations. For example: California Division of Safety of Dams (DSOD) for dams; California Department of Health and Services (DHS) for treated water systems; City of San Jose Fire Department and State Fire Marshall for chemical systems.

4. Hours of Work (Article 17.02)

Refer to MMRP element of the CEQA documents and other permits for specific working hour, truck hauling limitations, and observed holidays. Consult with the local community in developing the criteria that meet the community‘s needs and are reasonable. Be sure the requirements stated in the specifications are consistent with the CEQA commitments and permit conditions.

Observed holidays include Federal holidays in general and any special holidays observed by local community. Federal holidays include: New Year‘s Day, Martin Luther King‘s Birthday, Presidents‘ Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veteran‘s Day, Thanksgiving Day, Christmas Day.

Local schools in certain communities do not observe certain Federal holidays, such as Columbus Day, but may observe others such as Friday after Thanksgiving.

For projects located near schools, include restrictions such as construction activities and traffic during school operating hours and other activities in conformance with CEQA documents and/or consultation with local school officials.

For projects that require access through local and neighborhood streets, include restrictions as for truck routes, contractor personnel vehicle parking, truck queuing, and idling within this article and/or in appropriate sections.

Contractors normally obtain haul route permits from the local cities. The project team should work with the local community and city officials, early on, for identification and inclusion of special conditions or restrictions in the permits.

Clarify hour restrictions for daily preparation work (before the construction activity actually begins) when required, such as setting up equipment, traffic control measures, or engine warm-up.

Contractor‘s failure to perform or comply with these requirements can result in public nuisance. The existing remedies, such as Article 7.05—Temporary Suspension of Work and Article 9.05 – Character of Workers, should be sufficient to enforce contract compliance. However, it may be necessary to specify additional remedies, such as liquidated damages, to strengthen enforcement of these requirements. Consult with Construction Units and Legal Counsel for advice.

5. Noise (Article 17.03.01)

As a minimum, refer to MMRP element of the CEQA documents and other permits for specific noise restrictions. Consult with the local community and agencies in developing the noise restrictions that meet the community‘s needs and are reasonable. Be sure the requirements stated in the specifications are consistent with the CEQA commitments and permit conditions. The county of Santa Clara and most cities in the county have ordinances regulating construction noise levels and hours of allowed activities. Most local noise ordinances specify either: (a) a maximum noise level for individual equipment or a maximum noise level at the property line, or (b) the allowed hours of construction activities, as follows:

(a) No individual piece of equipment shall produce a noise level exceeding ___ dBA (varies among local jurisdictions, typically between 85 and 87 dBA) at a distance of ___ feet (typically between 25 and 50 feet); or

The noise level at any point outside the project right of way shall not exceed ___ dBA (typically between 75 and 85 dBA).

(b) Construction activity shall not occur between __ p.m. (typically between 5 and 7 p.m.) and ___ a.m. (typically between 7 and 8 a.m.) unless it meets the nighttime noise standards (typically between 50 to 55 dBA) or prior written approval is granted by appropriate local agencies and the Engineer.

For local agencies that do not have clear noise ordinance for construction, it is best to consult with their government officials.

If required, include noise restriction requirements for specific hours during weekdays, and during Saturdays, Sundays and holidays. Also, include requirements for steady, audible low level noise caused by equipment that must be left on overnight such as pumps, fans, compressors. Requirements are varied for residential, commercial, and industrial areas.

If allowed by local jurisdictions, consider applying for a variance if certain construction activities cannot meet the noise ordinance. Any obtained variance must be identified in the CEQA document.

For projects where the necessary construction means and methods cannot meet the local noise ordinance, explore the following alternatives:

- Obtain a variance from local officials.
- Prescribe an alternative construction method (for example: consider pre-drilled piles in lieu of pile driving).
- Devise an engineering control such as sound walls to control noise and include it as part of the construction contract.
- Provide relocation option for affected residents.

For projects in neighborhoods where there is need to go above and beyond the local noise ordinance, explore some of the same alternatives described above.

Regardless of what is specified in the contract specifications, communicate with the affected community. People are usually more tolerant when they know what to expect.

6. Noise Monitoring (Article 17.03.01)

Construction inspectors monitor noise levels with a hand held noise level meter; however, certain projects in highly sensitive neighborhoods may require a more extensive, and costly, noise monitoring process. According to the procedure established by the United States Federal Highway Administration, construction noise measurements account for the reference noise emission levels for each type of construction equipment, the equipment‘s mode of operation, and the site characteristics (large reflecting surfaces, ambient level, and nearby other noise sources).

As a minimum, refer to the MMRP element of the CEQA documents for any required noise monitoring and measurements. If necessary and as appropriate, consult with the local community and city officials in developing the monitoring requirements, making sure they meet the community's needs and are reasonable.

Determine if the required noise monitoring should be District's or Contractor's responsibility and provide the appropriate contract language. If the noise monitoring work is extensive, set it as a separate bid item and include in the Technical Provisions.

7. Vibration (Article 17.03.02)

Projects with activities such as pile driving, structure demolition, and pavement breaking may have high levels of construction vibration. See Caltrans' publication titled –Transportation and Construction Induced Vibration Guidance Manual" dated June 2004 (http://www.dot.ca.gov/hq/env/noise/pub/vibrationmanFINAL.pdf). Earthborne vibration is measured by peak vertical velocity of soil particles, and depends on attenuating distance and soil parameter. The main concerns of vibration involve human annoyance, damage to structures, disruption of vibration sensitive operations or activities, and triggering of landslides (only at extremely high vibration level). The concern may be more significant where the projects are located near historical buildings or structures in poor condition.

Avoiding adverse vibration effects involves using physical methods to reduce the actual vibration and good public relations to ensure the public is well informed about the work and its potential effects. Based on the above Caltrans' publication, the following steps are recommended:

- Identify potential problem areas surrounding the project site.
- Determine conditions that exist before construction.
- Inform the public about the project and potential vibration-related consequences.
- Schedule work to reduce adverse effects.
- Design construction activities to reduce vibration.
- Notify nearby residents and property owners that vibration-generating activity is imminent and provide expected duration.
- Monitor and record vibration from the activity.
- Respond to and investigate complaints.

The purpose of the vibration-monitoring program is to protect properties from excess vibration during demolition and construction activities associated with the

project. Numerous vibration criteria have been reported by researchers, organizations, and governmental agencies. The following threshold values are cited from Appendix A—Transportation Related Earthborne Vibrations January 23, 2004, of the above publication:

- Historical building damage threshold for continuous vibration: Peak vertical particle velocity of 0.08 in/sec.

- Human annoyance threshold for continuous vibration: Peak vertical particle velocity of 0.1 in/sec.

- Architectural damage threshold for continuous vibration: Peak vertical particle velocity of 0.2 in/sec.

- Structural damage threshold for continuous vibration: Peak vertical particle velocity of 0.4 to 0.6 in/sec.

Extreme care must be taken when sustained pile driving occurs within 25 feet of any building, and 50 to 100 feet of a historical building, or building in poor condition.

When high level of construction vibrations is expected, a detailed structural survey will probably be needed before the start of construction. See instruction and include the appropriate language under the Article for Property Surveys.

Determine if vibration monitoring is required and provide the appropriate contract language. Using the vibration criteria above as a basis, specify the extent of properties to be monitored and the appropriate Threshold and Limiting Vibration Values (see examples). Make sure the values specified are reasonable. Refer to the MMRP element of the CEQA documents for any required vibration limitations and monitoring. District is not responsible for the safety of the work based on vibration-monitoring data, and Contractor‘s compliance with the vibration monitoring should not relieve the Contractor of full responsibility for damage caused by the Contractor‘s operations. If the contractor‘s vibration monitoring work is extensive, set it as a separate bid item and include in the Technical Provisions.

8. Spillage and Dust (Article 17.05)

As a minimum, ensure the specific spillage and dust control requirements in the MMRP element of the CEQA documents are addressed. If necessary and as appropriate, consult with the local community and city officials in developing the requirements, making sure they meet the community‘s needs and are reasonable.

9. Traffic Control, Truck Traffic, Truck Queuing (Articles 17.06 and 17.07)

Refer to the MMRP element of the CEQA documents for any requirements. If necessary and appropriate, consult with the local community and city officials in developing the restrictions, making sure they meet the community‘s needs and

are reasonable. If the Traffic Control work is extensive, set it as a separate bid item and include in the Technical Provisions.

10. Parking (Article 17.08)

Refer to the MMRP element of the CEQA documents for any requirements. If necessary and as appropriate, consult with the local community and city officials. If the parking restrictions on neighborhood streets cause constraints or severely limit the Contractor‘s ability to perform the work, develop an alternative parking area or an alternative means to resolve the parking constraint. Delineate the areas of imposed restrictions and/or allowed parking areas on the Drawings and make reference in the Specifications.

Section 18— Environmental

1. Water Quality Regulatory Requirements (Article 18.01)

Depending on the nature of construction, a construction project may be subject to the following permits to comply with the Clean Water Act and California Water Code:

a. State Water Resources Control Board‘s Water Quality‘s National Pollutant Discharge Elimination System General Permit for Storm Water Discharges Associated with Construction Activities.

b. U.S. Army Corps of Engineers CWA Section 404 Permit and Regional Water Quality Control Board/State Water Resources Control Board CWA Section 401 Water Quality Certification: Discharge of dredge and/or fill to any jurisdictional surface water (e.g., wetland, channel, pond, or marine water)

c. Other individual RWQCB NPDES Permits.

d. Department of Fish and Game 1602 Stream Bed Alteration Agreement.

Review conditions for management of storm and non-storm water from all the above permits and address the requirements in the appropriate article(s) under this section.

Discharges of non-storm water may be necessary for the completion of certain construction projects. The project team should identify and evaluate the construction activities that generate and require disposal of non-storm water, and determine whether or not, such discharges will be authorized by the General Permit. If not, a separate permit from RWQCB for non-storm water discharge may be required. Construction non-storm water discharges include, but are not limited to: irrigation of vegetative erosion control measures, pipe flushing and testing, street cleaning, excavation dewatering, and pumped ground water. Such discharges are authorized by the General Permit as long as they (a) do comply with Section A.9 of the General Permit, (b) do not cause or contribute to violation of any water quality standard (from Basin Plan

http://www.swrcb.ca.gov/rwqcb2/basinplan.htm), (c) do not violate any other provisions of the General Permit, (d) do not require a non-storm water permit as issued by some RWQCBs, and (e) are not prohibited by a Basin Plan.

Review results of available hazardous material investigations conducted to date. Consult with in-house environmental engineering staff to determine the quality of the water discharges. For example: (1) Do existing hazmat data support conclusion that the water discharges will meet the above conditions for authorized non-storm water discharges under the General Permit? (2) If the answer to (1) is NO, do we need additional hazmat investigations to collect more data to make the determination?

Common sources of contaminated or likely contaminated non-storm water discharges include: excavation dewatering in areas with known soil/groundwater contamination, water from disinfection of a new pipeline, or pumped groundwater from an area with known contamination. For these types of discharges, consult with in-house environmental engineering staff to develop a proposed procedure for the Contractor to follow during construction and work with the RWQCB for a separate non-storm water discharge permit. List these discharges and the proposed requirements and procedure in the permit application. Ensure that the permitting agencies agree with the proposed requirements and procedures and that they can be included in the specifications.

The requirements listed in the Template are typical for most projects. Some are based on the water quality objectives taken from the Basin Plan. Include additional water quality requirements from other permits as applicable, such as pH, temperature, dissolved oxygen, etc.

2. Compliance with current NPDES General Permit for Construction (Article 18.02)

The Project Engineer must determine if a SWPPP (Alternative 1) or a Best Management Practices (BMP) Action Plan (Alternative 2) is required. The conditions to be evaluated are as follows:

a. When a project site or sites (including sites from different stages or phases of the work) are 1 acre or over 1 acre, a Notice of Intent must be filed by the District with the SWRCB and a SWPPP is required from the Contractor per Alternative 1.

b. When a project site or sites are less than 1 acre but the Project Engineer believes that compliance with the General Permit is appropriate, a Notice of Intent is not filed by the District but a SWPPP is still required from the Contractor.

c. When a project site or sites are less than 1 acre and the Project Engineer believes there is no potential for pollution due to stormwater or other factors, no Notice of Intent is filed and no SWPPP is required from the Contractor. However, a BMP Action Plan will be required of the Contractor per Alternative 2.

The SWPPP should be reviewed by engineers who have received SWPPP training.

To assist the Contractor in preparing the SWPPP, the Project Engineer should begin preparing the necessary SWPPP mapping needed by the Contractor before the project is advertised. Site maps (including a map which extends ¼-mile beyond the project boundaries and a clean set of contoured [if available] construction drawings, aerials if possible) should be developed during the design phase of the project.

The Project Engineer should prepare and file the Notice of Intent (with fee) following award of Contract.

Compliance with New NPDES General Permit for Construction:

a. The new General Permit for Construction was adopted by the SWRCB on September 2, 2009 and will become effective on July 1, 2010. See attached link for the new permit and requirements. http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/wqo_2009_0009_complete.pdf

b. All projects taking place after July 1, 2010 with construction and land disturbance activities of one or more acre are covered under the new permit.

c. The District (Project Team) must file all Permit Registration Documents (PRDs) online with the SWRCB. The PRDs include NOI, Risk Assessment, Site Map, SWPPP, and Signed Certification Statement.

d. Compliance efforts are based on risk evaluation that is comprised of two elements: sediment risk and receiving water risk. There are Risk Levels 1 to 3 with 3 requiring the most documentation and compliance efforts.

e. The Project Team must perform the Risk Assessment (Sediment Risk and Receiving Water Risk) based on the instructions provided in the Permit. Sediment Risk is based on Rainfall Erosivity, Soil Erodibility, and Site Topography factors. Receiving Water Risk is based on Watershed characteristics (i.e. impaired by sediment or designated beneficial uses).

f. The Project Team must prepare the specifications accordingly based on the determined Risk Level. The Permit has specific compliance requirements for each Risk Level 1, 2, and 3.

g. The Project Team must ensure that the SWPPP be prepared, amended and certified by a Qualified SWPPP Developer (QSD), and implemented by a Qualified SWPPP Practitioner (QSP). The QSD must have proper registrations or certifications, and experience, as required, such as registered professional civil engineers, registered professional geologists, registered landscape architects, etc. The QSP must be either the QSD or

inspectors with appropriate certifications in erosion and sediment control. All these requirements must be clearly stated in the specifications.

h. Any active construction projects permitted under the previous Construction Storm Water Permit (SWRCB Order No. 99-08 DWQ) are grandfathered into Risk Level 1 of the new permit and must comply with the Risk Level 1 regulations. For these projects, the project teams must file the PRDs electronically with the SWRCB after July 1, 2010.

3. BMP Fact Sheets (Article 18.02.03)

Review and evaluate all the BMPs' fact sheets listed for the project and, in consultation with Construction Unit and Stream Water Quality Unit, modify or clarify them as needed. The modifications and clarifications may be general or specific to certain BMP's, and include construction materials, design configurations, or frequency of inspection.

4. Regulated Material Management (Article 18.05)

Conduct hazmat investigation of the project site early during design to determine the condition of the excavated materials, and to develop requirements for proper management of the materials during construction. Excavated materials may be characterized as either regulated materials or non-regulated materials. Regulated materials, including hazardous materials and hazardous waste, must comply with federal, state, and local regulations regarding storage, transportation, and disposal. Non-regulated materials follow certain guidelines from regulatory agencies. The Template Special Provisions include language for management of regulated and non-regulated materials.

If there is existence of asbestos or lead, refer to the District's Environmental Asbestos Management Program or Environmental Lead Management Program for applicable laws, regulation and recommendations. Asbestos may exist in soils (naturally occurring asbestos) or building materials (vinyl flooring, fireproofing, etc.). Lead may present in paints, piping, or equipment.

5. Solid Materials Management (Article 18.06)

An August 2002 District Feasibility Study of Solid Materials Management Options identified that a small percentage of solid waste streams generated from District activities included construction and demolition waste and recommended several strategies/tactics to reduce the disposal of solid waste to landfill. Because this is a new article that was added to the special provisions guidelines in August 2006, it is recommended that the spec writer consult with the Technical Review Committee when preparing this specification article.

6. Construction and Demolition Waste Management (Article 18.06.02)

Construction and Demolition (C&D) waste management requirements may consist of one of the following:

a. Require recycling/salvaging a specified percentage of total C&D waste generated.

b. Require reporting only of percentages of total C&D waste generated that are disposed and recycled/salvaged.

c. Require both recycling/salvaging of a percentage of certain specified C&D materials AND require reporting only of percentages of other specified C&D waste generated that are disposed and recycled/salvaged.

Determine which of these will be required of the Contractor based on an evaluation of the project. The intent is to promote and/or encourage recycling/salvaging of C&D waste and thereby reduce the amount of waste material that is disposed of in landfills. If construction will generate wastes such as asphalt, concrete, or masonry, most likely it will be economical for the Contractor to recycle/salvage this material instead of disposing the material at a landfill. Demolition work, for example, is generally amenable to recycling/salvaging. Consult with Construction Engineering Unit for questions regarding the feasibility of recycling/salvaging C&D wastes on a project. If recycling/salvaging is required, the Contractor should report quantities recycled/salvaged and disposed in the same unit of measurement. Though recovery and disposal facilities have truck scales, for small quantities, and if adequate existing dimensions are known, material is generally measured by volume (e.g., cubic yard). For larger quantities, such as material delivered by end dump (w/min. capacity of 8 CY) or 10-wheeler, material is measured by weight (ton). Therefore, if the materials specified will be generated in large quantities, measurement by weight is appropriate.

If recycling/salvaging is determined to be cost-prohibitive, determine whether to require the Contractor to report the total C&D waste generated and the percentages of C&D waste that are disposed and recycled/salvaged. Little is currently known about the degree of recycling/salvaging of C&D wastes generated on District projects; therefore, the District can use this information to document the percentage of District-generated C&D waste that is diverted from landfills. If recycling/salvaging will not be required, the reporting requirement should be included in the construction contract unless it is determined that doing so would be cost-prohibitive. If recycling/salvaging will not be required, the Contractor may report quantities recycled/salvaged and disposed by either weight (ton) or volume (cubic yard).

There might be an instance where we want the contractor to meet a minimum 50 percent recycling rate for materials A and B and report the rate of recycling of materials Y and Z. In this case, the spec writer will need to establish two lists: one list of C&D waste material which must meet the minimum 50 percent recycling and one list of C&D waste material that we want the contractor to report quantities disposed and recycled only.

If recycling/salvaging or reporting will be required, specify what materials will be considered C&D waste for the project. C&D waste can include material such as asphalt, concrete/masonry, metal, wood, and mixed debris (including cardboard,

plastics, etc.). C&D waste does not include dirt/soil or groundwater and does not include material that contains contaminated or hazardous substances. Keep in mind that any material identified as a C&D waste, will require that the Contractor track the total weight of the material, the percentage of the material that is recycled or otherwise diverted from landfill and the percentage that is disposed to landfill. Since this is a new requirement for District projects, the best approach is to start small and expand the program over time. So, initially, it is advisable to require recycling/salvaging for select projects and to limit the materials specified as C&D waste to those recyclable materials that will be generated in large quantities. For example, one might specify minimum C&D recycling requirements for a bridge demolition project and specify only concrete as a C&D waste. As the District gains more experience with contractors and a better understanding of recycling opportunities available, we can expand to include more projects and add to the list of materials specified as C&D waste. Consult with Construction Engineering Unit for assistance in determining which materials should be specified as C&D waste for a project.

As noted above, dirt/soil is not considered a C&D waste. The reason for this is that there are risks associated with reusing dirt excavated on a District project for some other use. The soil is tested, but because soil samples may miss an area of contamination, there is always a risk that there is some level of contamination in the dirt that is not identified through testing. The District has existing procedures covering the disposition of excess dirt/soil generated which protects against this potential liability. If the amount of dirt/soil to be hauled off site is large, it may be beneficial to have the contractor report on the actual quantity disposed so the District can track the quantity of dirt that is disposed to landfill.

Regarding minimum percent recycling, the 2002 Solid Waste Management study recommended a minimum recycling rate of 50 percent. When selecting the material to be classified as C&D waste on a particular project, list material that we are confident can reasonably be recycled at the min. 50 percent rate. If unsure whether the material can be recycled at the minimum 50 percent rate, it is advisable not to require recycling. A case could be made that if we are uncertain whether the 50 percent rate is reasonable for a given material, the minimum be lowered to something less than 50 percent. The question then becomes, what should the rate be lowered to and on what basis will this rate be established? Also, evaluate whether the benefit of the recycling is negated by the small quantity generated or the cost. For example, we set the min. at 10 percent and this equates to a bucket of material. Or we set the minimum at 10 percent and this is a sizeable quantity, but there is no market for this material, so the cost to recycle is equal to or greater than the cost to dispose of to landfill. The thought is that, initially, attention should be focused on materials we know are recycled at a high rate and which will be generated in sufficient quantities. In these cases, the benefits are very clear. If we are unsure of the reasonableness of setting a requirement of 50 percent, rather than set an arbitrary minimum, it is recommended reporting only be specified. Over time, the data will give us a better understanding of what materials can be recycled and at what rates. We can then use this data to make informed decisions regarding what materials to specify as C&D waste. Keep in mind that the 50 percent rate is cumulative for all C&D materials specified. So, if asphalt, concrete and metal are listed as C&D

waste, depending on the quantities, if the contractor recycles 30 percent asphalt, 90 percent concrete and 0 percent metals, he could still meet the specification. Therefore, knowing the typical recycling rates for materials and factoring in the quantities of these materials generated on a project, we can ‗calculate' the likelihood of the contractor meeting the 50 percent minimum. The Solid Materials Management Report (Form S12201) should be modified to separate the wastes that must meet a minimum recycling rate and the wastes in which reporting only of recycling rates will be required.

Note to specification writer: The Solid Materials Management Report (Form S12201) has not been approved by District Counsel. Until this occurs, the spec writer is directed to contact Word Processing to obtain a working draft of the form which can be used in the interim.

Determine if there are any materials that would be acceptable to reuse on the project. If so, specify the particular material(s) that the contractor can reuse on the project. If the material can only be used for limited purposes, specify what the acceptable uses of the salvaged material(s).

In the examples in the Template, a separate bid item is not specified. However, the specification writer may choose to establish a bid item for this work. Creating a bid item provides a financial incentive to encourage the Contractor to comply with the requirements. In addition, it informs the District of the cost associated with this contract requirement. In discussions with the City of San Jose, which has implemented a C&D recycling program since 2001, they have stated that the 50 percent minimum goal is easily attainable, that contractors are familiar with recycling requirements and that contractors recognize the economic benefits of recycling and comply regardless of whether there is a financial incentive/penalty. The District will monitor compliance. If problems with compliance occur, it may then be advisable to establish a bid item and/or penalties for non-compliance. To encourage a higher level of recycling, the District may want to evaluate the benefits of providing additional incentive for contractors who recycle above the minimum 50 percent rate at some future date.

Evaluate if cross references to the article in the Template should be included in other sections of the specifications. For example, if C&D waste generated on the project will result from demolition activities, a cross reference to this article might be warranted in the demolition article of the technical provisions.

7. Post-Consumer Recycled Content Requirements (Article 18.06.03)

A recycled-content product is an item that contains recovered materials. Recovered materials are wastes that have been diverted from conventional disposal (such as landfills) for another use. Recovered materials include both pre-consumer and post-consumer wastes. Pre-consumer materials are generated by manufacturers and processors, and may consist of scrap, trimmings, and other by-products that were never used in the consumer market. Post-consumer material is an end product that has completed its life cycle as a consumer item and would otherwise have been disposed of as a solid waste.

The higher the percentage of post-consumer recycled content in a product, the greater the amount of waste that is diverted from disposal.

Post-consumer recycled content (PCRC) requirements may consist of one of the following:

a. Require that specified materials/products to be furnished/installed by the Contractor contain a minimum percentage post-consumer recycled content.

b. Require reporting only of material/product furnished that contains post-consumer recycled content, including the percent content.

c. Require both specified material/product contain a minimum percent post-consumer recycled content AND require reporting only of other material/product furnished that contains post-consumer recycled content, including percent content.

Determine which of these will be required of the Contractor based on an evaluation of the project. The intent is to promote and/or encourage the use of construction materials which are manufactured from post-consumer recycled material. The economic and environmental benefits of recycling and resource recovery include lowering manufacturing costs by reducing the energy demands associated with extraction and processing of raw materials, slowing the use of virgin material and, slowing the fill rate of landfills. Specifying recycled-content products helps to ensure that the materials collected in recycling programs will be used again in the manufacture of new products.

When evaluating the appropriateness of specifying recycled content in material and product to be furnished and installed by the Contractor, consider items such as:

a. Does the material/product contain constituents that may be detrimental to the facility, such as impact the life span of a component of the facility, be aesthetically undesirable, and/or incur additional operations and maintenance costs? If so, has this been discussed with the customers/stakeholders and has there been agreement that the benefits outweigh the disadvantages?

b. Could the material/product contain constituents that could potentially have adverse impacts to the environment and human health?

For example, concrete rubble cannot be used in backfill for channel embankment or levees of flood protection projects. In addition, recycled asphalt aggregate base material may contain petroleum products. If this material was to be used for a depressed maintenance road on a creek improvement project, and if the petroleum product leached into the water, fish and amphibious wildlife could potentially be impacted.

If a project will require material which is known to be manufactured with post-consumer recycled content material, it can be specified that this material must contain __ percent of post-consumer recycled content. The 2002 feasibility study recommended a PCRC of 10 percent or more. An example would be a building project where metals such as flat-rolled aluminum will be required for roofing or siding panels. Consult with Construction Engineering Unit for questions regarding what construction materials for the project could reasonably be expected to be manufactured with PCRC material.

If requiring PCRC material on the project is determined to be cost-prohibitive, the specification writer should determine whether to require the Contractor to report material installed/furnished which is manufactured with PCRC material, including the percent content. The Contractor should be required to report construction material installed/furnished for the project which is manufactured from PCRC material and also provide the percent content, unless it is determined to be cost-prohibitive.

There might be an instance where we want the contractor to both furnish/install certain material/product which contains a specified minimum percent of post-consumer recycled content and also report only the percent PCRC for other specified material/product to be furnished/installed. In this case, the specification writer will need to establish two lists: one list of material/product which must meet the min. ___ percent PCRC and another list of material/product in which the contractor is to report on the percent of PCRC only. The Solid Materials Management Report Form should be modified to separate the material/product that must contain a specified minimum percent of PCRC and the material/product for which PCRC is to be reported only.

In the examples in the Template, a separate bid item is not specified. However, the specification writer may choose to establish a bid item for this work. Creating a bid item provides a financial incentive to encourage the Contractor to comply with the requirements. In addition, it informs the District of the cost associated with this contract requirement.

8. Migratory Birds (Article 18.07)

Refer to MMRP element of the CEQA documents and regulatory permit requirements for mitigation measures necessary for the protection of migratory birds, and address all applicable measures in this Article.

If the migratory bird protection work is extensive and must be paid as a bid item, consider moving the entire migratory bird protection Article to the Technical Provisions.

While it is true that not all species on the list of birds protected by provisions of the Migratory Bird Treaty Act are likely to occur in a given project area, the list is a lengthy one, and many seasonally-abundant species are persistent in their efforts to carry out nesting activities. Therefore, the potential for a project to be affected by migratory birds can be high.

For these reasons, all pre-bid meetings should include an agenda item for the discussion of migratory bird-related issues.

Furthermore, because timing the issuance of the Notice to Begin Work in coordination with onset of the nesting season can be critical, the Design Team should consult with the project‘s Environmental Planner of record, the project-specific MMRP, and the District‘s Migratory Bird Guidelines. This is because of the potential need for site clearance work by District forces, or a separate force, prior to Contractor‘s commencement of site construction. The work likely will need to include: (i) conducting site surveys; (ii) installing and maintaining exclusion devices; (iii) managing and maintaining vegetation areas; (iv) monitoring; and (v) depending on the time of year when the Notice to Begin Work is issued, establishment and maintenance of protective buffer zones.

Contractor Biologist

Refer to MMRP element of the CEQA documents and regulatory permit requirements for mitigation measures related to an on-site biologist. The language in the Template requires Contractor to hire its own biologist. Determine if a District-provided biologist is preferable, and if so, confirm availability, and then, modify the language appropriately.

Migratory Bird Surveys

Refer to MMRP element of the CEQA documents and regulatory permit requirements for mitigation measures related to migratory bird surveys. For example, pre-activity surveys likely will be necessary:

- If work involves removing or trimming trees during the nesting season.
- If nesting has been recorded before or after the nesting season in previous years at or near the site.
- If work involves earthmoving operations, or the removal or trimming of vegetation during the nesting season.
- If any project-related activity could result in regulatory non-compliance.

General Nesting Seasons

Refer to MMRP element of the CEQA documents and regulatory permit requirements for mitigation measures related to the migratory birds‘ nesting seasons.

Protective Buffer Zones

Refer to MMRP element of the CEQA documents and regulatory permit requirements for mitigation measures related to the establishment of project-activity protective buffer zones for the protection of migratory birds.

Installation and Maintenance of Exclusion Devices

Refer to MMRP element of the CEQA documents and regulatory permit requirements for mitigation measures related to the need to install/maintain exclusion devices.

Coordinate with the project's Environmental Planner to carry out a Design Phase site survey to support the development of Plans, Specifications and Estimates for exclusion devices.

Vegetation Management for Nest Prevention

Refer to MMRP element of the CEQA documents and regulatory permit requirements for mitigation measures related to vegetation management. In some cases, prescriptive measures for vegetation management may be necessary.

For example, "means and method" of vegetation removal may need to be specified during the winter months. California Department of Fish and Game (CDFG) and the Regional Water Quality Control Board (RWQCB) will not allow any equipment in the channel during the winter, if we were just to say maintain vegetation less than 6 inches, the Contractor could argue that their planned mode of removal is by using a tractor mower. If removal by hand tools is necessary due to CDFG and RWQCB restrictions, clearly state so; otherwise the District could be wide open to claims from the Contractor.

CONTRACT ADMINISTRATIVE PROCEDURES

Section 19—Quality Assurance Requirements

This section of the special provisions includes quality assurance procedures to ensure that the products furnished and work performed meets the specified standard and performance.

1. Submittals (Article 19.01)

   District requires that Contractor submit product information and/or methods of work for District review prior to conducting the work. The Engineer's review of the submittals should follow the procedures described in Article 9.02.02.

2. Equal, Sole or Single Source, and Substitution (Article 19.03)

2.1 District's definitions and requirements for Equal, Sole or Single Source, and Substitution are in Article 10.10 of the Standard Provisions. Below are some examples of how to distinguish "substitution" from "equal":

   a. For certain projects, the material is not the same. For example, if the spec states 60" dia. welded steel pipe for a pipeline project and the contractor proposes to use 60" dia. concrete pipe.

b. The product/equipment/service does not meet a stated material/performance requirement. For example, if we specify ―Doors with lifting springs that rub against the door in any manner shall not be allowed" and the product does not meet this requirement.

c. Equipment does not meet a stated performance specification. For example, if we specify a requirement that the Contractor shall furnish a pump whose manufacturer/distributor shall respond to a maintenance service call within XX hours and the manufacturer/distributor cannot meet this requirement.

d. The specifications require a manufacturer/model and the Contractor submits a product by the same manufacturer but lists a different model. The Contractor might do this for a number of reasons:
   i. The model we specified no longer is made
   ii. The Contractor can get another model for a lower cost
   iii. The Contractor may have surplus of a model that is similar to but not equal to what is specified

2.2. Timing for submission of ―substitution" and ―or equal" submittals:

a. Or equal submittals can be submitted at any time during the contract.

b. For substitution submittals, Article 10.10 specifies the Contractor is to submit substitution submittals within 35 days after the date of the Notice to Begin Work. The reasons for this include: It may take considerable time for the District to review the substitution; the approval/rejection of a substitution may impact the sequencing of work, construction schedule; etc. However, irrespective of the benefits to the Contractor and/or District, if the approval of the substitution will benefit the project, District reserves the right to allow submission of the proposed substitution any time after the 35-day time limit.

2.3. In general, if the product/material appears to be equivalent to what is specified, and unless the Contractor specifically identifies the submittal as a ―substitution", it is initially evaluated as an ―or equal" submittal. For example, if we specify air release valves shall be model XX manufactured by APCO; model YY manufactured by Val-matic; or equal, and the contractor submits model ZZ manufactured by Crispin, and the valve appears on the surface to be equivalent and it is not identified by the Contractor as a ―substitution", we would initially evaluate this as an ―or equal". If, in the process of reviewing the submittal, we discover that it is not an equivalent to what is specified, we would then classify this as a ―substitution" submittal.

In the case of example 2.1.d above, if it is not the model we specify, it is considered a substitution. The model the contractor submits could have more features than the model we specify. Regardless, even if the Contractor describes this as an upgrade, it is still a substitution. In the case of (i), we would

have to consider the substitution. For (ii) and (iii), if within the 35 days, we would be required to consider the substitution.

3. Contractor‘s QA/QC Requirements (Article 19.02.08)

An appropriate Contractor‘s QA/QC program requires that Contractor inspect, sample, and test the materials, products, equipment, and workmanship supplied for the project. Based on individual project needs, the District may also want to perform independent testing in addition to the Contractor‘s tests.

Only certain projects require a Contractor‘s QA/QC program. QA/QC programs may be needed on large and complicated projects or federal funded projects. The project team should determine if the project requires it.

Section 20—Payment Procedures

This section of the special provisions includes the contract payment procedures.

1. Bid Items, Measurement, and Payment (Article 20.01)

Bid items should align with the execution of the work. A detailed ―Listing of Bid Items" is not needed if the bid items (scope, product, execution, and measurement, and payment) are described and organized clearly in the Technical Provisions.

A bid item typically includes labor, materials, tools, equipment, and incidentals for doing all work necessary to construct or furnish the item as shown on the Drawings and/or specified in the Specifications. Certain bid items can be described completely in one specification section while others of more complex nature (i.e., work that involves multi-discipline engineering or various trades) may require several sections to fully describe its material and installation requirements. A project may include both lump sum and unit price bid items.

A lump sum item is one in which the contractor agrees to perform work for a stated amount[*]. Lump sum work is appropriate when the quantities are not expected to vary. Contractors assume certain risks for doing lump sum work. A work item paid by lump sum must be readily determinable in all its features at the time of bidding. It typically requires more contract drawings to show in detail everything that will be needed. Work that involves unpredictable risks, or all its features not readily determinable, is not suited for lump sum. For example: work involving excavation of uncertain quantity and character, or work subject to unpredictable hazards. Examples of lump-sum work are as follows:

- Routine construction of buildings or similar structures with which the average contractor has had considerable experience* is appropriate for a lump-sum method. A chemical feed building by lump sum bid may require many different kinds of work (i.e., structural excavation, structural backfill, concrete, architecture treatment, chemical resistant coating,

[*] *Dunham and Young's Contract, Specifications, and Law for Engineers, Fourth Edition*, Joseph T. Bockrath (1986).

mechanical, electrical, and instrumentation.), but a capable and experienced contractor can generally estimate the total cost and prepare the bid with a fair degree of accuracy.

- A confined footprint work (i.e., valve vault, inlet facility, small bridge, etc.) that involves large variety materials but each kind will be used in small quantities would be appropriate for a lump sum.

- Work difficult to classify and to keep track in the field such as mobilization and clearing and grubbing may be treated as a lump-sum item for convenience.

The remuneration for lump sum items is made in a series of partial payments as work progresses[*]. It requires the contractor to prepare and submit a schedule of value and progress schedules.

A unit-price item is one in which payment for the work is to be made upon the basis of the computed quantities of specifically stated items of work actually performed and materials furnished and used by the contractor in the project*. Unit price is appropriate when there is an expected variation in quantities (i.e., earthwork). In order to calculate quantities accurately, the design work generally needs to be fairly detailed and certain. Otherwise, the District is exposed to risk due to varying quantities. Based on our current standards, we need to be within at least 25%+/- and to be fair to the bidder, it should be even closer. If the quantity variation is likely to exceed the variation limits specified in the standard provisions, additional payment terms will need to be specified to address this risk.

Units for unit-price items must be definite and readily measurable*. Unit-price items require general designs and drawings together with estimates of quantities so that the bidders may ascertain the magnitude of the project, the character and difficulty of the work, and the probable cost of performing it. Payment for unit-price contract is based on whatever work units actually performed or furnished by the contractor. This method likely reduces some of the gamble in bidding by the contractor. Example: Difficult foundations for which no one knows how much excavation will be required, or how much of the work may be the excavation of rock instead of earth. Quantities of work paid by unit price are calculated based on drawings or field measurements.

2. Mobilization Bid Item (Article 20.01)

Mobilization bid item is normally related to construction logistics. The payment limits and distribution strategy for mobilization should align with the degree of work compared to bid item work and how the Contractor executes the work (i.e., upfront payment or monthly).

3. Progress Payment and Schedule of Values (Article 20.02)

[*] *Dunham and Young's Contract, Specifications, and Law for Engineers, Fourth Edition*, Joseph T. Bockrath (1986).

Article –Progress Payment and Schedule of Values" only applies to projects that have lump sum bid items, or projects that will be paid for on a lump sum basis. This article may not apply to flood protection or pipeline projects which are mostly paid for on a unit price basis.

Section 21—Contract Closeout

This section of the special provisions includes requirements and procedures to close out the contract.

1. Upon notification by the Contractor on milestone completion or project completion, the District Engineer will inspect the work to ensure that all the necessary work has been completed and issue the milestone completion letter or project completion letter. (Article 21.01)

2. Prior to final payment, the Contractor is required to provide a guaranty for the materials and workmanship furnished under the project in a form of a written guaranty bond. Under this guaranty, the Contractor is required to make repairs or replacements for any defects in materials or workmanship within the guaranty period. The Contractor is also required to test and startup the new facilities and to train District staff (with completed operations and maintenance manual) on the new facilities. (Article 21.02)

3. Other final close-out documents required include the record drawings and specifications, evidence of compliance with permits, copies of guarantees, warranties, and bonds, evidence of release of all liens and stop notices, and release of claims. (Article 21.05)

4. Training, Testing, and Startup (Articles 21.03 and 21.04)

   Contractor training of District staff, and testing and startup of new facilities are typically needed for water utilities projects where Contractor provides new equipment, products, or systems. These requirements may also be applicable to flood protection projects (e.g., review and testing of irrigation systems/schedules and operation of controller boxes/valves for vegetation installed as part of the project).

DOCUMENTS AND URL LINKS REFERENCED IN THE SPECIAL PROVISIONS GUIDELINES

SECTION 12 INSTRUCTION

U.S. Department of Transportation, Geotechnical Engineering Notebook, Geotechnical Guideline No. 15: http://www.fhwa.dot.gov/engineering/geotech/policymemo/gt-15.pdf

SECTION 13 INSTRUCTION

Three Party DRB Agreement Form: Three-Party Agreement (District, Contractor, and DRB)

Caltrans' dispute resolution process:
http://www.dot.ca.gov/hq/construc/manual2001/chapter5/chp5_4.pdf

Dispute Review Board:
http://www.oles.com/publications/2005/Dispute%20Review%20Boards.pdf

Deciding to have a DRB: http://www.drb.org/manual/1.4_final_12-06.pdf

Dispute Resolution Board Foundation Practices and Procedures:
(http://www.drb.org/manual_access.htm).

SECTION 16 INSTRUCTION

8 CCR 3203 (General Industry): http://www.dir.ca.gov/Title8/3203.html
8 CCR 1509 (Construction): http://www.dir.ca.gov/Title8/1509.html
8 CCR 8406 (Tunneling): http://www.dir.ca.gov/Title8/8406.html
8 CCR 5194: http://www.dir.ca.gov/Title8/5194.html
8 CCR 5157: http://www.dir.ca.gov/Title8/5157.html
8 CCR 5158: http://www.dir.ca.gov/Title8/5158.html
8 CCR 5144: http://www.dir.ca.gov/Title8/5144.html
8 CCR 3314: http://www.dir.ca.gov/Title8/3314.html
8 CCR 5097: http://www.dir.ca.gov/Title8/5097.html
8 CCR 3668: http://www.dir.ca.gov/Title8/3668.html
8 CCR 5006.1: http://www.dir.ca.gov/Title8/5006_1.html
8 CCR 4335: http://www.dir.ca.gov/Title8/4355.html
8 CCR 6151: http://www.dir.ca.gov/Title8/6151.html
Cal/OSHA's Diving Safety Orders: http://www.dir.ca.gov/Title8/sb7g26.html
8 CCR 1541: http://www.dir.ca.gov/Title8/1541.html
8 CCR 1671.1: http://www.dir.ca.gov/Title8/1671_1.html
8 CCR 1599: http://www.dir.ca.gov/Title8/1599.html
8 CCR 3395: http://www.dir.ca.gov/Title8/3395.html

Most of the above regulations can be obtained through this website:
http://government.westlaw.com/linkedslice/default.asp?SP=CCR-1000. Click _Search' then enter Title and Section numbers.

Memorandum from Anthony Fulcher to Nai Hsueh, Feb 20, 2007, *RLS-2006-0037: Reviewing Contractor's Safety Plans*

SECTION 17 INSTRUCTION AND TEMPLATE

United States Federal Highway Administration's Technical publication titled "Measurement of Highway-Related Noise," Section 7 "Construction Equipment Noise Measurements for Highway-Related Projects" dated May 1996: http://www.fhwa.dot.gov/environment/noise/measure/chap7.htm

Caltrans' Transportation- and Construction-Induced Vibration Guidance Manual (June 2004): http://www.dot.ca.gov/hq/env/noise/pub/vibrationmanFINAL.pdf

13 CCR 2485 (Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling): This regulation can be obtained through this website http://government.westlaw.com/linkedslice/default.asp?SP=CCR-1000. Click "Search" then enter Title and Section numbers.

SECTION 18 INSTRUCTION AND TEMPLATE

Basin Plan: http://www.swrcb.ca.gov/rwqcb2/basinplan.htm

Storm Water Discharges Associated with Construction Activities (State Water Resources Control Board's Water Quality Order 99-08-DWQ): http://www.cicacenter.org/pdf/capermit.pdf

California Stormwater Quality Association "Stormwater Best Management Practice Handbook," Construction, 2003: www.cabmphandbooks.com.

SWPPP Template: http://www.cabmphandbooks.com/Documents/Construction/Appendix_B.pdf

SWPPP checklist: http://www.waterboards.ca.gov/stormwtr/docs/const_swppp.doc

Stormwater Best Management Practice Handbook, Construction, 2003: www.cabmphandbooks.com

New NPDES General Permit for Discharges Associated with Construction and Land Disturbance Activities: http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/wqo_2009_0009_complete.pdf

District Feasibility Study of Solid Materials Management Options: District Feasibility Study of Solid Materials Management Options

Solids Materials Management Report Form: Solid Materials Management Report (Form S12201)

City of San Jose's Construction and Demolition Deposit Program Certified Facility List: http://www.sjrecycles.org/business/pdf/cddd_certified_list.pdf

Additional recycling resources are available at: www.ciwmb.ca.gov/condemo/ and www.crra.com/cdc/index.html

Migratory Bird Permit Memorandum, issued by the U.S. Fish and Wildlife Service dated April 15, 2003: http://www.fws.gov/permits/mbpermits/PoliciesHandbooks/MBPM-2.nest.pdf

Contractor Biologist: Contractor Biologist

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SPECIAL PROVISIONS
SECTION 11. WORK AND SCHEDULE OF WORK

11.01. Summary of Work

Most District's projects are related to construction of flood control facilities, or of the conveyance, transmission, treatment, process, or storage of water, including the supporting facilities such as streets, bridges, buildings, utilities, communication, chemical storage and feed systems. Describe the major items of work quantitatively and qualitatively in terms of these components. Include a disclaimer that any quantities provided with the summary description are just estimates and the actual anticipated quantities are as reflected in the Bid Items Listing. Use this same summary description on the Notice to Prospective Bidders.

EXAMPLE 1:

A. The work to be completed under this Contract shall consist of furnishing all tools, equipment, materials, supplies, and manufactured articles and furnishing all labor, transportation and services, including fuel, power, water, and essential communications, and performing all work, or other operations required to construct the Santa Clara Valley Water District/ San Francisco Water Department Intertie Pump Station (SCVWD/SVWD Intertie Pump Station) as illustrated on the Plans and detailed in these Specifications. The pump station is being constructed to serve as an emergency and planned maintenance water transfer system between SCVWD and SFWD. The work includes, but is not limited to the following:

1. Resurfacing, cutting, and filling of approximately 25,000 square feet of existing asphalt parking lot to include a 50′ x 265′ pump station and building, storm drainage area to include a 4,700 square foot concrete swale, replacement of parking lot and utilities outside the pump station, and installation of a new storm drainage outlet to Wrigley Creek.
2. Construction of foundation supported on piers for station building, chemical containment/storage, and station piping and vault.
3. Construction of foundations, structures, and slabs for outside electrical equipment, engine generator, and fuel tank.
4. Furnish and install four (4) pumping units, each of which includes a 700 HP electric motors, horizontal split-case pump, hydraulically actuated control valves, and isolation valves.
5. Furnish and install four separate chemical injection systems to include tanks, pumps, containment, injections, and control systems. The chemicals to be used are sodium hypochlorite,

sodium hydroxide, aqua ammonia, and di-potassium phosphate.

6. Installation of above and below ground piping to include valves, flanges, gages, meters, and all other related appurtenances.

7. Furnish and install a 2000kW diesel engine generator and necessary switch gear for standby emergency use.

8. Furnish and install a 12,000 gallon aboveground diesel tank and associated piping system for emergency generator use.

9. Furnish and install a 21 kV electrical service, including an outdoor vacuums switchgear, 2500 kVA power transformer, an indoor 4.16 kV switchgear, 4.16 kV variable frequency drive, and a 4.16 starter line-up for 4160 motors.

10. Coordinate, furnish, and install connections with PG&E and Pacific Bell.

11. Furnish and install light fixtures, valve control equipment, dry type transformers, panel boards, main PLC, conduits and grounding for the pump station.

12. Furnish and install SCADA System components including Wide Area Network (WAN), Advanced Digital Network (AND) leased lines, and Very Small Aperture Terminal (VSAT) satellite communications.

18. Configuration and programming of the SCADA system, system software, and RTU‘s.

14. Furnish and install three 42″ diameter pipelines from the new pump station to the following locations:

    a. A pipeline approximately 1000 feet long that runs south adjacent to Wrigley Creek that will be connected to the terminus of the existing Milpitas Pipe Line.

    b. A pipeline approximately 60 feet long that will be connected to the Bay Division Pipeline #4 (a 90″ water distribution line).

    c. A pipeline approximately 40 feet long that will be connected to the Bay Division Pipeline #3 (a 72″ water distribution line).

15. Furnish and install 24″ service connection with water meter from SFWD and connections to the SCVWD and the City of Milpitas, Gibralter Pump Station to include a penetration of an existing 5 million-gallon tank.

16. Furnish and install sewer system to connect to City of Milpitas at Turquoise St.

EXAMPLE 2: *(This addition is for projects that include landscape/re-vegetation work)*

B. In addition, the work to be completed under this Contract includes the landscape installation and landscape maintenance. The landscape maintenance includes the maintenance during the landscape installation and the maintenance during the one-year establishment period following the landscape installation.

11.02. Drawings

A. The following listed Drawings accompany these Specifications and are made a part thereof:

LIST OF DRAWINGS:

11.03. Site Maintenance and Clean-Up

A. During construction, the Contractor shall keep the work site, areas adjacent to the work site, and access roads in an orderly condition, free and clear from debris and discarded materials. Care shall be taken to prevent spillage when hauling is done. Any spillage or debris resulting from Contractor's operation shall be immediately removed by the Contractor. The Contractor shall not sweep, grade, or flush surplus materials, rubbish, debris, or dust into storm drains or stream channels.

B. Upon completion of work, the Contractor shall remove from the work site and areas adjacent to the work site, all building materials, debris, unused materials, concrete forms, and other materials used during the construction belonging to the Contractor. All access roads and maintenance roads shall be graded, removing wheel tracks and smoothing up such roads. See Article 21.06 for Final Cleaning.

11.04. Time Allowance for Completion of Work

See instruction on how to determine the time allowance for completion of work.

A. The Contractor shall complete all work required under this Contract before the expiration of ___ days from the First Chargeable Day of the Contract. The First Chargeable Day of the Contract will be defined in the Notice to Begin Work issued by the District.

B. See Article 17.02 – Hours of Work.

C. The District is not required to accept an earlier (advanced) schedule, i.e., one that shows early completion date(s) but within the Contract time as specified in

these Specifications. Time(s) for completion of work shall adhere to the Contract time(s) specified in these Specifications unless earlier time(s) of completion are requested by Contractor and agreed to by the District. Any such agreement shall be formalized by a change order in accordance with Article 5.05.

MILESTONE COMPLETION:

Certain projects may include other milestones in addition to the Project Completion.

The example below is for a flood protection project that includes two milestones: 1) completion of the landscape installation and civil work; and 2) completion of the Project including the landscape establishment.

EXAMPLE 1:

11.04. Time Allowance for Completion of Work

A. Work shall include the following milestones:

Milestone 1: Completion of the landscape installation and other civil work as defined in these Specifications.

Milestone 2: Completion of the Project including the one-year landscape establishment period as defined in these Specifications.

B. Milestone Completion:

The Contractor shall complete Milestone 1 before the expiration of 200 days from the First Chargeable Day of the Contract.

The Contractor shall complete Milestone 2 before the expiration of 565 days from the First Chargeable Day.

C. The First Chargeable Day of the Contract will be defined in the Notice to Begin Work issued by the District.

D. See Article 11.07 for liquidated damage assessments.

The example below illustrates the milestone completions for treatment plant projects.

EXAMPLE 2:

11.04. Time Allowance for Completion of Work

A. Work shall include the following milestones:

Milestone 1: Completion of the Potassium Permanganate Feed System, including the PP building and all associated electrical, mechanical work as defined in these Specifications.

Milestone 2: Completion of the Ferric Chloride Feed System including all FC storage tanks, and all associated electrical, mechanical work as defined in these Specifications.

Milestone 3: Project Completion.

B. Milestone Completion:

The Contractor shall complete Milestone 1 before the expiration of 300 days from the First Chargeable Day of the Contract.

The Contractor shall complete Milestone 2 before the expiration of 320 days from the First Chargeable Day.

The Contractor shall complete Milestone 3 before the expiration of 400 days from the First Chargeable Day of the Contract.

C. The First Chargeable Day of the Contract will be defined in the Notice to Begin Work issued by the District.

D. See Article 11.07 for liquidated damage assessments.

Describe any other constraints or operating conditions affecting time of work, or reference sections that describe these constraints.

EXAMPLE:

C. The Contractor is advised that dry conditions may not exist and that flow in various watercourses encountered in this Project may occur. In no case shall any extension of time be granted if the basis of claim is water flowing in a watercourse. No extension of time will be given because of rain or results of rain except as set forth in these Specifications.

11.05. Excusable Inclement Weather Delays

A. The time allowance for completion of work is based upon the inclusion of _____ days of excusable inclement weather.

See instructions on how to determine the number of days of excusable inclement weather delay.

B. Contractor's attention is directed to Article 5.05.02—Extension of Time for Delay Due to Excusable Inclement Weather.

11.06. Schedule of Work

A. Except as provided for in these Specifications, the Contractor shall be responsible for scheduling the sequence of its work. Once work has begun, it shall proceed in a manner in accordance with the accepted schedule.

11.06.01. Preliminary Schedule of Work

A. Within 14 days from the date of the Notice to Begin Work, the Contractor shall submit to the Engineer a Preliminary Schedule of Work. This schedule shall be a graphic bar diagram showing the planned contract work operations during the first 45 days of the Contract. See Article 11.07 for Liquidated Damages.

See instructions.

11.06.02. Detailed Schedule of Work

A. Within 35 days from the date of the Notice to Begin Work, the Contractor shall submit a Detailed Schedule of Work. The submittal shall be in hard copy and electronic format.

Select one of the following two alternatives. See instructions.

Alternative 1

B. CPM Schedule

1. The Detailed Schedule of Work shall be a Critical Path Method (CPM) schedule which represents the planned order of significant activities to complete the work within the time allowed under this Contract. The CPM schedule shall be presented in sufficient detail such that sequence and interdependence of activities of the Project can be identified.

2. The schedule shall account for on site and offsite activities such as, but not limited to:

- Construction and other executable tasks;
- Testing, training and start-up activities;
- Design, procurement, fabrication, inspection and delivery of materials and long lead time equipment;

- Submission, review, resubmittal and approval of contract submittals;
- Reviews by regulatory agencies and other third parties of the work;
- Construction and sequencing constraints as specified in these Specifications;
- District managed activities such as District furnished equipment which can affect project schedule;
- Removal or relocation of interfering utilities by third parties;

3. The schedule shall be a fully legible, calendar time scaled, network diagram in the form of Activities on the Arrow Diagram Method (ADM) or Precedence Diagram Method (PDM). Activities for each designated portion of the work shall be identified by separate subnetworks interconnected with the basic network diagrams. The network diagram shall show task relationship lines and be drawn for the early start of all activities.

4. The activities shall describe, in detail what is to be accomplished and where, the number of working days allocated for the activity, and identify the resources to be used. A legend and code may be used to show that an activity is to be performed in whole or part by a subcontractor.

5. The following information shall be furnished as a minimum for each activity:

   a. Preceding and succeeding activities
   b. Activity description
   c. Estimated duration of activity
   d. Earliest start date (by calendar date)
   e. Earliest finish date (by calendar date)
   f. Actual finish date(by calendar date)
   g. Slack or float
   h. Percentage of activity completed
   i. Activity constraints
   j. Dollar value of each activity if cost loaded schedule is required

6. Activities making up the critical path for the entire Contract and the critical path for each specific designated portion of the work shall be identified. The network diagram shall be organized to indicate a continuous flow of progress of activities from left to right.

7. Except for concrete curing, submittal review, equipment fabrication and deliveries, activities shall be no longer than 20 working days. Activities

longer than 20 working days shall be subdivided into sub-elements of work.

8. Along with the network diagram, the Contractor shall submit a tabular listing of the schedule.

9. When required in accordance with Article 20.02—Progress Payment and Schedule of Values, the Schedule of Work shall be fully construction cost loaded. Work activities other than third party activities and District managed activities shall be cost loaded. The task breakdown of the Schedule of Work shall coincide with the Schedule of Values.

10. The Engineer‘s favorable review and acceptance of the schedule shall not relieve the Contractor for errors and omissions in tasks, durations, or logic.

C. Progress Schedule (Adjustment to Schedule, Schedule Updates and Recovery Schedule)

1. If the Contractor desires to make a change to the CPM schedule after commencing construction, a revised CPM schedule shall be submitted to the Engineer at least 15 days prior to any such change in the project work.

2. The Contractor shall submit a schedule update to the Engineer before the fifth day of each month. The schedule update shall incorporate all current information, including progress, approved adjustments of time duration, and proposed changes in sequence or logic. The updated schedule shall state the percentage of work completed as of the last date of the previous month. The Contractor shall also submit a narrative report which shall include a description of problem areas, current and anticipated delaying factors and their impact, and explanation of corrective actions taken or proposed. Progress status shall be evaluated on the basis of float on the critical path at the time of updating, with negative float indicating the Project is behind schedule and positive float indicating status ahead of schedule. Reference is made to Article 11.07 for Liquidated Damages for failure to update the CPM schedule.

3. At any time that construction progress lags behind the original or current CPM schedule by either 20 working days or by five percent of the remaining time to complete the Contract, whichever is less, the Contractor shall prepare and submit a recovery schedule to the Engineer. This recovery schedule shall demonstrate how construction will be expedited and executed to achieve the contractual completion dates.

D. Time Impact Analysis

1. If the Contractor foresees that an ordered change or District delay will impact a controlling item of work or work progress, a written request for

adjustment of time and supporting data shall be submitted to the Engineer promptly in accordance with Section 5.05.01. The supporting data shall include a schedule analysis and updated CPM schedule substantiating the Contractor's request.

2. The CPM schedule shall document all ordered changes or District delays as separate activities or groups of activities. These activities shall be entered into the relevant part of the approved schedule at the time the ordered change or District delay occurred. In case of a deductive change reducing the quantity of work, the estimated duration for these activities shall be adjusted to reflect the reduction.

3. The Contractor shall submit a written report describing the ordered change or District delay; status of construction at the time of the occurrence; activities affected by the occurrence; and the impact of the event time computation on all affected activities.

4. Only changes or delays that affect or create controlling items of work as defined by the schedule will result in time adjustments. The Engineer will determine if a request for time extension is warranted.

5. Total float or slack is defined as the amount of time between the early start date and the late start date, or the early finish date and the late finish date of any activity in the schedule. Total float or slack is not time for the exclusive use or benefit of either the District or the Contractor. It is a resource available to the Project.

Alternative 2

B. Graphical Bar Diagram Schedule

1. The Detailed Schedule of Work shall be a Detailed Graphical Bar Diagram (GBD) Schedule. The schedule shall identify tasks and time durations. Activities longer than 20 days in duration should be separated into sub-activities.

C. Adjustment to Schedule, Schedule Updates and Recovery Schedule

1. If the Contractor desires to make a change to the GBD schedule after commencing construction, a revised GBD schedule shall be submitted to the Engineer at least 15 days prior to any such change in the project work.

2. The Contractor shall submit a schedule update to the Engineer before the fifth day of each month. The Contractor shall review and update the schedule to incorporate all current information, including progress, approved adjustments of time duration and proposed changes in sequence or logic. The updated schedule report shall state the percentage or work completed as of the last date of the previous month.

Reference is made to Article for Liquidated Damages for failure to update the schedule.

3. At any time that the actual construction progress lags behind the original or current schedule by either 20 working days or by five percent of the remaining duration of time to complete the Contract, whichever is less, the Contractor shall prepare and submit a recovery schedule to the Engineer. This recovery schedule shall demonstrate how construction will be expedited and executed to achieve the contractual completion dates.

D. Time Impact Analysis

1. If the Contractor foresees that an ordered change or District delay will impact a controlling item of work or work progress, a written request for adjustment of time and supporting data shall be submitted to the Engineer promptly in accordance with Section 5.05.01. The supporting data shall include a schedule analysis and updated GBD schedule substantiating the Contractor‘s request.

2. The schedule shall document all ordered changes or District delays as separate activities or groups of activities. These activities shall be entered into the relevant part of the approved schedule at the time the ordered change or District delay occurred. In case of a deductive change reducing the quantity of work, the estimated duration for these activities shall be adjusted to reflect the reduction.

3. The Contractor shall submit a written report describing the ordered change or District delay; status of construction at the time of the occurrence; activities affected by the occurrence; and the impact of the event time computation on all affected activities.

4. Only changes or delays that affect or create controlling items of work as defined by the schedule will result in time adjustments. The Engineer will determine if a request for time extension is warranted.

5. Total float or slack is defined as the amount of time between the early start date and the late start date, or the early finish date and the late finish date of any activity in the network. Total float or slack is not time for the exclusive use or benefit or either the District or the Contractor. It is a resource available to the Project.

11.06.03. Payment

A. Full compensation for furnishing, updating and submitting project schedules and associated reports shall be considered as included in various Contract items of work and no additional compensation will be provided. Liquidated Damages for failure to submit schedules and schedule updates within the time specified shall be assessed in accordance with this Contract.

11.07. Liquidated Damages

EXAMPLE 1: *(w/ Project Completion as the only milestone)*

A. In accordance with Article 7.06, the District shall deduct, as liquidated damages from monies due the Contractor the following amounts:

1. $_____ per day for failure to complete all work included in the Contract within the time limit allowed.

EXAMPLE 2: *(for failure to complete other defined milestones)*

2. $_____ per day for failure to complete all work of Milestone# 1 within the time limit allowed.

3. $_____ per day for failure to complete all work of Milestone# 2 within the time limit allowed.

EXAMPLE 3: *(for failure to submit Schedule of Work)*

4. $_____ per day for failure to submit the Preliminary Schedule of Work, Detailed Schedule of Work, Schedule Updates, and Master Submittal List within the time limits allowed.

EXAMPLE 4: *(for failure to submit certain submittals)*

5. $_____ per day for failure to submit each of the Immediate Submittals as listed within the time limits allowed.

EXAMPLE 5: *(for causing unplanned shutdown of operational facility)*

6. $_____ per hour for each and every hour‘s that the operational facilities or systems listed below remain shutdown beyond that allowed in the Contract.

   a. Backwash Pump Structure; see Article 15.01.01.
   b. West Pipeline; see Article 15.01.01.
   c. etc.

EXAMPLE 6: *(for non-compliance with certain contract provisions)*

7. $_____for each truck found to be idling or queuing at the Plant Entry Gate or in the surrounding neighborhood without prior approval by the Engineer.

8. $_____for each truck that arrives at the Plant before 9:00 am.

B. Contractor's attention is directed to Article 13.10.07 regarding Liquidated Damage assessments for failure to submit O&M documents.

C. Liquidated damages shall be assessed separately and independently. Imposition of liquidated damages shall not preclude the District from taking other action as deemed appropriate to ensure performance of the Contract, and shall not relieve the Contractor of responsibility to comply with these Specifications.

11.08. Submittals and Withholding of Partial Payment

A. The Engineer retains the right to withhold partial payments in accordance with Article 8.03 of these Specifications until the Contractor has submitted the Preliminary Schedule of Work, Detailed Schedule of Work, Schedule Updates and any other schedules and submittals as required by these Specifications.

11.09. Fines

A. The Contractor shall bear the cost of any penalties, fines, clean-up costs, or damages imposed on the District by the State or other regulatory agencies for violations caused by actions, or lack of action, of the Contractor. The District may deduct the amount thereof from any moneys due, or that may become due, to the Contractor under this Contract.

11.10. Bonus

Provide a bonus clause if required. Consult with the Project Team and the Construction Units. See Government Code 53069.85. As with Liquidated Damage assessments, the bonus, if used, should tie to the Milestone work and its completion.

EXAMPLE:

A. The Contractor will be paid:

1. Milestone #1: $_____ per day for each day the Contractor completes all work of Milestone #1 before the expiration of the number of days specified under Article 18.04. The maximum number of days for which the Contractor can earn the Bonus is X calendar days.

2. Milestone #2: $_____ per day for each day the Contractor completes all work of Milestone #2 before the expiration of the number of days specified under Article 18.04. The maximum number of days for which the Contractor can earn the Bonus is X calendar days.

B. The assessment of the bonus, if any, shall be based upon the Engineer‘s established date of milestone completion as specified in Article 21.01.

SECTION 12. GENERAL REQUIREMENTS

12.01. Abbreviations and Acronyms

A. In addition to the abbreviations provided under Section 1 of the Standard Provisions, the following abbreviations and acronyms shall apply for this Project:

Add project specific abbreviations and acronyms that were not included in Section 1—Definitions of the Standard Provisions.

EXAMPLE:

ACIL	American Council of Independent Laboratories
AITC	American Institute of Timber Construction
APA	American Plywood Association
ASME	American Society of Mechanical Engineers
CPM	Critical Path Method
CDFG	California Department of Fish and Game
DSOD	Division of Safety of Dams
ICBO	International Conference of Building Officials
PWTP	Penitencia Water Treatment Plant
RWTP	Rinconada Water Treatment Plant
STWTP	Santa Teresa Water Treatment Plant
SWPPP	Storm Water Pollution Prevention Plan
etc.	

12.02. Definition of Key Terms

List and define any project specific key terms, including their intent, meaning, use, and applicable conditions. The terms below are suggested for treatment plant related projects.

A. ***Operational Facility Shutdown***: The period of time when the normal intended use of the facility cannot take place; or when the facility is operating at less than its normal intended production capability.

B. ***Unscheduled Operational Facility Shutdown***: Operational facility shutdowns initiated by or due to action by Contractor that are beyond that anticipated or allowed in the Contract. Causes of unscheduled shutdowns could include, but are not limited to, actions causing a power outage; contaminating water such that State water quality regulations are violated or are in imminent danger of violation; impeding chemical feed systems, water quality monitoring, or process operations.

C. ***Operational***: To be considered operational, a facility or facility component must be functional in all manners intended for its use, at its rated capacity and through

its entire operation range. Operational facilities may require transmission facilities, storage facilities, process facilities and support systems (such as chemicals, water, power, communication) to be fully functional and accessible. For a new facility to be considered operational, it must be installed, tested, and District personnel must have received the specified training in the facility's operation and maintenance by the Contractor.

D. ***Continuous Operation***: A completed system operating continuously, 24 hours a day, without interruption and without the need for intervention other than normal operational adjustments by the District's operating personnel.

12.03. Site Investigation

Provide a site investigation clause as deemed appropriate. The example language below, with Legal consideration and approval, could be moved to the Notice to Bidders.

EXAMPLE:

A. Contractor acknowledges that he has visited the site of the work, has fully informed himself as to existing conditions and limitations prior to the presentation of his bid, and agrees that there will be no increase in the contract price or time for any additional work done or material or equipment furnished, the need for which would have been disclosed by a reasonable inspection**.**

12.04. District-Furnished Reports

12.04.01. Geotechnical Reports

List applicable geotechnical reports and special conditions that could have a material effect on bidding or construction of the Project. See instructions.

***EXAMPLE**:*

A. A geotechnical investigation consisting of soil borings and test pits was carried out for the District. The results of the soil samples and laboratory test analyses are provided in the report titled "_____."

B. A copy of this geotechnical report is available for review at the District office, 5750 Almaden Expressway, San Jose, California. The Contractor may, with an advance notice of three working days, purchase a copy of the geotechnical report from _____ (Consultant) for a price of $XXXX/per copy. Reference is made to Article 3.02.

C. The Contractor shall be aware that the geotechnical report indicated the presence of water at various locations along the project alignment. At locations shown on the plans, piezometer wells were installed to monitor the depth to groundwater. This information is available for review at the District office.

12.04.02. Environmental Report

List project's environmental reports, if available, that could have a material effect on bidding or construction of the Project.

EXAMPLE:

A. The City of San Jose has prepared documents regarding environmental impact of the South Bay Water Recycling Program which include discussions of the impacts of the Milpitas Recycled Water pipeline Project. These documents are:

1. ~~"~~Final Environmental Report for the San Jose Non-potable Reclamation Project," dated November 1992;

2. ~~"~~Addendum to the Final Environmental Impact Report for the San Jose Non-potable Reclamation Project" dated December 1995;

3. ~~"~~Addendum to the Final Environmental Impact Report for the San Jose Non-potable Reclamation Project" dated May 1996:

4. ~~"~~The Final Environmental Impact Statement for the South Bay Water Recycling Program" dated May 1996.

B. The above documents are available for review at the District Office, 5750 Almaden Expressway, San Jose, California 95118. The Contractor is advised that these documents are for Contractor's information only.

12.04.03. Hazardous Materials Investigation Report

Include hazardous materials investigation reports, if available, that could have a material effect on bidding or construction of the Project.

EXAMPLE 1:

A. An investigation was performed for the District to identify potential areas where construction of the Milpitas Pipeline (Stages I, II, and III)

might encounter soil and/or groundwater impacted by regulated materials. The investigation included a records review, field reconnaissance, soil and water sampling and analysis.

B. A summary of the investigation and findings, as they apply to construction of the Milpitas Pipeline, Stage III, is included in Appendix ____ of these Specifications. A reference copy of the Stage 2 Field Investigation Work Plan and a reference copy of the final Project Alignment Report, which discuss findings of the records review and field reconnaissance, and sampling are available for review at the District office at the Crest Building, 5684 Almaden Expressway, San Jose, California. It should be noted that ~~"~~stage 2" of the investigation and the ~~"~~Stage II" portion of the Milpitas Pipeline do not describe the same project limits.

C. Additional sampling by others for contaminants has been performed in the vicinity of Station 164+00 to 167+00. This information is available at the District office for review by the prospective bidders.

D. Boring logs from the investigation and others are included in Appendix ___ of these Specifications.

E. A reference copy of ~~"~~Milpitas Pipeline Local Site Assessment" report is also available at the District office for Contractor review.

F. The Contractor shall be responsible for reviewing the investigation and findings, and for evaluating the need for, and for providing for, any safety measures he/she deems necessary. Any such measures shall be considered incidental to the work and no additional payment will be made therefore, except as specified in Article XX.XX of these Specifications.

EXAMPLE 2:

A. A reference copy of the results of the mercury sampling program and the Soil Management Plan (SMP) prepared by Tetra Tech, Inc., is available at the District Office for Contractor review.

12.04.04. Archeological Findings Report

Include archeological study/evaluation and reports, if available, that could have a material effect on bidding or construction of the Project. Include a reference to Article 17.09—Discovery of Archeological Artifacts and Human Remains.

12.04.05. As-Built Drawings

List here any record or as-built drawings to be used for Contractor's reference or that could have a material effect on bidding or construction of the Project. See instructions.

EXAMPLE:

A. The following as-built drawings are provided: "Map and Construction Plans for Penitencia Water Treatment Plan – As-Built dated March 1976." The as-built drawings are for reference only and the District does not warranty their completeness or correctness. Certain dimensions for the footing foundation for the Filter Gallery Area may be incorrect as the structure may not have been constructed to the neat line dimensions. The elevation of the 54" finished water line has not been verified. See Drawings for requirements.

12.05. Contractor's Engineering and Design

List the work that Contractor will be responsible for design in addition to fabrication and installation. The following example is for a treatment plant related project.

EXAMPLE:

A. The Contractor shall provide engineering and design of the following work components:

1. Chemical storage tanks, access platform between tanks, all access stairways, and manways;
2. Anchorage of mechanical and electrical equipment;
3. Sunscreens for control panels;
4. Other structures or items as specified herein or indicated on the Drawings.

B. See Technical Provisions for additional information.

12.05.01. Seismic Design Criteria

Reference appropriate building codes as required. Example 1 below is for a treatment plant related project that references site specific Seismic Design Criteria The State of California and some local cities and agencies have adopted the International Building Code. Example 2 comes from the 2009 Membrane Filtration System Procurement

Contract that references the California Building Code (CBC) Chapter 16. Check to make sure appropriate seismic design criteria are referenced.

EXAMPLE 1:

A. Design requirements: Design in accordance with the 2007 California Building Code (CBC), or the applicable site-specific sesimic criteria herein, whichever is more stringent.

B. General Seismic Design Criteria:

GENERAL SEISMIC DESIGN CRITERIA			
NO.	**DESIGN CRITERIA**	**UNIT**	**PENITENCIA WTP**
1	Design Earthquake		
	Probability of exceedance in 50 years	%	10
2	Peak Ground Accelerations(2)		
2.1	Horizontal (phga)	g	0.70
2.2	Vertical (pvga)	g	0.77
	Water Retention Structures	I, I_p	1.25, 1.50
	Pump Stations	I, I_p	1.25, 1.50
	Process Buildings	I, I_p	1.25, 1.50
	Operation Buildings	I, I_p	1.25, 1.50
	Chemical Storage Areas	I, I_p	1.25, 1.50
	Pipelines	I, I_p	1.25, 1.50
	Warehouse Storage Areas	I, I_p	1.0, 1.0
(1)	Importance factors for structures (I) and non-structural elements, components or equipment(I_p).		
(2)	At period (t) equal to zero for an earthquake with a 10 percent probability of being exceeded in 50 years. Values recommended from the Geotechnical Investigation by Woodward-Clyde.		

REDUCTION FACTOR, R_W		
NO.	**Structure Type**	**RW**
4	Reduction Factor RW	
4.1	Steel Tanks	AWWA D100
4.2	Concrete Structures	
4.2.1	Structural Inertia	4
4.2.2	Impulsive Fluid Force (R_{wi})	

		Buried	4
		Above Grade	S_{ai}/S_a @ T=0
	4.2.3	Convective Fluid Force (R_{WC})	1
	4.3	Submerged Components	
	4.3.1	Structural Columns w/ axial stress ratio f_a/F_a <0.15	8
	4.3.2	Structural Columns w/ axial stress ratio 0.15 < f_a/F_a <0.40	6
	4.3.3	Structural Columns w/ axial stress ratio f_a/F_a >0.40	3
	4.3.4	Welded Steel Pipe	8
	4.3.5	Other Pipe	6
	4.3.6	Ladders, davits, similar appurtenances	6
	4.3.7	Launders	3
	4.3.8	Rotating Parts, scrapers	3
	Where: f_a = axial load. F_a = axial capacity. S_{ai} = Spectral acceleration for first mode using 2% damping, taken as the peak spectral acceleration on the site specific response spectrum. S_a = Horizontal spectral acceleration for the appropriate period and damping of the structure.		

EXAMPLE 2:

A. Seismic loading criteria for the design of anchorage of equipment and other appurtenant facilities shall be as follows:

Parameter	Project Site Specific Value
Latitude	37°25‘42”N
Longitude	121°56‘20”W
Ss	1.500
S1	0.600
Fa	1.0
Fv	1.5
SMS	1.500
SM1	0.900
SDS	1.000
SD1	0.600
TL	12 second

12.05.02. Wind Design Criteria

Reference appropriate building codes as required. The following example is for a treatment plant related project that references Wind Design Criteria from UBC. The UBC has not been updated since 1997 and the State of California and some local cities and agencies have adopted the International Building Code in lieu of the Uniform Building Code. Check to make sure appropriate wind design criteria are referenced.

EXAMPLE:

A. Design Requirements: Design in accordance with the requirements of the Uniform Building Code (UBC).

1. Uniform Building Code Basic Wind Speed: 80 miles per hour.

2. Uniform Building Code Wind Exposure: C

3. Use anchor bolts, bolts, or welded studs for anchors for resisting wind forces. Anchor bolts used to resist wind forces shall have a standard hex bolt head. Do not use anchor bolts fabricated from rod stock with an L or J shape.

   a. Do not use concrete anchors, flush shells, chemical anchors, powder actuated fasteners, or other types of anchor unless indicated on the Drawings or accepted in writing by the Engineer.

   b. Wind forces must be resisted by direct bearing on the anchors used to resist wind forces. Do not use connections which use friction to resist wind forces.

12.05.03. Hydraulic Design Criteria

Include relevant hydraulic design criteria if necessary.

12.05.04. Truck Loading

Specify appropriate traffic loads for Contractor's design items, if applicable.

There are five classes of traffic loading: H20-44, H15-44, and H10-44 (loading by trucks with two loaded axles, and HS20-44 and HS15-44 (loading by trucks with trailer and three loaded axles). The designation 44 indicates the loading standard was adopted in 1944.

EXAMPLE:

A. All pre-cast products used shall be designed for H20-44 bridge loading.

For protection of underground utilities, include language under Section 15 – Work Constraints and Site Restrictions.

SECTION 13. SPECIAL REQUIREMENTS

13.01. Engineer

A. The Designated Engineer of the District shall be the District's representative who assumes all duties and responsibility and have all rights and authority as assigned in the Contract Documents in connected with completion of the work in accordance with the Contract Documents.

B. The Designated Engineer of the District is the Deputy Officer of the (*Water Utility Capital or Watershed Capital, as applicable)* Division.

13.02. Project Signs

Not all projects require project signs. Consult with the Office of Communications. If project signs are required, provide the language below.

A. Contractor shall install and maintain District-furnished project identification signs at the locations shown on the Drawings and in accordance with the notes and details thereon and as specified in these Specifications.

B. The signs shall be clearly visible to the public. The bottom edge of the sign shall be as shown on the Drawings. All hardware, posts, and fasteners shall be furnished and installed by the Contractor.

C. The signs are to be picked up at the sign painter whose address and telephone are:

List sign painter's addresses and telephone number.

Arrangements to pick up the signs shall be made by contacting the sign painter at least 2 working days in advance of the date when the signs are to be picked up.

D. The Contractor shall be responsible for the transportation of the signs to the jobsite and to ascertain all information, dimensions, connections, and appurtenances required to provide satisfactory installation of the signs.

Specify sign installation details according to specific project needs. The following example is taken from a treatment plant related project. If possible, provide details on drawings in lieu of describing the work here.

EXAMPLE:

E. Sign Installation:

1. Project signs furnished by the District will be approximately 4 feet wide and up to 8 feet high.

2. Sign support structure shall be two 4 by 4-inch (surfaced 4 sides) pressure treated wood post supports (grade No. 2 or better, straight, with no loose knots), one on each side of sign. Fasten posts to District-furnished signboard with 4-inch long minimum deck screws through post, 8 inches on-center. Top edges of each post shall have a ½-inch chamfer all around. Two-thirds of the height of each sign board shall be fitted into a nominal ¾-inch deep dado (verify in field) centered on each support post.

3. Mounting hardware shall be galvanized steel, concealed or recessed fasteners.

4. Posts shall be painted with exterior quality paint, white semi-gloss, as specified in Article XXXXX.

5. Finishes and paints shall be adequate to withstand continuous exterior weathering for 4 years without fading or damage to the appearance.

6. Install sign support posts plumb with a minimum of 3 feet of burial in 12-inch minimum diameter holes backfilled with concrete. Bottom of sign board shall be approximately 12 to 18-inches above grade as directed by Engineer. Slope the top of the concrete away from posts all around.

F. Pull boxes for project flyers shall be installed on project sign as directed by the Engineer. Pull box flyers will be maintained by the District.

G. The signs shall be installed prior to the start of construction and shall be maintained throughout the construction of the Project. Maintain signs and supports in a neat, clean condition; repair damages to structures, framings or signs until Project Completion. Remove or paint over graffiti and repair signs. Straighten signs whenever they are not plumb.

H. Upon completion and acceptance of the Project by the District, the Contractor shall remove the signs and framing and return them to the District warehouse at 5905 Winfield Blvd., San Jose, CA 95123. Arrangement to return the signs shall

be made by contacting Winfield Warehouse at (408) 265-2607, extension 3800, at least 2 working days in advance of the date when the signs are to be returned. The Contractor shall restore the sign removal areas, backfill holes with soil and/or repair previous pavement saw cuts in kind, and clean the surrounding areas.

13.02.01. Payment

A. Full compensation for doing all work necessary to pick up and install the District-furnished signs shall be included in the lump sum price bid for MOBILIZATION.

13.03. Office Facilities

13.03.01. Engineer's Office

Coordinate with the Construction staff if office facilities are needed.

Alternative 1: Office facilities are not needed. This typically applies to small projects that are less than $500K and/or less than 6 month in construction duration. Confirm with Construction staff.

A. Office facilities for the Engineer will not be required for this Project.

Alternative 2:

A. The Contractor shall provide and maintain office facilities as described for the exclusive use of the Engineer and representatives of the Engineer. The location and condition of the office facilities shall be as approved by the Engineer. The Contractor shall furnish weekly janitorial services in connection with said office for the duration of the work.

B. The office facilities and furniture shall be clean and in good condition, consistent with common professional offices and shall be approved by the Engineer.

C. The Contractor shall provide a phone answering system and a broadband internet service connection to a District-supplied computer for the exclusive use of the District's Engineer and authorized representatives.

1. Phone answering system:

a. The phone answering system shall be a digital machine for outgoing messages, with day/time stamp, and shall be beeperless remote accessible. The phone answering system shall be a Phonematic Digital Answer No. 8800, Southwestern Bell No. FA1010 or equivalent. *Verify phone system with Construction staff.*

b. All calls pertaining to the job made from the telephone provided for the Engineer‘s use shall be at the Contractor‘s expense.

2. Broadband Internet Service:

a. Broadband connection shall meet the definition by the U.S. Federal Commission as any connection to the internet with a speed of 200 kbps or faster in at least one direction.

b. The broadband connection shall consist of any of the following technologies:

(1) Digital Subscriber Line (DSL), which uses copper telephone lines to carry voice traffic and high-speed data.

(2) Cable modems, which tap into existing cable television company lines.

(3) Wireless, which is typically made up of on-the-ground, antenna-to-antenna systems, commonly called ~~“fix~~-wireless” systems.

(4) Satellite, which is provided by direct broadcast satellite (DBS) companies such as DirecTV or Echo Star, as well as new companies focusing only on internet connections.

c. The service connection shall include all necessary software and hardware, such as Ethernet cards and modems, which will be compatible with Microsoft Windows 2000 Professional operating system.

Determine in consultation with Construction staff which office configurations best fit the project needs.

Alternative 2A:

D. The building or trailer shall be specifically designed for office facilities and shall not be less than 8 feet by 20 feet in plan, with side walls not less than 8 feet high.

E. The Contractor shall furnish and install one table or counter for use in viewing Drawings, two desks with a top dimension of not less than 4 feet by 2½ feet each, three swivel chairs, one wall-mounted Underwriter Laboratory approved fire extinguisher 10# (ABC type), one 16-unit first aid kit (the contents replenished as used), and a two-drawer legal size file cabinet. Adequate heat, light, electricity, ventilation, including air conditioning, hot and cold drinking water, private telephone (three lines) with a telephone answering system for messages, broadband internet services, and toilet facilities shall be provided.

Alternative 2B:

D. The building or trailer shall be specifically designed for office facilities and shall not be less than 12 feet by 60 feet in plan, with side walls not less than 8 feet high.

E. The Contractor shall furnish and install two tables or counters with a top dimension of not less than 6 feet by 2½ feet each for use in viewing the Drawings, three desks with a top dimension of not less than 4 feet by 2½ feet each, four swivel chairs, one wall-mounted Underwriter Laboratory approved fire extinguisher 10# (ABC type), one 16-unit first aid kit (the contents replenished as used), and 2 (two) 2-drawer legal size file cabinets. Adequate heat, light, electricity, ventilation, including air conditioning, hot and cold drinking water, private telephone (four lines) with a telephone answering system for messages, broadband internet services, and toilet facilities shall be provided.

The following example is taken from a treatment plant related project where more details are specified for the office facilities.

EXAMPLE:

A. The office shall consist of one 12 foot wide by 60 foot long office trailer. This trailer shall be no older than 5 years old when installed at the site.

B. The office trailer shall be insulated and of weather-tight construction. The trailer shall be rigidly mounted and level. Stairs with a landing at floor level and guardrails shall be provided for two entrance doors at each trailer, each complete with deadbolt locksets. All locksets shall be keyed alike and 10 keys shall be provided. The door closest to the conference room shall be provided with a ramp with a slope of no greater than 1 foot rise to 12 feet run, landing, and conforming to the CBC and Americans With Disabilities Act (ADA) requirements for access. Ground surfaces within 20 feet of each trailer shall be either paved or covered with 6 inches of Class 2 aggregate base rock compacted to 90% relative compaction overlying high modulus woven soil separation geotextile. Surrounding surfaces shall be sloped to drain away from the trailer.

C. The office trailer shall have four offices plus unisex bathroom. There shall be at least one operable, screened window per office room. All windows shall be fitted with mini-blinds. Each trailer room shall be adequately lighted, heated, ventilated, and air conditioned. HVAC equipment shall be capable of maintaining a 70 degree F temperature within each trailer. At least 6 air changes per hour shall be provided in all rooms except the toilet room, which shall have 10 air changes per

hour.

D. The Contractor shall provide electrical service to the office trailers, of sufficient capacity for all loads, including an adequate disconnect switch, and circuit breaker panel located in the inside of the trailer. At least one grounded 120 volt electrical receptacle shall be installed on the walls of each room with a maximum spacing between receptacles of 8 feet.

E. Provide fluorescent type lights inside suitable for office use. At least 70 foot-candles of initial uniform lighting at desk level shall be provided in all rooms except the toilet room, which may have 30 foot-candles. Provide a weatherproof outside light fixture near each entrance door.

F. The Contractor shall provide telephone service to locations within the temporary office as directed by the Engineer. A minimum of 8 separate phone lines shall be provided. Five new telephone handsets shall also be provided, all with speakerphone capabilities. One of these telephone handsets shall be suitable for use to allow a receptionist to connect to and transfer between at least 4 incoming telephone lines. Internet service provider accounts shall be provided for 4 separate computers.

G. The Contractor shall provide water connections, and a holding tank drain and waste system for the toilet room. The toilet room shall contain a flush-type water closet, a lavatory sink with hot and cold water, a mirror, an electric 5-gallon water heater, toilet and paper towel dispensers, coat hooks, shelf, and waste receptacle. The toilet room shall be ADA accessible. The Contractor shall maintain an adequate supply of toilet paper and paper towels during the duration of the work. The Contractor shall pump the holding tank empty whenever it is 50 to 75 percent full during the work and keep it adequately charged with chemicals.

H. The Contractor shall clean the Engineer‘s office on a regular basis, at least weekly, for the duration of the work. Cleaning shall include emptying of waste receptacles, vacuuming and mopping floors, dusting, cleaning the toilet room, and washing windows. Cleaning shall be completed after 4 p.m. during weekdays. The Contractor shall also provide pest control as required during the work.

I. The following equipment and furnishings shall be provided and installed by the Contractor for the exclusive use of the Engineer throughout the duration of the work. These items shall be provided at the same time that the Engineer‘s office is provided. The Contractor shall be responsible for all maintenance, repair, and technical support required for the supplied equipment. The Contractor shall retain

ownership of these equipment and furnishings after Final Completion.

1. Four steel desks; 60 by 30-inch; with a minimum of five side drawers and one center drawer; Hon model HON-32261-WK or equal. Provide desk wings suitable for desktop computer use.

2. Seven upholstered swivel desk chars with arm rests; Hon model HON-4002GG32W or equal.

3. Five five-drawer metal legal-sized filing cabinets with locks and keys.

4. One, approximately 4-ft by 8-ft conference table.

5. Four desk lamps; two-tube fluorescent; table mounted; adjustable arm for changing fixture location and angle.

6. One mobile print/clamp system rack; 12 clamp capacity; SAFCO SAF-5076 or equal; 12 each print clamps, 36-inches long, SAFCO SAF-5004-6 or equal.

7. Forty linear feet of wall mounted shelving; 12-inches deep; sized to hold continuous books without sagging; locations as directed by the Engineer.

8. Twelve identical padded metal folding chairs; KI model KRG-103-BE-0G3 or equal.

9. One work table; 29-inch desk height, 30 by 72-inch top; Bevis model BVS-FTE3072WA or equal.

10. Five waste receptacles, Rubbermaid model RUB--R2956-0 or equal.

11. Bottled drinking water ~~c~~ooler" with hot and cold water, small refrigerator, microwave oven, coffee machine, and paper cup dispenser. Provide five 5-gallon water bottles and 400 paper cups each month for the duration of the work.

12. One garment rack with top storage shelf, umbrella holder, and space for a minimum of 6 clothes hangers. Vogel Peterson Model VOG-SGN-BK or equal.

13. Three dry erase presentation white boards, magnetic 48 by 72 inches, with wall mounting brackets, Quartet Model QRT-2547 or equal.

14. Two dry erase presentation white boards, magnetic 36 by

48 inches, with wall mounting brackets, Quartet Model QRT-2544 or equal.

15. Five metal bookcases, each with 3 adjustable shelves, commercial grade, nominal dimensions 34 inches wide by 12 inches deep by 47 inches high, Hon Model HON-S48ABC-K or equal.

J. All of the above equipment shall be new (except where specifically noted), or used (no older than 3 years) equipment in excellent condition, acceptable to the Engineer.

13.03.02. Contractor's Office

A. The Contractor shall provide and maintain at the project site a suitable trailer office for Contractor's use. Location of Contractor and sub-contractor office trailers shall be at the Contractor's staging area shown on the Drawings, and shall be as approved by the Engineer. At this office shall be kept project copies of the Contract Documents, project progress records, project schedule, submittals, and other relevant documents which shall be accessible to the Engineer and other District employees during normal working hours. Contractor's office shall have sufficient space for weekly and other conferences for up to ___ people to be held.

13.03.03. Removal and Disposal

A. The office facilities, furnishing, and/or equipment specified in this Article 13.03 shall be furnished, installed and in operating conditions prior to performing any other contract work under the Contract and shall be removed and disposed of within 30 days upon completion and acceptance of the Project by the District.

13.03.04. Payment

A. Full compensation for doing all work necessary to provide office facilities including operating and maintenance costs as specified herein shall be included in the lump sum price bid for MOBILIZATION.

13.04. Use of District Facilities

Specify authorized District facilities available for the Contractor's employees use during construction. The following example is taken from a treatment plant related project.

EXAMPLE:

A. Contractor's employees shall not use District restrooms, offices, lunch rooms, parking spaces, work rooms, or similar facilities.

B. For work at Rinconada Water Treatment Plant, Contractor may be allowed to use existing control building freight elevators only in coordination with District use.

C. The Contractor will not be allowed to use any other District equipment in the facility including cranes, forklifts, and manlifts.

13.05. Temporary Utilities

List all temporary utilities that may be required during construction. The following example is taken from a treatment plant related project.

EXAMPLE:

A. Temporary Electrical Power: All electrical power for the Contractor‘s construction operations, offices, storage spaces, lighting, testing, heating, cooling, ventilating, security, and to support the other temporary utilities and facilities described herein shall be provided and paid for by the Contractor. The Contractor shall arrange, at no additional cost to the District, with the local electrical utility to provide and remove adequate temporary electrical service and/or provide temporary electrical generator. The location of the temporary electrical service equipment will be subject to the approval of the Engineer.

B. Temporary Lighting: Provide temporary lighting in all work areas sufficient to maintain a lighting level during working hours not less than the lighting level required by California OSHA standards. As permanent lighting facilities are completed they may be used in lieu of temporary facilities, provided however, bulbs, lamps, or tubes of such facilities used by the Contractor shall be replaced immediately prior to final acceptance of the work. Shield and direct all temporary exterior lighting downward and toward the interior of the treatment plant to minimize its effects on the treatment plant neighbors.

C. Temporary Heating, Cooling, and Ventilation: Provide means for heating, cooling, and ventilating all work areas as may be required to protect the work from damage by freezing, high temperatures, weather, or to provide a safe environment for workers. Unvented direct fired heaters shall not be used in areas where freshly placed concrete will be exposed to the combustion gases until at least two hours after the

concrete has attained its initial set.

D. Temporary Public Telephone for General Use: Provide a minimum of two pay telephones with enclosures at the site for use by Contractor's employees and others.

E. Temporary Water: (a) Pay for and construct facilities necessary to furnish potable water for human consumption and non-portable water for use during construction, (b) Provide backflow prevention devices properly sized for use on the metered potable water connection, (c) Post ample signs throughout the work area warning of the usage of non-portable water if non-portable water is being used.

F. Temporary Sanitary Facilities: Sanitary facilities for the Contractor and all subcontractors shall be provided by the Contractor. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view wherever possible. At least one toilet shall be provided for each 20 workers.

G. Solid and Liquid Waste Disposal: Provide a sufficient number of waste receptacles, dumpsters, and bins to contain all solid and liquid waste generated from construction operations. Existing waste receptacles owned by the District shall not be used by the Contractor. Waste receptacles shall be emptied a minimum of weekly, and more frequently when full.

H. Temporary Fire Protection: Provide portable UL-rated, 20 pound, Class A fire extinguishers at temporary Contractor's, Engineer's, and similar office spaces. In all other areas of construction operations, provide UL-rated, 20 pound or larger, Class ABC dry chemical extinguishers or a combination of NFPA recommended classes for the exposure. Comply with NFPA 10 and 241 for classification, extinguishing agent, and size required by location and class of fire exposure. Comply with the Uniform Fire Code and Cal/OSHA regulations for the number of fire extinguishers.

I. Temporary Propane Service: If required for construction operations and temporary facilities, the Contractor shall arrange, at Contractor's own cost, with a local propane vendor to provide adequate temporary propane service. Contractor shall also obtain and pay for all required permits and fees from authorities having jurisdiction. Contractor shall pay all charges from the utility or vendor, including charges associated with the removal of the service at the end of the work. The location of the temporary propane service equipment shall be mutually agreeable to the Contractor and the Engineer. The Contractor shall provide all gas distribution system piping, regulators, and other incidentals necessary for safe service. Comply with NFPA 54, 55, and 58 as

applicable to this work.

J. Temporary Compressed Air: Provide compressors for compressed air for construction operations as required. Use of the existing or new plant air compressor systems for construction operations is prohibited.

13.05.01. Payment

Select either option below based on the scope of work. If the work is incidental, use Option 1. Otherwise, choose Option 2.

Option 1

A. Full compensation for doing all work necessary to provide temporary utilities shall be included in the contract price for various items of work involved and no separate payment will be made therefore.

Option 2

A. Full compensation for doing all work necessary to provide temporary utilities shall be included in the lump sum price bid for MOBILIZATION.

13.06. Staging Area

A. Staging areas that are not already paved or covered with compacted aggregate base, and that are used for parking vehicles, trailers, workshops, maintenance areas, or equipment, piping, formwork, rebar, storing masonry on pallets, and metal product storage, shall be graded as required, and surfaced with a minimum of 3 inches of compacted aggregate base rock over a high modulus, woven, and soil separation geo-textile. Areas storing aggregate base or other rock products shall also be placed on this same geo-textile. The objective is to maintain separation between native and construction materials. Areas storing soils and sand are not required to be surfaced with aggregate base course.

B. Aggregate base shall be removed from all staging areas prior to project completion and the surfaces shall be re-graded to their original grades or matching surrounding conditions as directed by the Engineer.

C. Any soils contaminated with petroleum product or other hazardous materials by the Contractor shall be removed by the Contractor and disposed of in accordance with local, state, and federal laws.

D. Contractor is responsible for weed control in staging areas and material storage areas.

13.06.01. Payment

Select either option below based on the scope of work. If the work is incidental, use Option 1. Otherwise, choose Option 2.

Option 1

A. Full compensation for doing all work necessary to provide staging areas shall be included in the contract price for various items of work involved and no separate payment will be made therefor.

Option 2

A. Full compensation for doing all work necessary to provide staging areas as specified herein shall be included in the lump sum price bid for MOBILIZATION.

13.07. District Furnished Materials and Equipment

List all District-furnished materials and equipment and description of where materials are stored and arrangements to pick up and who to contact.

EXAMPLE 1:

A. The District will furnish the following materials to the Contractor. The Contractor shall install the District-furnished materials at the locations shown on the Drawings.

78-inch x 78-inch x 54-inch Fabricated Steel One-Plate Tee
54-inch buried service Butterfly Valve with manual operator
78-inch x 60-inch Taper
60-inch diameter spool piece with bulkhead
48-inch diameter butt-strap
Flange bolt kits, with insulating joint kits
Underground warning tape
Project signs

B. All District-furnished material, except the underground warning tape and the project sign, will be available to the Contractor at District's Maintenance Yard, 5750 Almaden Expressway, San Jose, California. Arrangement to inspect or pick up the material shall be made by contacting _____ at (408) 265-2607, extension ___, at least 2 working days in advance of the date when the material is to be inspected or picked up.

C. The underground warning tape will be available to the Contractor at the District's Rinconada Water Treatment Plant, 400 More Avenue, Los Gatos, California. Arrangements to inspect or pickup the

underground warning tape shall be made by contacting _____ at (408) 265-2600, at least 2 working days in advance of the date when the underground warning tape is to be inspected or picked up. The Contractor's attention is directed to Article XX.XX regarding the underground warning tape.

D. The Contractor's attention is directed to Article 13.02 regarding arrangements for pick up of the project signs.

E. The Contractor shall be responsible for the transportation of District-furnished materials to the jobsite and to ascertain all information, dimensions, connections, and appurtenances required to provide for satisfactory installation of all District-furnished materials.

The following example is taken from a treatment plant related project where a large piece of equipment for the project is furnished by the District and includes delegation of responsibilities between the District and the Contractor.

EXAMPLE 2:

A. District will furnish portions of the equipment required for the liquid oxygen, ozone generation, ozone destruction, and miscellaneous equipment as identified in the documents included with these Contract Documents and in the Drawings. This equipment shall be installed by the Contractor, and the Contractor shall complete and support training, testing, and start-up of this equipment. See the Ozone Equipment Supply Contract Procurement Documents and the Ozone Equipment Supply Contract drawings included with the Drawings.

B. District will furnish the LP gas tank and regulator for the ozone generation building. This equipment will be delivered to the site by the LP gas supply company and shall be installed and connected to the gas piping constructed by the Contractor. The Contractor shall be responsible for anchoring the gas tank and supporting the gas piping and regulator.

C. District will:

1. Have lead responsibilities for coordinating with the Ozone system Supplier.

2. Arrange for and deliver necessary shop drawings, product data and samples to Contractor that are received from vendors of equipment being furnished.

3. Review shop drawings, product data and samples prior to

manufacture and District delivery of these items to the Contractor for installation.

4. Arrange and pay for product delivery to site in accordance with the Ozone Equipment Supply Contract Documents for the items under that scope of work.

5. Provide a copy of the supplier‘s bill(s) of materials to Contractor.

6. Inspect deliveries jointly with Contractor.

7. If required by equipment condition, the District will draft claims for transportation damage to vendor or transportation firm and provide to the Contractor for review as to accuracy and completeness of the damage description. Following Contractor review (and revision, if necessary), the District will submit these claims.

8. Arrange for replacement of damaged, defective, or missing items prior to acceptance by Contractor.

9. Arrange for manufacturer‘s warranties, bonds, special services, and inspections, as specified.

10. Pay all sales and use taxes associated with District furnished equipment and items.

D. Contractor shall:

1. Be fully prepared to accept all items to be delivered under the Ozone Equipment Supply Contract documents at dates selected by the Contractor within the respective range of dates specified in these Ozone Equipment Supply Contract documents.

2. Review, understand, and develop a coordinated work plan based upon submittals received from the Engineer about District-furnished equipment.

3. For all items furnished by the District: Designate the early and late delivery dates for each District-furnished product. These dates shall be included in the preliminary and subsequent project schedule updates.

4. Submit notification of discrepancies or anticipated problems.

5. Receive and unload items at site.

6. Promptly inspect furnished items jointly with Engineer and record

shortages, damaged or defective items.

7. Handle items at site, including uncrating, disposal of packing materials, strapping, and pallets, and storage.

8. Protect items from damage.

9. Install, including assembly, anchorage, connections, adjustments, motor bump tests, other tests, and finish items in accordance with the Contract Documents.

10. Provide all materials to join piping, conduits, boxes, etc. provided by the Ozone System Supplier (e.g., gaskets, bolts, nuts, washer, conduit fittings, adapters, seals, etc.) and incidental materials required for complete installation.

11. Repair or replace items damaged after receipt until Date of Acceptance of the Project by the District.

E. When District fails to deliver products in accordance with approved Construction Schedule, adjustments will be made to Contract Time and Contract Price as stipulated in Standard Provisions.

13.07.01. Assignment of Contract for District-Procured Materials

See instructions.

13.08. Salvaged Materials and Equipment

List salvaged materials and equipment and special conditions.

EXAMPLE:

A. The Contractor shall salvage the 78-inch blind flange from the Almaden Valley Pipeline, and deliver the salvaged material to the District's Coyote Pump Station Facility, 18300 Peet Road, Morgan Hill, California. The Contractor shall notify _____ at (408) 265-2600, at least 1 week in advance of delivery. The Contractor shall provide all equipment and labor necessary to load, deliver, and unload the salvaged material.

13.09. Tools and Spare Parts

This Article applies to projects that provide new mechanical, electrical, and control equipment and systems, and may not be required on flood protection projects.

A. All special tools and the manufacturer's standard set of spare parts required for the normal operation and maintenance of respective items of equipment required under this Contract shall be furnished with those items of equipment by the manufacturer. This includes special tools, instruments, accessories required for proper "in-plant" adjustment, maintenance, overhaul, and operation. Tools shall be high-grade, smooth, forged, alloy tool steel, or non-sparking material as is appropriate.

B. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment, whether identified in the manufacturer's standard manual or not.

C. The Contractor shall collect and store all spare parts so required in an area to be designated by the Engineer. All spare parts shall be carefully packed in sealed, weather-resistant cartons and all tools packed in metal tool boxes with locking clasps, each labeled with indelible markings, and shall be adequately treated for a minimum 5 year long period of storage. Complete ordering information including manufacturer's name and address, part ordering information including manufacturer, part number, part name, and equipment name and number(s) for which the part is to be used shall be supplied with the required spare parts. A list of spare parts, respectively, shall be placed in each storage container and a duplicate list included with the operations and maintenance manuals.

D. Upon collection of all required tools and spare parts, as verified by the Engineer, the Contractor shall turn over all tools and spare parts to the Engineer with a complete inventory list. The inventory list shall include a description of all spare parts, the equipment they are associated with, the applicable specification sections, the name and address of the supplier, and the delivered cost of each item. Copies of the actual invoice for each item shall be furnished with inventory to substantiate the delivery.

E. Special tools and spare parts shall be new and shall not be utilized by the Contractor.

13.10. Operation and Maintenance Documents

This Article applies to projects that provide new mechanical, electrical, and control equipment and systems. The language below is intended for water utility projects. Consult with the Water Utility Operations Division if necessary. For flood protection projects, scale down the required O&M documentation as deemed appropriate in consultation with Watersheds Operations.

13.10.01. Scope of Work

A. The work specified in this Article includes providing O&M documents as specified herein.

B. O&M documents shall include the O&M manual for the complete system and/or the equipment maintenance data for pieces of equipment that operate on its own or as part of the complete system. The equipment maintenance data for each piece of equipment shall include booklets, literature, cut sheets, and any instructions that are packed with the equipment. Contractor shall include information on all motors supplied with equipment and complete equipment maintenance summary sheets for every piece of equipment and instrumentation with an equipment number or tag number as specified herein.

13.10.02. Submittal Schedule

A. Contractor shall submit O&M documents as required below in accordance with Article 9.02 of these Specifications.

B. Submit six (6) copies of draft O&M documents within four weeks of approved shop drawings but no later than three weeks before start-up and field quality control testing and before training of each piece of equipment or system.

C. Make two copies of draft O&M documents available at project site for use by construction personnel and District.

D. Make additions and revisions to the O&M documents in accordance with Engineer‘s review comments.

E. Submit four (4) copies of final O&M documents within four weeks after operators training (if applicable) or final approval of equipment installation. This should include three (3) copies of electronic files of shop drawings that accompany the O&M manuals or the equipment maintenance data.

13.10.03. Document Contents

A. Contents, for each unit of equipment and system, as appropriate:

1. Description of unit and component parts:

a. Function, normal operating characteristics, and limiting conditions.

b. Performance curves, engineering data, and tests.

c. Complete nomenclature and commercial number of replaceable parts.

d. A listing of all equipment and their weights for all items weighing more than l00 lbs. A motor and speed reducer, mounted on a common base, shall be considered both individually and together in listing. Other similar assemblies shall be similarly considered.

2. Operating procedures:

    a. Startup, break in, routine, and normal operating instructions.

    b. Regulation, control, stopping, shutdown, and emergency instructions.

    c. Summer and winter operating instructions.

    d. Special operating instructions.

3. Maintenance procedures:

    a. Routine and preventative maintenance operations.

    b. Guide to ~~tr~~ouble shooting."

    c. Disassembly, repair, and assembly.

    d. Alignment, adjusting, and checking.

4. Servicing and lubrication schedule: List of lubricants required, including time intervals for lubrication, adjustments, etc., on all new equipment furnished under this Contract, and a list of all required lubricants (including a notation as to lubricant used initially in each item of equipment). For each required lubricant, a list of acceptable equivalents from at least one different major manufacturer whose products are locally available near the project site shall be provided.

5. Manufacturer‘s printed operating and maintenance instructions.

6. Original manufacturer‘s parts list, illustrations, assembly drawings, and diagrams required for maintenance.

    a. Predicted life of parts subject to wear.

    b. Items recommended to be stocked as spare parts.

7. Each contractor‘s coordination drawings, as-installed color coded piping diagrams.

8. List of original manufacturer‘s spare parts to be left with District at completion of construction, manufacturer‘s current prices, address and telephone number and FAX number of authorized repair facilities, address of factory, and recommended quantities to be maintained in storage.

9. Other data as required under pertinent sections of these Specifications.

B. Contents, for each electrical and electronic system, as appropriate.

1. Description of system and component parts:

   a. Function, normal operating characteristics, and limiting conditions.
   b. Performance curves, engineering data, and test data.
   c. Complete nomenclature and commercial data.

2. Circuit directories of panel boards:

   a. Electrical service.

3. As installed color coded wiring diagrams.

4. Operating procedures:

   a. Routine and normal operating instructions.
   b. Sequences required.
   c. Special operating instructions.

5. Maintenance procedures:

   a. Routine and preventative maintenance operations.
   b. Guide to ~~"t~~rouble shooting."
   c. Disassembly, repair, and assembly.
   d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.

7. List of original manufacturer's spare parts, manufacturer's current prices, address, phone number, FAX number, and recommended quantities to be maintained in storage.

8. As-installed control diagrams by controls manufacturer. For each control device provide a hard-copy printout of the control program, annotated to describe all logic sequences. Provide a detailed description for modifying the control program.

C. Complete the **EQUIPMENT SUMMARY SHEETS** electronically using Excel. A hard copy of the forms is attached at the end of this Article. An electronic file of the forms with instructions will be provided to the Contractor by the Engineer.

D. O&M Documents shall be applicable to equipment actually furnished with general sections related to other models deleted. Manuals will be rejected if not satisfactorily marked.

E. Such other information as may be required to provide comprehensive information on all systems, subassemblies, and components to enable operation, service, maintenance and repair shall also be provided.

F. If, at the time of the project bid, any manufacturer, supplier, or subcontractor offers for use or sale an electronic copy of operations and/or maintenance information, it shall be provided with the paper information.

13.10.04. Document Format

A. General Requirements: Information and data shall be provided in the English language and in American units (feet, inches, pounds, degrees F, etc.). Supplemental metric units shall be included unless noted otherwise.

B. Size: 8½ X 11

C. Paper: 20 pound bond minimum, white, for typed pages

D. Binders

1. Commercial quality post or ring-type binders with durable plastic covers.

2. Minimum spine size: 1-inch.

3. When multiple binders are used, correlate data into related consistent groupings.

E. Text: Manufacturer‘s printed data, or neatly word processed information

F. Drawings

1. Provide reinforced punched binder tab, bind in with text.

2. Fold larger drawings to size of text pages and include in clear plastic pockets.

G. Provide fly leaf for each separate product, or each piece of operating equipment.

1. Provide typed description of product, and major component parts of equipment.

2. Provide indexed tabs for each product and piece of equipment.

H. Provide electronic files on diskette of CD for all non-preprinted text (Word), spreadsheets (Excel), or CAD drawings (AutoCAD) included in O&M manuals. These files shall become the property of the District for use in a master plan O&M manual, training programs, and other uses.

I. Depending upon the content of the O&M documents, cover shall include appropriate titles as follows:

1. For complete systems ~~"~~O&M MANUAL and EQUIPMENT MAINTENANCE DATA," for individual equipment ~~"~~EQUIPMENT MAINTENANCE DATA."

2. Project name

3. District's name

4. Equipment, Product, or System name as appropriate

5. Applicable tag number

6. Date

7. Manufacturer's name and address

J. Table of Contents

1. Neatly word processed table of contents for each volume, arranged in systematic order.

2. List of each equipment piece or product included, indexed to the content of volume. Reference all District equipment numbers.

K. List, with each product, name, address, and telephone number of:

1. Subcontractor or installer.

2. Maintenance contractor, as appropriate.

3. Identify area of responsibility of each.

4. Local source of supply for parts and replacement and list of recommended spare parts. List name, address, phone number, and FAX number.

5. List website URL (if available).

L. Identify each product by product name and other identifying symbols as shown on the Drawings and as specified herein, including nameplate information and shop order numbers for each item of equipment furnished.

M. Product Data

1. Include only those sheets which are pertinent to specific product.

2. Annotate each sheet to:

   a. Clearly identify specific product or part installed.
   b. Clearly identify data applicable to installation.
   c. Delete references to inapplicable information.

N. Drawings

1. Supplement product data with drawings as necessary to clearly illustrate:

   a. Relations of component parts of equipment and systems.

   b. Control and flow diagrams.

   c. Coordinate drawings to ensure correct illustration of completed installation.

O. Written text, as required to supplement product data for particular installation.

1. Organize in consistent format under separate headings for different procedures.

2. Provide logical sequence of instructions for each procedure.

P. Copy of each warranty, bond, and/or service contract issued (as applicable).

Q. Provide information sheet for District's personnel, giving:

1. Proper procedures in event of failure.
2. Instances which might affect validity of warranties.

13.10.05. Equipment, Products, and Systems Requiring O&M Documents

A. Listed below are the equipment, products, and systems for which Contractor is required to furnish O&M documents in conformance with this Article.

Prepare a list of the required O&M documents and the cost for furnishing them. Consult with the Asset Management Unit in developing the list. See instructions.

EXAMPLE:

1. Operation and Maintenance Document List

Specification No.	Description of Equipment, System	Unit Cost ($)
xx.xx	Centrifugal Pumps	XXX
xx.xx	Monorail System	XXX

xx.xx	MCC	XXX
xx.xx	Aqua Ammonia Feed System	XXX
…	…	…
	Subtotal	xxxx

2. The table above lists O&M documentation requirements for individual pieces of equipment and for complete chemical feed systems.

3. O&M documents for complete chemical feed systems should include the O&M Manual of the complete system, the Equipment Maintenance Data, and the Equipment Summary Sheet for each piece of equipment that makes up a system.

13.10.06. Payment

A. Full compensation for doing all work required for providing O&M documents as specified herein, shall be by the specified amount per each set of O&M Document as listed above.

B. Payment for each O&M document will be made progressively in the following manner:

1. Forty percent of the amount stated in the list above after the Contractor submits the draft O&M document for District's review according to paragraph 13.10.02.B.

2. Sixty percent of the amount stated in the list above after the Contractor submits the final O&M document according to paragraph 13.10.02.E.

13.10.07. Liquidated Damages

A. The District will assess a liquidated damage of $100 per day for each day that the Contractor fails to submit the O&M documents as required per paragraph 13.10.02.B.

B. The District will assess a liquidated damage of $100 per day for each day that the Contractor fails to submit the O&M documents as required per paragraph 13.10.02.E.

C. O&M documents that are submitted within the required schedule but are rejected will be a basis for the District to assess a liquidated damage.

13.10.08. Back Charges

A. For submittals that require re-review due to Contractor‘s failure to comply with the submittal requirements, Contractor‘s attention is directed to Article 19.01.01 paragraph F and Article 9.02.

Instrumentation/Controls Equipment Summary Sheet

General Information

Facility: _____ System: _____

Equip. Type: _____ Equip. ID: _____

Location in Plant or Facility: _____

Purchase/Replacement Value: $ _____ Estimated Service Life (Years): _____

Nameplate Data - Driver

Size: _____ Serial No: _____

Input Signal: _____ Model No: _____

Output Signal: _____ Range: _____

Power Supply: _____ Engr Units: _____

Volts: _____ Cal Factor: _____

AMPS: _____ Service: _____

Manufacturer

Name: _____ Phone: _____

Address: _____ Web Address: _____

City / St / Zip: _____

Manufacturer's Local Representative

Name: _____ Phone: _____

Address: _____ Web Address: _____

City / St / Zip: _____

Preventative Maintenance Procedures *Include: Task, Frequency, and Materials Required*

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

7 _____

8 _____

Maintenance Comments

Recommended spare parts for this specific installation

1		9	
2		10	
3		11	
4		12	
5		13	
6		14	
7		15	
8		16	

Electrical Equipment Summary Sheet

General Information

Facility: _____ System: _____

Equip. Type: _____ Equip. ID: _____

Location in Plant or Facility: _____

Purchase/Replacement Value: $ _____ Estimated Service Life (Years): _____

Nameplate Data - Driver

Frame: _____

Horse Power: _____

RPM: _____

Phase: _____

Volts: _____

AMPS: _____

Nameplate Data - Driven Unit *(e.g. Valve Actuator)*

Serial No: _____

Model No: _____

Size: _____

Service: _____

Stroke Time: _____

Manufacturer

Name: _____ Phone: _____

Address: _____ Web Address: _____

_____ _____

City / St / Zip: _____

Manufacturer's Local Representative

Name: _____ Phone: _____

Address: _____ Web Address: _____

_____ _____

City / St / Zip: _____

Preventative Maintenance Procedures *Include: Task, Frequency, and Materials Required*

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

7 _____

8 _____

Maintenance Comments

Lubricant List *Include: Trade Name, Reference Symbol, and Specification (AGMA, NLIG, etc.)*

1 _____

2 _____

3 _____

4 _____

5 _____

Recommended spare parts for this specific installation

1 _____ 6 _____

2 _____ 7 _____

3 _____ 8 _____

4 _____ 9 _____

5 _____ 10 _____

Mechanical Equipment Summary Sheet

General Information

Facility: _____ System: _____

Equip. Type: _____ Equip. ID: _____

Location in Plant or Facility: _____

Purchase/Replacement Value: $ _____ Estimated Service Life (Years): _____

Nameplate Data - Driver

Frame: _____

Horse Power: _____

RPM: _____

Phase: _____

Volts: _____

AMPS: _____

Nameplate Data - Driven Unit *(e.g. Valve Actuator)*

Serial No: _____

Model No: _____

Size: _____

Capacity: _____

TDH: _____

RPM: _____

Manufacturer

Name: _____ Phone: _____

Address: _____ Web Address: _____

City / St / Zip: _____

Manufacturer's Local Representative

Name: _____ Phone: _____

Address: _____ Web Address: _____

City / St / Zip: _____

Preventative Maintenance Procedures *Include: Task, Frequency, and Materials Required*

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

7 _____

8 _____

Maintenance Comments

Lubricant List *Include: Trade Name, Reference Symbol, and Specification (AGMA, NLIG, etc.)*

1 _____

2 _____

3 _____

4 _____

5 _____

Recommended spare parts for this specific installation

1 _____ 6 _____

2 _____ 7 _____

3 _____ 8 _____

4 _____ 9 _____

5 _____ 10 _____

13.11. Maintenance of Record Documents

See instructions.

A. The Contractor shall maintain at the site the following record documents:

1. Record Drawings (full size).
2. Specifications and addenda.
3. Favorably reviewed submittals including shop drawings, product data, samples, calculations, and other submittals.
4. Change orders, field orders, and other contract modifications.
5. Field and shop testing records.
6. Survey records.
7. Correspondence.

B. The Contractor shall store the record documents in an approved project site location apart from documents used for construction. Record documents are not to be used for construction purposes. The Contractor shall provide files and racks for orderly storage of the documents; maintain the documents in clean, dry, legible condition, and make all documents and samples available during regular business hours for inspection and reproduction by the Engineer.

C. The Contractor shall keep the record documents current with construction in progress. Completed construction work shall not be permanently concealed until required information has been recorded.

D. The Contractor shall label each record document except correspondence "PROJECT RECORD" in neat, large, printed letters.

E. The Contractor shall legibly mark specifications in red pencil or ink to record applicable changes as described in paragraph A.

F. At completion of construction, and prior to the final acceptance of the Project by the District, the Contractor shall deliver the Record Documents to the Engineer in accordance with Article 21.05.01.

13.11.01. Record Drawings (Marked-Up Drawings)

A. The Contractor is required to keep an accurately marked, up-to-date set of drawings for the work installed. Contractor shall record, as the work progresses, changes to the original Contract Drawings including, but not limited to, the following items:

1. Field changes or adjustments in the final location or in the final dimensions or details of the Work.

2. Changes resulting from requests for information, change orders, and other contract modifications.

3. Locations of underground and above ground utilities and appurtenances.

4. Details not included in the original Contract Drawings but incorporated into the Work, referenced to approved shop drawings, product data, samples, calculations, or other submittals.

5. Location of items embedded or concealed from view such as conduits, cables, junction boxes, piping, etc.

B. Changed work or conditions of the work covered up or concealed by the Contractor in advance of recordation of the Record Drawings shall be uncovered to allow accurate recordation of the change, then re-covered, all at the Contractor‘s expense.

C. Changes shall be marked directly on the Contract Drawings in accordance with instructions provided in Appendix _____. If there is insufficient space on a Drawing to mark up the change, the Contractor shall draw additional sketches to completely show the change and attach the sketches to the Drawing.

D. The Engineer has the right to review the Contractor‘s marked-up drawings at any time to ascertain that they are being kept up to date and show sufficient detail. Should the Contractor‘s marked-up drawings not be up to date or lack necessary detail, the Engineer may withhold 5 percent from each monthly progress payment, until the drawings are deemed acceptable by the Engineer. Such review by the Engineer shall not relieve the Contractor of its responsibility for keeping the Record Drawings current and complete.

E. The Record Drawings shall be stamped ~~-A~~S-BUILT” and shall be, at completion of construction, signed and dated by the Contractor.

13.12. Emergency Work

Specify the Contract conditions of emergency work completed with District or Contractor’s forces.

EXAMPLE:

A. The Contractor shall have personnel available on call for emergency work connected with those improvements, tie-ins, and modifications being completed as part of this work. Contractor on call personnel shall be able to be on site within 2 hours of verbal notice 24 hours a day, 7 days a week. Telephone numbers for these individuals shall be

provided to the Engineer and shall be kept current.

13.13. Dispute Review Board

Only certain projects require the DRB process. See instructions.

If a DRB process is required:

A. A Dispute Review Board (DRB) process is required and shall be in accordance with Article 5.10.

B. Immediately after award of the Contract, the District and the Contractor shall meet to discuss and establish the qualifications upon which nominees for the DRB are to be evaluated, and to jointly select prospective nominees.

C. The District, the Contractor and the DRB shall execute the Agreement at the first DRB meeting. A copy of the Three-Party Agreement form is attached in Appendix _____. If there are conflicts between the provisions of the Agreement and these specifications, the provisions of the Agreement shall take precedence.

D. The District and the Contractor shall each bear their respective in-house costs and costs of providing those DRB-related services for which such responsibility has been allocated herein.

E. The District and the Contractor shall equally bear the cost of the DRB's services in accordance with and as set forth in the DRB Agreement and these Specifications.

If a DRB process is not required:

A. A Dispute Review Board (DRB) process is not required.

13.14. Escrow Bid Documents

Only certain projects require the Escrow Bid Documents. See instructions.

If Escrow Bid Documents are required:

A. The Contractor shall prepare and submit to the Engineer the Escrow Bid Documents in accordance with Article 5.11.

B. Each subcontractor, whose total subcontract price exceeds __X__ percent of the total price proposed by the bidder, shall provide separate Escrow Bid Documents to be included with those of the bidder.

Determine the percentage of subcontract work that would require subcontractors to submit separate Escrow Bid Documents.

If Escrow Bid Documents are not required:

A. Escrow Bid Documents are not required.

13.15. Partnering

Contractor's attention is directed to Article 5.12 of the Standard Provisions.

13.16. Insurance

A. Without limiting the Contractor's indemnification of, or liability to, the District, the Contractor must provide and maintain at its own expense, during the term of this Contract, or as may be further required herein, the following insurance coverages and provisions:

1. Contractor must provide its insurance broker(s)/agent(s) with a copy of these requirements and warrants that these requirements have been reviewed by Contractor's insurance agent(s) and/or broker(s), who have been instructed by Contractor to procure the insurance coverage required herein.

2. In addition to certificates, Contractor must furnish District with copies of original endorsements affecting coverage required herein. The certificates and endorsements are to be signed by a person authorized by that insurer to bind coverage on its behalf. All endorsements and certificates are to be received and approved by District before the Contract commences. In the event of a claim or dispute, District has the right to require Contractor's insurer to provide complete, certified copies of all required pertinent insurance policies, including endorsements affecting the coverages required herein.

B. Contractor must, at its sole cost and expense, procure and maintain during the entire period of this Contract the following insurance coverage(s).

Each construction project is unique; therefore, the Project Team must consult with the District's Risk Management Administrator as early as possible, preferably during the preliminary design phase, to determine the appropriate liability insurance coverages and requirements. The coverages typically vary between 2 to 5 million dollars.

13.16.01. Required Coverages

A. Commercial General/Business Liability Insurance with coverage as indicated:

1. **$X,XXX,XXX** per occurrence / **$X,XXX,XXX** aggregate limits for bodily injury and property damage

2. **$X,XXX,XXX** Products/Completed Operations aggregate (to be maintained for at least three (3) years following acceptance of the work by District.

3. General Liability insurance must include:

    a. Coverage at least as broad as found in standard ISO form CG 00 01.
    b. Premises and Operations
    c. Contractual Liability expressly including liability assumed under this contract.
    d. If Consultant will be working within fifty (50) feet of a railroad or light rail operation, any exclusion as to performance of operations within the vicinity of any railroad bridge, trestle, track, roadbed, tunnel, overpass, underpass, or crossway must be deleted, or a railroad protective policy in the above amounts provided.
    e. Owners and Contractors‘ Protective liability
    f. Severability of Interest
    g. Explosion, Collapse and Underground Hazards, (X,C, and U)
    h. Broad Form Property Damage liability
    i. If the standard ISO Form wording for "OTHER INSURANCE," or other comparable wording, is not contained in Consultant's liability insurance policy, an endorsement must be provided that said insurance will be primary insurance and any insurance or self-insurance maintained by District, its Directors, officers, employees, agents or volunteers will be in excess of Consultant's insurance and will not contribute to it.

B. Business Auto Liability Insurance with coverage as indicated:

1. **$X,XXX,XXX** combined single limit for bodily injury and property damage per occurrence, covering all owned, non-owned and hired vehicles.

C. Builders‘ Risk (Course of Construction) Insurance

1. Covering all risks of loss less policy exclusions for an amount equal to the completed value of the project with no coinsurance penalty provisions. Builder‘s Risk policy shall name Santa Clara Valley Water District as loss payee.

D. Workers' Compensation and Employer‘s Liability Insurance

1. Statutory California Workers‘ Compensation coverage covering all work to be performed for the District.

2. Employer Liability coverage for not less than **$X,XXX,XXX** per occurrence.

E. Surety Bonds

1. Contractor shall provide the following Surety Bonds:

   a. A bid bond as specified in the Notice to Bidders.
   b. A performance bond as specified in Article 4.03.
   c. A payment bond as specified in Article 4.03.

13.16.02. General Requirements

A. Additional Insured Endorsement(s)**:** Contractor must provide an additional insured endorsement for Commercial General/Business Liability and Business Automobile liability coverage naming the Santa Clara Valley Water District, its Directors, officers, employees, and agents, individually and collectively**,** as additional insureds, and must provide covereage for acts, omissions, etc. arising out of the named insureds‘ activities and work. Other public entities may also be added to the additional insured endorsement as applicable and the Contractor will be notified of such requirement(s) by the District.

(**NOTE:** Additional insured language on the Certificate of Insurance is **NOT** acceptable without a separate endorsement such as Form CG 20 10, CG 2033, CG 2037. Note: Editions dated 07/04 are not acceptable)

B. Primacy Clause: Contractor‘s insurance must be primary with respect to any other insurance which may be carried by the District, its officer, agents and employees, and the District‘s coverage must not be called upon to contribute or share in the loss.

C. Cancellation Clause Revision: The Certificate of Insurance must provide **30** days notice of cancellation, (10 days notice for non-payment of premium). NOTE: The standard wording in the ISO Certificate of Insurance is <u>not</u> acceptable. The following words must be crossed out or deleted from the standard cancellation clause: "...endeavor to..." AND "...but failure to mail such notice must impose no obligation or liability of any kind upon the company, its agents or representatives."

D. Acceptability of Insurers: All coverages must be issued by companies admitted to conduct business in the State of California, which hold a current policy holder's alphabetic and financial size category rating of not less than A- V, according to the current Best's Key Rating Guide or a company of equal financial stability that is approved by the District‘s Risk Management Administrator.

E. Self-Insured Retentions or Deductibles: Any deductibles or self-insured retentions must be declared to and approved by the District. At the option of the District, either: the insurer shall reduce or eliminate such deductibles or self-insured

retentions as respects the District, its officers, officials, employees and volunteers; or the Contractor shall provide a financial guarantee satisfactory to the Entity guaranteeing payment of losses and related investigations, claim administration, and defense expenses.

F. Subcontractors: The Contractor must require each of its subcontractors of any tier to carry the aforementioned coverages, or Contractors may insure subcontractors under its own policies.

G. Amount of Liability not Limited to Amount of Insurance: The insurance procured by Contractor for the benefit of the District must not be deemed to release or limit any liability of Contractor. Damages recoverable by the District for any liability of Contractor must, in any event, not be limited by the amount of the required insurance coverage.

H. Coverage to be Occurrence Based: All coverage must be occurrence-based coverage. Claims-made coverage is not allowed.

I. Waiver of Subrogation: Contractor agrees on to waive subrogation against the District to the extent any loss suffered by Contractor is covered by any Commercial General Liability policy, Automobile policy, Workers‘ Compensation policy, or Builders‘ Risk policy described in Article 13.16.01 - Required Coverages above. Contractor agrees to advise its broker/agent/insurer about this provision and obtain any endorsements, if needed, necessary to ensure the insurer agrees.

J. Non-compliance: The District reserves the right to withhold payments to the Contractor in the event of material noncompliance with the insurance requirements outlined above.

K. The Contractor shall mail the certificates and endorsements to:

Capital Program Planning and Analysis
Unit Manager
Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118

The certificate of insurance must include the name of the project.

L. For any questions, the Contractor‘s insurance broker is adviced to call Mr. David Cahen, District Risk Management Administrator at (408) 265-2607, extension 2213.

SECTION 14. GENERAL COORDINATION

14.01. Meeting Requirements

A. This Article includes requirements for scheduling, attending, and conducting project meetings for the purposes of addressing issues related to the work, and reviewing and coordinating progress of the work. Project meetings include the pre-construction meeting, progress meetings, coordination meetings, and special meetings as specified herein.

B. Qualifications of Meeting Participants—Representatives of firms and organizations participating in each meeting shall be qualified and authorized to act on the behalf of the firm or organization they represent.

14.01.01. Preconstruction Meeting

A. The purpose of the preconstruction meeting is to review the Project, to designate responsible personnel, and to inform the Contractor of the District‘s contract administrative procedures, correspondence communication protocol, and other special requirements of the Contract.

B. Upon or before issuance of Notice to Begin Work, the Engineer will arrange the preconstruction meeting. The Contractor will be notified of the time, date and place where the preconstruction meeting will be held. The Engineer will prepare the agenda, preside at the meeting, and record meeting minutes.

14.01.02. Progress Meetings

A. The Engineer will conduct progress meetings on a regular weekday and time as mutually agreed by the Contractor and the Engineer. The purpose of the progress meetings is to review construction progress, submittal status, change order status, construction safety issues and concerns, conflicts, public/neighborhood issues, progress payments, and any other subjects as deemed appropriate.

B. The Contractor shall allow for one meeting a week, one hour minimum for each meeting.

C. Subject to the Engineer‘s approval, the frequency of the progress meetings may be reduced at the beginning and end of the construction period.

D. Contractor‘s suppliers and subcontractors shall attend the meetings as required. Third parties such as agency representatives and utilities may be invited by the Engineer to attend as deemed appropriate.

E. The Engineer will record meeting minutes as needed, and will distribute the agenda and recorded minutes in advance of the meeting.

14.01.03. Coordination and Special Meetings

A. The Engineer will conduct other coordination and special meetings in addition to progress meetings when appropriate. The purpose of these meetings is to discuss and coordinate shutdowns, outage, utility tie-ins, and any other special issues as deemed necessary.

List other required meetings.

EXAMPLE:

B. The Contractor shall schedule meetings with manufacturers and installers of major units of construction which require coordination between subcontractors. Major units of construction which require pre-installation meetings include:

1. Water proofing
2. Roofing
3. Coating systems
4. Electrical
5. Control system

C. Date, time, and location for coordination and special meetings will be as mutually agreed by the Engineer and the Contractor. The Contractor shall ensure attendance of appropriate Contractor staff, subcontractors, and suppliers.

D. The Engineer will record meeting minutes as needed, and will distribute the agenda and recorded minutes in advance of the meeting.

14.02. Integration and Coordination With District Operations

14.02.01. Overview of Existing Systems and Facilities

Include an overview of typical processes, functions, and work at the District facilities where the work will be constructed. The following example is for a treatment plant related project.

EXAMPLE:

A. The following is a cursory overview of typical processes, functions, and work at the Santa Teresa Water Treatment Plant. Not all items listed are shown on the Drawings.

1. Water Treatment:

a. Water flows from reservoirs and pipeline sources to Santa Teresa

WTP. This, as yet untreated, water is called ~~"r~~aw water."

b. Pumped raw water is injected with several chemicals in the raw water pipeline system at static and pumped mixer points. These chemicals are added to aid in the conglomeration of particles in the water and oxidize particulate matter. The raw water piping splits to the west and east sides of the treatment plant. Raw water enters the flocculation basins and passes through these basins into the sedimentation basins.

c. Water flows through the sedimentation basins where particles drop to the bottom of these basins. One of the major features of this work is to add an additional process step, ozonation, after the sedimentation process. The purpose of ozonation is to disinfect the water and provide other process benefits. Water channels, piping and structures will be built as part of this Project to divert water through new east and west ozone contactor structures and then back to the filters. Currently after sedimentation (and after ozonation once the facilities of this work are complete), water flows to and through 12 filters (6 on the east side and 6 on the west side). Water enters the top of the filter and flows downwards through the filter media. Water entering the filter from the adjoining channel is typically called ~~"s~~ettled", ~~"a~~pplied", or ~~"o~~zonated" water.

d. Periodically, a filter is removed from service and is cleaned by reversing the flow of water through the filter media and blowing air into the filter media. This process is known as ~~"b~~ackwashing." Water for backwashing is pumped from the backwash water pump station. Backwash water is also called ~~"w~~ashwater." Used backwash water flows into the washwater equalization basins. This Project is adding an additional step to the filter backwash process called ~~"fi~~lter-to-waste." After the filter is returned to its normal downward flow mode of operation the water will be ~~"w~~asted" into the new washwater clarification facility until its turbidity is steady and suitable to the District. After filter-to-waste cycle ends water is diverted to the clearwell and transmission system.

e. Large blowers provide air for agitating the filter media during backwashing. Each blower is essential to keep the filter media clean and to prevent the filter from plugging. These blowers are housed in the generator/blower building. This same building also houses standby electrical power generators for the treatment plant.

f. Filtered water is routed via a 96-inch diameter pipeline into the buried 10 million gallon clearwell. This clearwell is connected with

piping that distributes water to consumers.

2. Operations:

   a. The treatment plant is staffed 24 hours a day, every day of the year by licensed water treatment professionals. Staff monitors all plant facilities, operate equipment and systems, enter and exit the treatment plant grounds as required.

   b. Chemical deliveries for the various treatment processes occur on an almost daily basis.

   c. Deliveries of various supplies and materials occur on an almost daily basis.

   d. Training and staff meetings occur on a regular basis.

   e. Security guards check vehicles and people entering the gate(s) and patrol the property.

3. Maintenance:

   a. Various maintenance staff works at the treatment plant or uses it as a resource center for work at other District facilities. Staff enters and exits the treatment plant grounds regularly each day and night as required.

4. District Staff:

   a. District staff of various professional disciplines works inside the Operations Building completing various work assignments.

14.02.02. Requirements of an Operational Facility or System

Include the required facilities, systems or conditions to keep the District facility or system operational. The following example is for a treatment plant related project.

EXAMPLE:

A. The Santa Teresa WTP is the regular source of potable water for a large portion of the service area of the Santa Clara Valley Water District. Facility operation must continue as described below at all times, 24 hours a day, every day of the year during the construction of this work. The plant has a rated production capacity of 100 million gallons per day (mgd). Facilities or conditions required to keep the existing treatment plant operational include, but are not limited to, the

following:

1. Raw water pipelines and control and pressure reducing valves.

2. All pipelines (settled, backwash water and air supply, filtered, sludge, washwater return, drains, plant water, overflows, bypasses, etc.).

3. All flocculation and sedimentation basins with sludge collection systems and connecting channels.

4. All filters.

5. Clearwell, including valve actuator power and instrumentation.

6. All backwash pumps, constant head tank, flow meter, and appurtenances.

7. All backwash blowers.

8. Plant electrical, instrumentation and SCADA systems.

9. All existing chemical feed systems including storage tanks, piping, pumps, control panels, instrumentation, diffusers, meters, mixers, and related facilities necessary to maintain uninterrupted, controlled, feed of process chemicals.

10. Plant water (pumps, hydropneumatic tank, pipelines, and appurtenances) and compressed air systems.

11. The existing standby power generators, fuel tank and supply piping, transfer and control panels, and all other accessories.

12. Operations building.

13. Washwater recovery basins.

14. Washwater/sludge pump station.

B. Conduct the work and provide temporary facilities required to keep the existing facility continuously operational.

C. Do not remove or demolish existing facilities required to keep the existing facility operational at the capacities specified until the existing facilities are replaced by temporary, new or upgraded facilities or equipment. The replacement facilities shall have been tested and demonstrated to be operational prior to removing or demolishing

existing facilities.

14.03. Coordination of Work Activities

This Article includes the requirements on coordination of work activities with other contractors that are also doing work at the site.

14.03.01. Work by Others

A. The Contractor's attention is directed to Section 7-1.14 of the State Specifications and Article 6.19 of these Specifications regarding cooperation. No additional payments will be made or claims considered for delay caused to this Contract because of conflicts with other construction.

B. The Contractor shall complete the following activities as requested by the Engineer to assist in the coordination of Contract work with work by others: attend planning meetings; review and comment on project documents relative to coordination aspects; schedule work to promote efficient installation of all improvements; move equipment, materials, or vehicles to allow work by others to proceed; and other reasonable activities.

List maintenance and miscellaneous improvements to be done by the District during the work of this contract. The following example is for a treatment plant related project.

EXAMPLE:

C. The Contractor is advised that the following water treatment plant maintenance and miscellaneous improvements and work may take place during the work of this Contract:

1. District staff will be completing miscellaneous minor improvements, servicing, and repairs to all areas of this treatment plant during the course of this work.

2. The District will contract with a variety of firms during the course of this work to complete improvements that are outside the scope of this work.

3. District staff will complete certain work related to this project as described under Article 15.01.02.

List other known construction projects that may take place during the work of this contract. The following example is for a treatment plant related project.

EXAMPLE:

D. The Contractor is advised that the known construction projects may take place during the work of this Contract:

1. Chemical System Modifications – Modifications to the existing chemical systems to include tanks, piping, secondary containment, and other features as required. These modifications will take place concurrently with this work.

2. Pacific Gas & Electric Company (PG&E) – PG&E will be completing work related to the delivery of electrical power to the treatment plant for these new facilities. Power needs for construction trailers and Contractor's plant may be provided by PG&E as agreed by the Contractor and PG&E at no additional cost to the District.

3. Landscaping Improvements Project – This Project will include irrigation and landscaping improvements to areas adjoining new facilities constructed by this work and other areas of the treatment plant property. It will take place after this work.

14.03.02. Coordination With Others

List any known activities or conditions by others that may be affected by the work of this contract. The following example is for a treatment plant related project.

EXAMPLE:

A. The Contractor is advised that San Jose Water Company (SJWC) personnel will utilize the access road and gates located on the south side of the Rinconada Reservoir to gain access to their facility. The Contractor shall maintain continuous access required by SJWC and shall fully cooperate with SJWC personnel so as to not hinder or interrupt the assigned task of said personnel.

14.04. Construction Survey

A. The Contractor shall notify the District in writing a minimum of 7 working days before starting operations that require stakes. The Contractor shall request for staking only for the areas that are cleared and grubbed.

B. As a minimum, the District will establish survey control points and reference points as shown on the Drawings for required field layout.

C. The District will provide other staking services as follows:

The services below are listed in the order of completeness. Prepare the list after confirming with the Land Surveying and Mapping Unit for their availability.

EXAMPLE:

1. Set reference points (RP's) with elevations to key alignment stations: Begin Project, Beginning of Curves (BC's), End of Curves (EC's), Point of Intersections (PI's), Equation Stations (Eq. Sta.), Grade Breaks, beginning and end points of vertical curves (VPC & VPT), and End Project.

2. Set intermediate stakes at fifty (50) foot intervals along tangents and twenty-five (25) foot intervals along curves.

3. Set slope stakes to determine location of intersection of design grade and original ground at fifty (50) foot intervals along tangents and twenty-five (25) foot intervals along curves.

D. The District will provide to the Contractor the station(s) and offset distance(s) to all reference points and bench marks that were created.

E. The District will establish required stakes only once. Survey stakes destroyed or removed will be replaced by the District at the Contractor's expense.

F. The Contractor shall be solely responsible for the measurements and layout of the Project from the given line and grade stakes, slope stakes, and offset stakes. Any questions with regard to interpretation of project layout shall be resolved by the Engineer.

Include other survey requirements as needed.

EXAMPLE:

G. The Contractor shall survey all points of connection to existing structures or underground utilities prior of beginning the installation of new facilities to confirm the actual locations and grades. Significant deviations shall be reported in writing to the Engineer prior to proceeding with the installation of new facilities.

H. The Contractor shall not remove or disturb survey monuments and permanent markers unless otherwise approved by the Engineer and the District has recorded and referenced the locations. The Contractor shall be charged at a

reasonable rate for the restoration or replacement of survey monuments and permanent markers by the District.

I. The relocation and protection of survey monuments shall be in accordance with Article 15.03.01 –Survey Monuments" of these Specifications.

14.05. Public Notification

Refer to MMRP element of the CEQA documents, or consult with local community, and/or the District's Office of Communications for any Public Outreach and Notification effort required during construction. See instruction.

EXAMPLE:

A. The Engineer is responsible for all written and oral communication with the public and neighbors. The Contractor shall provide the Engineer with the schedules of major construction operations three weeks in advance of their occurrence to allow the District time to notify the neighbors. The Contractor shall include in the submittals the major milestones, descriptions of the work activities, and the start and end date(s) of each activity.

B. The schedule submittals shall include, but not be limited to, the following activities: *(List activities and milestones such as installing traffic control measures, material deliveries and haul-off, concrete pouring, pile driving, asphalt paving, etc.)*

C. The Engineer will provide the above schedules two weeks in advance as well as 24-hour notices to all property owners and tenants adjacent to the project site and to others potentially impacted by the construction activities. If for any reason, any construction activity is anticipated to be delayed for more than one week beyond the aforementioned schedule, the Contractor shall notify the Engineer immediately, submit the revised schedule, and explain the delay. The delay notice shall be given to the Engineer no later than one week prior to the performing the activity.

D. All payments for coordinating the work and providing submittals as specified shall be considered incidental and included in the other items of work and no additional compensation will be made thereof.

SECTION 15. WORK CONSTRAINTS AND SITE RESTRICTIONS

15.01. General Work Constraints

List general work constraints that have not been described elsewhere that could impact the contract work, such as schedule, work sequencing, coordination, site safety and security, access, District-furnished material delivery, neighborhood outreach, etc. If the constraints directly impact specific items of work, describe them as part of the work items.

For work that involves an operational facility, include requirements or restrictions necessary to minimize disruption of the facility and/or to ensure the facility remains operational during construction.

EXAMPLE 1:

A. The water treatment plant is a critical operation facility which must remain in continuous operation except as specified herein. Construction shall be scheduled and performed in a manner to maintain continuous operation of the treatment plant except during the specified shutdown period. The treatment plant is one of three plants which are the primary regular source of potable water for the treated water service area of the Santa Clara Valley Water District (District). Operation of PWTP must continue at all times, 24 hours a day, every day of the year except during the specified shutdown period.

B. Work sequence and constraints discussed below do not include all items affecting completion of the work, but are intended to describe critical events necessary to minimize disruption of the existing facilities, to ensure compliance with water quality permit requirements, and to ensure completion of the work within the Contract Time.

1. The new Potassium Permanganate and Powdered Activated Carbon facilities are completely new facilities and therefore can be partially constructed prior to plant shutdown. The two facilities shall be constructed without impacting existing facilities (except for irrigation piping and lower access roadway). The Contractor is advised that certain work associated with these facilities cannot be completed until the shutdown period.

2. Modifications to the existing alum system shall be done without impacting plant operations. The Contractor is advised that the existing tanks utilize circulation pumps while the new tanks do not. The Contractor shall coordinate the work to maintain in operation at least two alum/ferric chloride storage tanks, two circulation pumps, two metering pumps and all necessary appurtenances at all times while the plant is in operation.

3. While the plant is in operation, the Contractor may block off the lower access roadway, if necessary, for no more than 2 days per week (Tuesday, Wednesday or Thursday). The Contractor shall provide the Engineer 14-day written advance notice so that the District can schedule chemical deliveries. The Contractor shall request any additional roadway restrictions necessary to construct the Powdered Activated Carbon and the Potassium Permanganate facilities in writing to the Engineer. Approval of additional roadway restrictions will be based on the District's ability to maintain operational functions including, but not limited to, chemical deliveries.

EXAMPLE 2:

A. The Contractor shall take all precautionary measures as necessary to not cause any disruption of the operation of the treatment plant. The activities discussed below do not include all items affecting the operation of the plant, but are intended to describe certain actions that could disrupt the normal function, or cause shutdown, of the plant:

1. Contractor removing a process unit from service or impeding the operation of a process unit.

2. Contractor removing from service, restricting, or impeding the function of any utility such as water, electrical, gas, telephone, compressed air, sanitary sewer, storm drain, sludge piping, overflow piping, and instrumentation system.

3. Contractor removing from service, restricting, or impeding the function of any portion of District's SCADA (supervisory control and data acquisition) system.

4. Contractor delaying or denying access to any district plant structure or area needed by District staff to complete their work assignments.

EXAMPLE 3:

A. The Contractor may only use Matadero Avenue for six (6) consecutive months, excluding Saturdays, Sundays, and holidays, for construction access. The Contractor may only use the temporary construction area (TCA) at the upper sediment basin for four (4) consecutive months for the construction of the floodwall. The Contractor may only use the access through Veterans Affairs Medical Center (VA) for eighteen (18) consecutive months.

B. Installation of the temporary bike path as shown on the Drawings shall be the first order of work. The Contractor shall not interrupt the use of the existing bike path until the temporary one has been constructed.

EXAMPLE 4:

Article 15.01.01. Shutdown Constraints

A. Except for certain shutdowns or outages allowed in these Specifications, no shutdown of any kind will be allowed. This includes, but not limited to, plant shutdown, power outages (partial or total), chemical feed system or process shutdown, pipeline shutdown, or any other utilities (water, electric, gas, etc.) or process supporting system shutdowns.

B. The plant shutdowns, system shutdowns or partial power outages as allowed in these Specifications shall take place only during the winter months except when noted otherwise.

C. The winter period is defined as the period between November 15 and through March 15 each year.

D. 48-Inch Treated Water Magnetic Flowmeter

1. The District will allow the Contractor one continuous shutdown, not to exceed 72 hours total (3 days total), of the west pipeline for the installation of the 48-inch flowmeter and other associated work that necessitates the west pipeline shutdown. Contractor‘s attention is directed to Article 18.07—Liquidated Damages.

2. This shutdown shall take place during the winter months.

3. The Contractor shall sequence the work and complete all the required work such that there shall be no treated water service interruption on the west pipeline before and after the 72-hour

shutdown.

4. The Contractor shall provide the Engineer with at least 2 weeks written notice of the shutdown. The scheduling of the work shall be approved by the District.

E. Backwash Pump ASD

1. The District will allow the Contractor a one-time partial power outage as specified herein, not to exceed 120 hours total (5 days total), for continuous power outage to the backwash pump for installation of the backwash pump ASD and other associated work that necessitates this power shutdown. Power to the remaining of the plant shall not be disrupted. Contractor‘s attention is directed to Article 18.07—Liquidated Damages.

2. This shutdown shall take place during the winter months

3. The Contractor shall sequence the work and complete all the required work such that there shall be no shutdown of the backwash pump or any other pumps before and after the 120-hour shutdown.

4. The Contractor shall provide the Engineer with at least 2 weeks written notice of the shutdown. The scheduling of the work shall be approved by the District.

F. Caustic Soda Feed System

1. The District will allow the Contractor one continuous shutdown as specified herein, not to exceed 24 hours, of the caustic soda feed system for the installation of the caustic soda supply hose and other associated work that necessitates a caustic soda system shutdown. Contractor‘s attention is directed to Article 18.07—Liquidated Damages.

2. This shutdown needs not to take place during the winter months.

3. The Contractor shall sequence the work and complete all the required work such that there shall be no service interruption to the caustic soda feed line before and after the 24-hour shutdown.

4. The Contractor shall provide the Engineer with at least 2 weeks written notice of the shutdown. The scheduling of the work shall be approved by the District.

EXAMPLE 5:

Article 15.01.02. Work completed by District Staff

A. Draining of Existing Chemical Pipelines. District staff will isolate and drain existing chemical pipelines for modification or replacement by the Contractor. Some residual chemical will remain for the Contractor to dispose of in a safe and legal manner. Flushing, disposal of residuals, cleaning, protection of plant facilities and on-site personnel, and all other work is the responsibility of the Contractor.

B. Draining of Water Pipelines. The maximum rate such process pipelines can be drained will depend upon the existing valves, drain piping, appurtenances, and receiving bodies. Up to 10 percent of the water contained in the process pipeline will remain to be removed by the Contractor as required for completion of the Work. Contractor shall discuss the desired schedule for draining with the Engineer a minimum of 10 working days in advance of such operations so that the Contractor‘s work can be coordinated with District capabilities. The Contractor shall assume that all existing valves, sluice gates, and stop logs have significant leakage (e.g., requires barriers, pumping and water control).

C. Additional District staff will monitor the Contractor‘s activities during execution of the following special work. The Contractor shall provide a minimum of 3 working days notification to the Engineer in order to arrange monitoring of the specific work under the classifications described below:

1. Any hot-tapping, or any tie-in to existing equipment or facilities in operation.

2. Shutdown of any pipelines.

3. Disinfection of pipelines.

15.02. Utilities

A. The Contractor‘s attention is directed to Article 6.14—Preservation of Property and Article 7.10—Coordination with Utilities.

B. Various existing utilities, both above and below ground, will be encountered during construction. The Contractor shall perform all work in such a manner as to avoid damage to existing utilities. The Contractor will be held responsible for any damage due to his/her failure to exercise due care.

C. The Contractor shall notify Underground Service Alert (U.S.A.) a minimum of 5 working days prior to start of excavation or demolition.

D. The Contractor shall verify the exact location of all indicated or field marked utilities and make a sufficient number of exploratory excavations of all utilities that may interfere with the work sufficiently in advance of the construction. Contractor shall perform exploratory excavations in the presence of the owner of the utility to be explored. Contractor shall promptly notify the Engineer when such exploratory excavations show the utility location as shown on the Drawings to be in error.

E. The Contractor shall not interrupt the service function or disturb the support of any utility without authority from the utility owner or order from the Engineer. All valves, switches, vaults, and meters shall be maintained and be readily accessible for emergency shutoff.

15.02.01. Utility Coordination

A. The District and the owners of utilities or their authorized agents reserve the right to enter upon the right of way at all times for the purpose of operations and maintenance of their facilities or for making necessary connections or repairs to their properties. The Contractor shall cooperate with the District and the affected utilities engaged in such work to avoid any unnecessary delay or hindrance to such work.

B. The telephone numbers of owners of known utilities that may be encountered are:

List utilities and telephone numbers.

EXAMPLE:

City of San Jose	(xxx) xxx-xxxx
Pacific Bell	(xxx) xxx-xxxx
PG&E Gas	(xxx) xxx-xxxx
PG&E Electric	(xxx) xxx-xxxx
San Jose Water	(xxx) xxx-xxxx

C. Contractor shall be responsible for the coordination of work near utilities and the protection of the utility during construction. Where it is known or anticipated that an existing utility will be encountered during construction, the Contractor shall be responsible for notifying and/or supplying appropriate Drawings to the affected utility‘s owner at least 5 working days in advance of work in which the utility will be involved.

15.02.02. Protection of Existing Utilities

A. The Contractor is responsible for doing all work and furnishing all materials required for protecting in place or restoring all existing above and below ground utilities disturbed or damaged during construction to a condition equal to or better than that existing prior to construction. Payment for complying with this provision shall be considered as included in the price paid for other items of work and no additional compensation will be made.

B. The Contractor shall protect all utilities which may be impacted by the work. All exposed utilities shall be supported firmly and uniformly, conforming to the utility requirements. No utilities shall be left exposed for a period exceeding 8 hours unless approved by the utility and the Engineer. Unless otherwise shown on the Drawings, all utilities shall be backfilled with at least 12 inches of select backfill around the utility.

C. All utility pole and guy anchors shall be protected and, where the walls of the trench are within 5 feet of a pole or anchor, lateral support to the pole shall be provided at the Contractor‘s expense.

D. The Contractor shall immediately notify the utility owner and the Engineer if any existing utilities which have sustained damage prior to excavation, or if the Contractor disturbs or damages the existing utility during the excavation. The Contractor shall bear the cost of repair or replacement of any utility damaged as a result of construction operation.

EXAMPLE:

E. In no case shall any service (gas, water, electricity, telephone, etc.) be interrupted. If it is impractical to support the utility across trench excavations, the Contractor may remove the services, provided a temporary bypass has been installed and is operational prior to the removal.

Include other special requirements. If telemetry cables are part of the work or believed to be present at the job site, include the following language:

EXAMPLE:

F. Telemetry cables are critical to the operations of District water supply facilities; therefore, advance notice from the Contractor in writing is required for any scheduled telemetry cable service interruptions.

1. The Contractor shall notify the Engineer two weeks in advance of any activities that will result in cutting or splicing of a telemetry cable. The Contractor shall confirm this cutting or splicing to the Engineer by phone the day before it occurs, and the day when it occurs.

2. The Contractor shall exercise care to prevent accidental cutting of telemetry cables. Locating cables shall be performed by hand digging or other non-destructive means.

3. In the event of accidental telemetry cable service interruption resulting from Contractor activities, the Engineer may use District forces to make the repairs or direct the Contractor to make the repairs at no additional cost. If directed by the Engineer to do the repairs, the Contractor shall complete the repairs within 4 hours. If the District forces make the repairs, the Engineer will double the cost of any direct or indirect damages resulting from the loss of telemetry cable service and the cost of the repairs, and deduct these costs from the monies that are due or that may become due the Contractor. If the Contractor makes the repairs, the cost damages resulting from the loss of telemetry cable service shall be deducted from the monies that are due or that may become due the Contractor.

15.02.03. Utility Installation/Relocation by Others

This section identifies the work to be performed by Contractor to coordinate with the utilities to be relocated or installed by others.

EXAMPLE:

A. The utility owner will relocate service connections as necessary within the limits of the work or within temporary construction easements. The Contractor shall coordinate his activities, and shall fully cooperate with the utility owner so as to not hinder or interrupt the assigned task of said personnel.

15.03. Protection of Existing Improvements

A. The Contractor's attention is directed to Article 6.14—Preservation of Property.

Identify special conditions of existing improvements to remain and be protected during construction.

Specify the requirements for restoration of existing improvements if any.

15.03.01. Survey Monuments

A. No survey monuments, permanent markers for the District right of way, or District survey control points shall be removed or disturbed until the Engineer has recorded the locations thereof, and a permit for such removal has been received from the agency having jurisdiction. When the construction work has been completed, the Contractor shall replace said monuments accurately in the locations as referenced by the Engineer at no cost to the District.

Indicate any special conditions regarding survey monuments.

EXAMPLE:

B. Installation of the survey monuments shall be in accordance with initial monument installation as shown on the City of San Jose's Standard Plan Details for Public Works Construction, pages R-16, R-17, and R-18, and the City of San Jose's Standard Specifications for Public Works Construction, Section 81. (*This example is from a project located in the City of San Jose.*)

C. Contractor shall provide new monuments at locations noted on the Drawings. Contractor shall perform and submit a record of survey for the new monuments provided for all roadway alignments. The record of survey shall be examined by the County Surveyor and recorded by the County Clerk-Recorder's Office.

D. If any marker or monument is destroyed by the Contractor and the marker or monument has not been referenced by the Engineer, the Contractor shall be responsible for the accurate replacement of said marker or monument at no expense to the District by a Land Surveyor licensed by the State of California in accordance with the California Business and Professions Code Section 8771.

15.04. Pre-Construction Surveys

15.04.01. Pre-Construction Survey Within the Project Limits

A. After the Contract has been awarded, and before commencement of work, the Contractor shall conduct a thorough examination of the work areas within the project limits in the presence of the Engineer.

B. The Contractor shall inspect the condition of all areas which may have potential impacts, including but not limited to, existing improvements, levees, ramps, buildings, landscape planting, architectural finishes, the size of structural cracking or settlement, the rate of leakage, and any other conditions deemed appropriate. The presence of the Engineer shall in no way relieve the Contractor of the responsibility for completely and accurately documenting all existing conditions.

C. Records of all observations shall be prepared by the Contractor, and every copy of all documents shall be signed by the authorized representative of the Contractor, and provided to the Engineer. Photographs and video tapes with dates, as deemed appropriate by the Engineer, shall be made by the Contractor and be included in the record of observations. One signed copy of every document, photographs, and video tape will be kept on file in the office of the Engineer.

D. The above records, photographs, and video tapes are intended for use as evidence in ascertaining the extent of any damage which may occur as a result of the Contractor‘s operations during the prosecution of the Contract work.

E. Structural surveys, if required, shall be conducted by a licensed civil or structural engineer.

15.04.02. Surveys of Properties in the Vicinity of the Work

This section includes the survey requirements for properties adjacent to the project site that may be impacted by construction. If structural or crack surveys are required, provide the appropriate language.

EXAMPLE:

A. The Contractor is advised that there are residential or commercial properties in the immediate vicinity of the work. The Contractor is responsible to protect those properties from damage. Any damage to the adjacent properties shall be addressed in accordance with Article 6.14—Preservation of Property.

B. The Contractor shall perform structural surveys on all properties as shown on the Drawings to be surveyed. Structural surveys shall consist of all structural survey work necessary to establish and document the existing structural condition of the properties adjacent to the construction project, before and after construction.

C. The District has obtained Right of Entries to perform the structural surveys and will provide these to the Contractor.

D. The Contractor shall employ a licensed civil or structural engineer registered in the State of California to conduct the structural surveys and to prepare reports documenting the survey results. The Contractor shall submit to the Engineer a copy of the pre-construction survey reports prior to the field work, and a copy of the post-construction survey reports within one month of the substantial completion of the Contract work.

E. Scope of Work:

1. Pre-Construction Survey

   Prior to start of construction, the Contractor shall survey and document the existing condition of the structures and grounds of each of the residential or commercial properties as shown on the Drawings. The Contractor shall submit inspection reports to the Engineer with photographs, including videotaping with verbal description, of the existing condition for each property being inspected. All photographs submitted in the inspection reports shall be mounted on 8 ½″ X 11″ sheets. The Contractor shall notify each property owner by phone or mail at least 48 hours in advance of his/her visit to perform these surveys. All submittals shall be in accordance with Article 9.02 of the Standard Provisions.

2. Post-Construction Survey

   Post-construction work shall consist of the survey work necessary to document the condition of the existing structures and grounds of each of the residential or commercial properties included in the pre-construction survey, after the construction

has been completed. The Contractor shall submit inspection reports to the Engineer with photographs, including video taping with verbal description, of the existing condition for each property being inspected. All photographs submitted in the inspection reports shall be mounted on 8 ½″ X 11″ sheets. The Contractor shall notify each property owner by phone or mail at least 48 hours in advance of his visit to perform these surveys. All submittals shall be in accordance with Article 9.02 of the Standard Provisions.

15.05. Rights of Way

List any special conditions with regard to rights of way.

EXAMPLE:

A. Work will be located in public streets and rights of way in the City of San Jose, the County of Santa Clara, and in District-furnished rights of way. In the performance of the work within the City of San Jose and the County of Santa Clara, the Contractor shall comply with the ordinances, regulations, and all other requirements of the authorities governing work in public streets and rights of way.

B. The District has obtained paving, excavation, and related permits as required by the ordinance and regulations of the City of San Jose, County of Santa Clara. Contractor must comply with the following conditions as stated in the permits: *List conditions*.

15.05.01. District-Furnished Right of Way

A. The District has provided all rights of way as shown on the Drawings. The Contractor has full use of this right of way except for the limitations specified in these Specifications and as noted on the Drawings.

List any special conditions with regard to District-furnished right of way.

EXAMPLE:

B. The Contractor shall restrict his/her construction operations on District and County of Santa Clara (County) property to a maximum width of 50 feet on each side of the pipe centerline. This area is designated on the plans as ~~li~~mits of construction." In areas where earthwork or construction of miscellaneous facilities exceeds the designated ~~li~~mits of construction" the Contractor may exceed these limits in order to perform

the required work. It is the Contractor‘s responsibility to obtain County‘s approval on undefined construction limits prior to actual field work taking place. The Contractor shall submit the written request to the County asking for review and approval: upon receiving the favorable approval from the County, Contractor shall submit the approved document to the Engineer for record.

15.05.02. Contractor-Furnished Right of Way

A. Any additional rights of way desired by the Contractor for his/her convenience shall be acquired by the Contractor at no expense or obligation to the District. The Contractor shall provide the Engineer with copies of any agreements between the Contractor and property owners regarding disposal of excess materials generated by the Contractor‘s activities, storage of materials, or any use of property in conjunction with this Project. The agreement shall state that the agreement is solely between the Contractor and the property owner and that the District is not a party to the agreement and not responsible for compliance with any conditions stated in the agreement.

15.05.03. Temporary Construction Easement (TCE’s)

List all temporary construction easement agreements.

EXAMPLE:

A. The District has obtained temporary construction easement agreements with its respective property owners, listed in the following table, along the limits of work for use during construction of this Project. The Contractor shall be fully aware of the conditions stipulated in the agreements that may govern his/her operation in these temporary construction easements and shall conduct construction operation accordingly.

Owner	APN	Location/Description
John Doe 1	XXX-XX-XXX	111 A Street, Left Bank
John Doe 2	XXX-XX-XXX	234 D Street, Right Bank
John Doe 3 Trustee	XXX-XX-XXX	1000 G Road
City of Palo Alto	XXX-XX-XXX	City of Palo Alto, Left Bank

B. Copies of the TCE agreements are included in Appendix __.

C. The Contractor shall comply with other conditions stipulated in the City of Palo Alto's Encroachment Permit for work within City's right-of-way along Matadero Creek as listed below: *List conditions*.

D. Access to the temporary construction easement areas will only be permitted from the existing District rights of way or public streets. Entry to or egress from the temporary construction easement areas outside the existing District rights of way, or public streets will not be allowed.

E. The Contractor shall notify the Engineer with an advance written notice at least 5 working days before any entry on the property.

F. The temporary construction easement shall not extend beyond the date specified in the TCE agreement.

G. Should the actual use of the temporary construction easement extend beyond the prescribed period of time, the Contractor shall notify the Engineer in writing 20 working days prior to the expiration of the temporary construction easement. The Contractor shall bear all costs incurred by the District for extension of temporary construction easement.

H. When use of the temporary construction easement is no longer required, the Contractor shall clean all debris and leave the property in a neat, clean, and presentable condition, and notify the owner that the work is complete.

I. Full compensation for conforming to the requirements of this Article and to the conditions stipulated in the temporary construction easement

agreement between the District and the property owners shall be considered as included in the various contract in terms of work and no additional compensation will be allowed therefore.

15.06. Access to Properties Owned by Others

A. The Contractor shall conduct the construction operations in a manner that will cause as little inconvenience as possible to adjacent property owners.

B. Convenient access to driveways, houses, buildings, and businesses along the work shall be maintained in operational condition and temporary approaches to crossings or intersecting streets shall be provided and kept in good condition.

C. When construction operation is directly within the driveway area, provide temporary access. The existing access shall not be closed until the temporary replacement access is usable. Once construction is completed, restore access to a condition equal to or better than the existing condition prior to the Contractor‘s operation.

D. Per California Vehicle Code Section 22500, stopping, parking, or leaving standing any vehicle in front of public or private driveway is not allowed.

15.07. Access to Job Site

A. The project location is shown on a map included in the Drawings. The Contractor may use the existing roads to access and perform the work subject to the restrictions specified herein.

B. It shall be the Contractor‘s responsibility to obtain any and all permits that may be required from the State, City, or County to move materials and equipment to the jobsite, dispose of excess material created by the Contractor‘s operation and for traffic control to, from, and on the project sites.

15.08. Access Roads Within Job Site

A. The Contractor shall maintain access road to all staging, office trailer, and storage areas and other areas to which frequent access is required. Maintain access to all other existing facilities on the site, including access for delivery of materials and for maintenance and operation.

B. Where temporary roads cross buried utilities that might be injured by the loads likely to be imposed, such utilities shall be adequately protected so that no loads shall discharge on such buried utilities.

C. Maintain on-site access roads free of mud. Under no circumstance shall vehicles leaving the site track mud or dirt off the site onto public right-of-way.

Include other project specific requirements.

EXAMPLE:

D. Contractor has the option to use the unpaved roadway section for temporary access by installing the compacted subgrade and aggregate base rock shown on the Drawings.

E. The Contractor will be performing work at an operational facility which is critical and must remain in continuous operation at all times. The Contractor shall schedule and perform his/her work such that there is no disruption to the facility operations and access. Access to the facility and all portions of the facility shall be maintained at all times for the staff, chemical deliveries, and all other delivery vehicles.

F. Trenching for irrigation piping and electrical conduits will cross the access roads at the Plant Entry Gate and at several other locations as shown on the Drawings. The Contractor shall coordinate the trenching activities with the Engineer, and shall provide traffic steel plates as required to maintain Plant access. No access interruption to any portion of the Plant will be allowed. The Contractor shall notify the Engineer at least 10 days in advance of any planned trenching or excavation crossing any access road.

G. Contractor shall provide a minimum of one route for fire engine access to all structures (existing, new, and those under construction) at all time. Such a route shall be at least 20 feet wide and have a minimum of 13 feet–6 inches clear height. The Contractor shall post signs to indicate the vehicle travel route if it is not along the existing roadways so that travel route is evident to emergency vehicle operators. A turnaround adequate for a fire engine is required when any roadway to a structure is a -dead end" over 150 feet long.

15.09. District Use of Facilities/Premises Within the Work Area

Apply this Article if District must occupy and use certain premises within the work area. The Contractor will be required to maintain the premises in pre-existing condition, and will be held responsible for any damages caused by his operations.

A. The District reserves the right to access and use the following premises during performance of the work to conduct operations and maintenance of District's facilities.

Describe the specific facilities or premises that the District must occupy during the work. For example: roadways or a specific operations building.

B. The Contractor shall coordinate all construction operations with the District to avoid conflict and to facilitate District‘s usage of the premises.

C. The Contractor shall maintain the premises in pre-existing condition, and shall repair immediately any damages to the premises caused by Contractor‘s operations.

SECTION 16. SAFETY AND SECURITY

16.01. Safety

A. The Contractor is hereby informed that work on this Project could be hazardous. The Contractor shall instruct all personnel working in potentially hazardous work areas of the potential dangers and shall provide such safety equipment and instruction as is necessary to prevent injury to personnel and damage to property. Special care shall be exercised relative to work around high-voltage wires, high-pressure gas mains, high-pressure water pipelines, and other utilities. Temporary supports, as required by the utility company, shall be provided by the Contractor to protect utility facilities.

B. All work and materials shall be in strict accordance with all applicable City, County and State Rules, Ordinances, Regulations, and Codes. The Contractor shall comply with CAL-OSHA Labor Code Section 6300 et seq. and with Chapter 4 of Title 8 of the California Administrative Code. Nothing in these Specifications shall be construed to permit work not conforming to governing codes. When Contract Documents differ from governing codes, the Contractor shall furnish and install the higher standards called for without extra charge.

C. Prior to start of work, the Contractor shall submit an Injury and Illness Prevention Program in accordance with CAL-OSHA requirements, Title 8, CCR Section 1509 (Construction). In addition, the Injury Illness Prevention Program shall comply with Title 8, CCR Section 3203 (General Industry) and/or Section 8406 (Tunnel) as deemed necessary. A copy of the program shall be available at all times in the Contractor‘s jobsite trailer. The Contractor shall designate a safety officer who will monitor and enforce the Injury and Illness Prevention Program.

D. For projects involving hazardous waste operations, the Contractor shall develop and implement a written Safety and Health Program and a site-specific Safety and Health Plan, and designate a Site Safety and Health Supervisor who has the responsibility and authority to develop and implement the site-specific safety and health plan and verify compliance, in accordance with Title 8 CCR Section 5192.

Include a statement to direct Contractor’s attention to the Article for Safety and Health Plan if applicable.

E. At all times the Contractor shall provide sufficient measures, such as, but not limited to: barricades, railings, lights, fences, and any other warning devices, to reasonably and prudently provide for the greatest public safety and convenience.

F. The Contractor is referred to Article 5.11 regarding excavation safety plans.

G. The services of the Engineer in conducting construction review of the Contractor‘s performance are not intended to include review of the adequacy of the Contractor‘s work methods, equipment, bracing or scaffolding, or safety measures, in, on, or near the construction site.

Describe any other special requirements regarding safety.

EXAMPLE:

I. The Contractor is advised that the park area at Calero Reservoir is used for picnicking and recreation year-round. Therefore, the Contractor shall provide all safety measures required to ensure the public safety as required by Article 6.10.

J. When working on District or Santa Clara County property, the Contractor shall erect temporary fences and install warning signs around any trenches left open outside the working hours indicated in Article XX.XX to prevent access to the trench.

K. For work within public streets, the length of trench remaining unbackfilled shall not exceed 100 feet. For work outside of public streets, the length of unbackfilled trench shall not exceed twice the actual daily production rate of completely installed and backfilled pipe, unless approved in writing by the Engineer. For the first 3 days of pipe laying operation, the actual daily production rate shall be assumed to be 100 feet of completely installed and backfilled pipe. The actual daily production rate for succeeding days shall be determined by the daily average of pipe completely installed and backfilled during the 3 preceding working days as determined by the Engineer. The Contractor‘s attention is directed to Article XX.XX regarding the requirement to backfill, or steel plate all open trenches within the roadways at the end of each working day.

16.01.01. Temporary Facilities

A. Use construction hoists, elevators, scaffolds, stages, shoring, and similar temporary facilities of ample size and capacity to adequately support and move loads to which they will be subjected. Provide railings, kick-plates, enclosures, safety devices and controls required by law or regulation, or for adequate protection of life and property.

B. Staging and Falsework: Temporary support such as formwork, falsework, or shoring shall be designed and constructed in accordance with Construction Safety Orders, CCR Title 8, Sections 1541.1 and 1717. The falsework plan, shoring plan, and any required calculations shall be submitted to and accepted by the Engineer prior to commencement of any work on site.

C. Warning Devices and Barricades: Identify and guard hazardous areas and conditions by visual warning devices and, where necessary, physical barriers per CAL-OSHA requirements, the latest version of the California Manual on Uniform

Traffic Control Devices for Streets and Highways (MUTCD) and State agency permit conditions.

D. Barricades: Place barriers at ends of excavations and along excavations to warn pedestrian and vehicle traffic of excavations. Provide barriers with flashing lights after dark. Keep barriers in place until excavations are entirely backfilled and fully compacted. Barricade excavations to prevent persons from entering excavation areas in streets, roadways, parking lots, or other public or private areas associated with the Project.

E. Temporary Enclosures: When sandblasting, spray painting, spraying of insulation, fireproofing, or other activities inconveniencing or dangerous to property or the health of employees, District staff, or the public are in progress, the area of activity shall be enclosed adequately to contain the dust, over-spray, or other hazard. In the event there are no permanent enclosures of the area, or such enclosures are incomplete or inadequate, the Contractor shall provide suitable temporary enclosures. Contractor shall submit a temporary enclosure plan for protection of open bodies of water from contamination for Engineer‘s review in accordance with Technical Provisions Section XX.XX. Temporary enclosures shall not hinder or adversely affect treatment plant operations.

F. Above Grade Protection: On multi-level structures, the Contractor shall provide safety protection that, as a minimum, shall meet the requirements of Title 8, California Code of Regulations.

G. Fences: Enclose site of the work with fence adequate to protect the work as necessary against acts of theft, violence, and vandalism. When entire or part of site is to be permanently fenced, permanent fence may be built to serve for both permanent and temporary protection of the work site, provided that damaged or defaced fencing is replaced prior to final acceptance.

16.02. Safety and Health Program

This Article applies to projects that involve hazardous waste operations. The Contractor will be required to develop and implement a written Safety and Health Program and a site-specific Safety and Health Plan, and provide a Site Safety and Health Supervisor who has the responsibility and authority to develop and implement the site safety and health plan and verify compliance, in accordance with Section 5192 Title 8 of the CCR.

A. The Contractor shall comply with Title 8 CCR, Section 5192, and shall develop and implement a written safety and health program and a site-specific safety and health plan for employees involved in hazardous waste operations. The program shall be designed to identify, evaluate, and control safety and health hazards, and provide for emergency response for hazardous waste operations. The written safety and health program shall incorporate the following:

- An organization structure;

- A comprehensive workplan;
- A site-specific safety and health plan;
- The safety and health training program;
- The medical surveillance program;
- The Contractor's standard operating procedures for safety and health; and
- Any necessary interface between general program and site-specific activities.

16.02.01. Site-Specific Safety and Health Plan

A. The Contractor shall develop, implement and verify compliance of a site-specific Safety and Health Plan for work on this Project.

B. The Safety and Health Plan shall conform to the requirements of all local, state, and federal ordinances, rules, regulations, and guidelines concerning occupational health and safety issues. It shall also include protocol to be utilized in the event unexpected materials or substances are encountered.

C. The Safety and Health Plan shall consist of procedures for the protection of the Contractor's personnel, including subcontractors, District personnel, consultants, inspectors, and supplier personnel working with hazardous materials, and the general public from site-specific hazards.

D. The Safety and Health Plan shall be prepared and signed by a Certified Industrial Hygienist (CIH). The Safety and Health Plan shall identify the supervisor who is responsible for the implementation of Plan

E. Should the types of activities and associated hazards change during the course of work, the Contractor's CIH shall amend the appropriate sections of the Safety and Health Plan to reflect the changed site conditions. The revisions shall address the specific potential hazards to workers and any others who will be involved in the construction that could result from exposure to the new hazard(s).

F. The Contractor shall keep a copy of the Safety and Health Plan at the job site at all times, and shall provide a copy to all personnel working on site. All Contractor personnel performing work on site shall be required to read the Safety and Health Plan and shall be required to sign an acknowledgment that he/she has obtained and read a copy of the Safety and Health Plan. No worker shall be allowed to perform work on the site until a copy of his /her signed acknowledgment has been submitted to the Engineer by the Contractor. At a minimum, the Safety and Health Plan shall consist of the following items:

Project Organization: To include Project Manager, Project Site Safety Officer, Superintendent, Forepersons, Subcontractors, any team leaders, and other workers, and shall address their roles and responsibilities.

Workplan: Address anticipated project activities and objectives of the site operations; identify performance tasks for the Project, methods, and activities for accomplishing these tasks, task hazard analysis for each task activity listed in the Safety and Health Plan, personnel requirements, personnel training requirements, and medical monitoring requirements for site personnel.

Site Safety Meetings: Include the frequency of the meetings, who will conduct the meetings, time of day meetings will be held, general topics that will be covered at the meetings, and documentation protocol.

Employee Training Assignments: Discuss the training elements and the employees who received the training.

Review of the Site History for Overall Hazard Characteristics: Discuss physical and health hazards, site characterization, and known and potential exposures to hazardous materials.

Site Control Program: At a minimum, specify the site work zones, site personnel training requirements for each class/type of worker, site protective clothing requirements, safe working practices, and site communication.

Personnel Medical Monitoring Requirements: Discuss requirements for each class/type of worker to be on site and special condition hazards.

Personnel Protective Equipment Program: At a minimum, specify selection, personnel training requirements, equipment storage requirements, equipment maintenance and repair requirements, equipment decontamination requirements, and equipment limitations.

Engineering Controls: Specify additional Engineering controls to be used for workplace safety, if any.

Monitoring: As applicable, at a minimum, specify monitoring methodology, frequency of monitoring, personnel training requirements to monitor, equipment to be used, equipment calibration methodology, and documentation protocol.

Material Handling: As applicable, specify machinery and equipment to be used, tools to be used, containers to be used, and personnel training requirements for operators.

Decontamination: As applicable, specify procedures for decontamination area construction, personnel decontamination, equipment decontamination, reinstate control, protective clothing debris control, and decontamination station personnel requirements.

Emergency Response Program: At a minimum, specify directions to the nearest medical facility, decontamination procedures for injured workers, and emergency equipment available on site.

Spill Contamination Contingency Program: Shall include provisions for gases, liquids, and solids.

Sanitation Facilities: Identify availability for workers and provisions for different sexes.

Illumination: If used during the Project, specify the condition requirements for use, type of illumination to be provided, and illumination locations on site.

Confined Space Entry: Discuss personnel protective equipment, ventilation method and equipment, illumination method and equipment, atmosphere testing and equipment, safety protocol, and documentation protocol.

Site Excavation: Discuss types of equipment to be used, personnel training requirements, safety practices to be utilized, open excavation construction, and personnel entry safety.

Safety Inspections: Identify scope of inspections, frequency and time of inspections, personnel qualification of inspector, and communications protocol.

G. The Contractor shall comply with the Safety and Health Plan. Noncompliance with the Safety and Health Plan shall be grounds for temporary suspension of all work. Suspension of work for noncompliance shall not be grounds for additional time or compensation.

H. The Safety and Health Plan may be revised and/or amended by the Contractor and the Contractor‘s CIH as necessary during work progress and as specified in these Specifications. Revisions and/or amendments to the Safety and Health Plan shall be considered incidental to this item of work and no additional payment shall be made therefore.

16.02.02. Safety and Health Plan Implementation

A. Providing for worker safety and personal protection shall be the Contractor‘s responsibility and shall be in accordance with the Contractor‘s Safety and Health Plan. The Contractor shall be responsible for providing any and all training, monitoring, personal protective equipment, protective clothing, devices, equipment, and/or facilities necessary for ensuring worker safety as may be recommended and/or specified in the Contractor‘s Safety and Health Plan.

B. The Contractor shall be responsible for ensuring that its personnel understand and comply with all site health and safety requirements specified in the Safety and Health Plan.

16.02.03. Submittals

A. The Safety and Health Plan shall be submitted and accepted by the Engineer prior to commencement of any work on site.

B. The District may review or comment on the Safety and Health Plan. The District's review, or comment on, the Plan does not, in any way, relieve the Contractor of (i) any responsibility or liability for the Plan, and (ii) being solely, fully, and completely responsible for the safety of all persons and property at the job site.

16.03. Security Requirements at Job Site

A. Contractor shall make adequate provision for the protection of the work area against fire, weather, theft, vandalism, and for the protection of the public against exposure to injury. All costs arising from theft, fire, or vandalism of the construction materials and equipment shall be borne by the Contractor.

B. During night hours, weekends, holidays, and other times when no work is performed at site, Contractor shall provide temporary closures or enlist services of security guards to protect temporary openings.

C. The Contractor shall not allow his/her staff to stay at the project site outside of normal hours or authorized work hours.

The following articles apply primarily to critical water utility facilities such as water treatment plants and pump stations. They may not be needed to flood protection projects. Specifications writer should adapt the proposed language for District building projects (e.g., Headquarters, New Water Quality Lab, etc.), as necessary.

16.03.01. General

A. The Contractor shall comply with the security requirements specified herein during the entire construction duration. These requirements are not to be construed to relieve the Contractor of his/her responsibility for the work as specified in Article 6.15 of these Specifications.

B. Contractor's personnel includes the Contractor's own staff including, but not limited to, all tiers of subcontractor's staff, manufacturer's representatives, technicians, delivery drivers, etc.

16.03.02. Identification and Badging

A. All of the Contractor's personnel that enter the project site are required to possess and carry a valid photographic identification. Current driver's license or identification card issued by the California Department of Motor Vehicles or by other States, or current passport, is considered valid photographic identification. This identification shall be presented to District staff and security guards upon

request. Contractor‘s personnel without such identification will be denied access or be asked to leave the site.

B. The District will provide project-specific identification badges for use by Contractor‘s personnel. The District will issue a photographic identification badge to each person who works at the site more than 5 continuous days and generic (non-photographic) temporary badges for Contractor‘s personnel who work on an occasional basis (less than 5 continuous days.)

C. The Contractor shall submit to the Engineer for approval a list of all Contractor‘s personnel intended to work at the site more than 5 continuous days. The list shall include the name, employer, and work phone number of each person. Upon approval by the Engineer, the Contractor shall complete a District-furnished identification badge application form for each eligible employee and make arrangement with the Engineer to have Contractor‘s employee photographs taken at the District for the purpose of obtaining District-furnished photographic identification badges. Approved application forms and valid photographic identifications will be required before issuance of District photographic identification badges.

D. Planned occasional site access—The Contractor shall plan all occasional site accesses (less than 5 continuous days) in advance. The Contractor shall notify the Engineer of the name and employer of the Contractor‘s personnel requiring occasional site access at least 1 day in advance of each occasional site access. After sign-in, the District‘s security guard will issue a generic temporary badge to the occasional visitor. The occasional visitor shall return his/her badge to the security guard upon leaving the site.

E. Emergency or unplanned site access—For emergency or unplanned access, as determined by Contractor and approved by the Engineer, and upon notification by the District‘s security guard, the Contractor‘s designee shall verify the identity of the Contractor‘s personnel requiring emergency or unplanned site access to District‘s security guard. After sign-in, the District‘s security guard will issue a generic temporary badge to the emergency or unplanned visitor. The emergency or unplanned visitor shall return his/her badge to the security guard upon leaving the site.

F. Contractor shall ensure that all Contractor‘s personnel display their District-issued photographic identification badge or generic temporary badge in plain view at all times while on site. Any Contractor‘s personnel who do not display their photographic identification badge or generic temporary badge while on site will be required to leave the site.

G. Lost or missing photographic identification badges shall be reported immediately to the Engineer. A generic temporary badge will be issued by the District‘s security guard. District will deduct $100 for each lost or missing photographic identification badge from the Contract amount.

H. Lost or missing generic temporary badges shall be reported immediately to the Engineer. A generic temporary badge will be issued by the District's security guard. District will deduct $100 for each lost generic temporary badge from the Contract amount.

I. Contractor shall maintain a list of Contractor's personnel in possession of a photographic identification badge. The Contractor shall record at a minimum the following information: employee name, employer, work phone number, badge issuance date, date when employee ceases working at the site, and date when badge was missing or lost or returned to the District. Contractor shall submit updated badge lists to the Engineer on or before the fifth day of each month. District will deduct $200 for each badge list not submitted on time from the Contract amount. Approved lists will be the basis for determination of the deductions for photographic badges not returned within the allowed time limit.

J. Contractor shall collect and return to the District photographic identification badges from all Contractor's personnel within 30 days from the date of their employment termination or when their assignment on the site is complete. If the Contractor fails to return the badges within 30 days of the employee's termination or assignment completion, the District will deduct $100 from the Contract amount for each photographic badge not returned on time.

K. At the completion of Project, Contractor shall return all District-issued photographic identification badges to the District. District will deduct $100 from the Contract amount for each photographic badge unreturned or returned after the Project Completion.

16.03.03. Background Checks

A. The District reserves the right to request and receive such information as allowed by law and as required to complete a background check on any Contractor's personnel that must enter the site.

B. The District reserves the right to deny access to the site to any person as allowed by law.

16.03.04. Site Access Control

A. The District will maintain a security checkpoint at the gate (*indicate gate location*) of the (*indicate name of facility*) (*indicate additional locations as needed*). The security checkpoint(s) will be staffed by a District security guard during normal working hours and at other hours on an as needed basis. Roving guard(s) may also patrol the property.

EXAMPLE:

A. The District will maintain a reception area at the (*indicate location*) of the (*indicate name of facility*). The reception area will be staffed by a receptionist during normal working hours and at other hours on an as needed basis.

B. Unless otherwise specifically required in these Specifications, the entire site perimeter including all fences and gates are to remain intact and functional throughout the construction period. Fences and gates that are accidentally breached by the Contractor shall be restored by the Contractor, at no additional costs to the District, at the latest by the end of the work day. Perimeter breaches shall be secured by the Contractor until the breaches have been closed to the satisfaction of the Engineer. For work requiring perimeter breaches, the Contractor shall work with the Engineer to arrange appropriate measures to secure the perimeter, at the Contractor's cost. The Contractor shall promptly inform the District of any accidental perimeter breaches. No unauthorized entries shall be allowed in these breaches including deliveries and Contractor's personnel entry.

C. All vehicles entering the project site are subject to search by District guards.

16.03.05. Mail and Postal Deliveries to the Project Site

A. Unless an exception is granted by the Engineer, Contractor shall not have United States Postal Service, Federal Express, UPS, or similar mail and package deliveries addressed to the (*indicate facility name*) address. Under no circumstance shall mail/packages be delivered to the reception areas of any District facility.

Verify with Operations and Construction Engineering Unit if mail deliveries to the job site are allowed and adapt these Specifications as appropriate.

EXAMPLE:

A. The District prefers that United States Postal Service, Federal Express, UPS, or similar mail and package deliveries for the Contractor NOT be addressed to the (*indicate facility name*) address. Under no circumstance shall mail/packages be delivered to the reception areas of any District facility.

B. However, if the Contractor elects to receive mail and package deliveries at the (*indicate facility name here*) address, the Contractor shall provide a special mail and package receiving/holding facility at (*indicate location here, e.g. plant main entry gate*) for delivery of all Contractor's

mail and packages. The exact location of this facility shall be subject to Engineer‘s approval.

C. All mail and packages whether delivered to the Contractor‘s special plant receiving/holding facility or offsite point shall not be allowed into the main plant area until such time as they have been screened by Contractor‘s personnel in accordance with the District‘s mail and package screening guidelines. Those guidelines are as follows:

Mail Handling

- Contractor‘s staff should wear adequate protective clothing including gloves, respirator mask, etc. while handling material.
- Mail that must be opened is done so in an isolated area away from other staff and in a well ventilated location.
- Do not shake or bump; do not open, smell or taste the material.
- If suspicious material is identified, Contractor‘s staff have been trained to drop the material in a plastic lined garbage can, and then remove one glove at a time so that both gloves are removed without touching the skin and are self-contained. They then seal the plastic bag and notify the manager.
- Contactor‘s staff shall wash hands with soap and water after handling materials, suspicious or not.
- Do not destroy or discard as evidence may be destroyed also.

  (The guidelines above are for handling mails/packages that are suspected to contain chemicals. Consult with appropriate District security experts for any additional guidelines for handling other suspected materials, as appropriate.)

Treat as Suspicious Any Material that:

- Either comes from an unknown source or contains no return address or one that cannot be verified as legitimate.
- Is marked ―Hand Deliver” or other restrictive addressing.
- Comes in an unusual size or packaging.
- Contains excessive or foreign postage.
- Has stains, odors, wires.

16.03.06. Productivity Lost for Non-Compliance with Security Measures

A. Costs and delays incurred by the Contractor due to security measures (e.g., deliveries or personnel held at the gate without badges or identification, refusal of package deliveries, etc.) shall not be cause for additional Contract time or additional compensation for the Contractor.

B. Failure to comply with these security measures may lead to delay or stop of work with no additional Contract time or additional compensation granted to the Contractor.

16.04. Payment

A. Full compensation, for doing all work and furnishing all materials required to comply with site safety and security requirements, as specified in these Specifications, shall be considered incidental and included in the other items of work and no additional compensation will be made therefor.

SECTION 17. PERMITS AND REGULATIONS

17.01. Permits and Agreements

17.01.01. District Obtained Permits

The District is normally responsible for obtaining permits as a condition of the Project from federal, state and local agencies. See instructions.

EXAMPLE:

A. The District has obtained permits for work on this Project from the following agencies having jurisdiction:

- NPDES General Permit
- San Francisco Water Department Encroachment Permit
- 404 Permit from the U.S. Army Corps of Engineers;
- 401 Water Quality Certification/Waste Discharge Requirements from the Regional Water Quality Control Board;
- 1602 Streambed Alteration Agreement from the California Department of Fish and Game.
- Etc.

B. Copies of the permits are attached to these Specifications as Appendix ___ and made a part hereto.

C. The Contractor shall refer to the following Articles for requirements in compliance with the above permits: (*List the Articles and the associated permits.*)

1. Article 15.05.03—Temporary Construction Easements
2. Article 17.02—CEQA requirements
2. Article 17.03—CEQA requirement.
3. See Article 17.10—NPDES General Permit etc.

D. The Contractor shall comply with other conditions of the above permits as listed below: (*List conditions that have not been covered in other Articles or Sections*)

17.01.02. Contractor Obtained Permits

List permits required to be obtained by Contractor here. See instructions. If necessary, indicate who is to pay permit fees. Normally, the District should pay, or reimburse the Contractor if he pays.

17.01.03. Operation Regulations

Describe other regulations that the project facilities will be operated under and the requirements that may affect the Contract work or Contractor's operations. For example: California Division of Safety of Dams (DSOD) for dams; California Department of Health and Services (DHS) for treated water systems; City of San Jose Fire Department and State Fire Marshall for chemical systems.

17.02. Hours of Work

A. Unless noted otherwise, no work, including material hauling to/from the site and equipment movement, shall be performed during the days and hours restricted by and set forth in this Article.

EXAMPLE:

B. No work shall take place between 5:00 pm and 8:00 am on weekdays. The Contractor's attention is directed to the Article for Traffic and Parking Requirements for additional restrictions.

C. Unless noted otherwise on the Drawings or these Specifications, or approved in writing by the Engineer, no work shall be performed on Saturdays, Sundays, or on any of the holidays listed below.

D. New Year's Day, Martin Luther King's Birthday, Presidents' Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, Friday After Thanksgiving, Christmas Day, and _____. If any of the above holidays should fall on a Sunday, the following Monday shall also be considered a holiday; and if a holiday should fall on a Saturday, the previous Friday shall also be considered a holiday.

Describe other work hour limitations if applicable.

EXAMPLE:

E. Unless otherwise indicated, normal working hours within the City of San Jose and County of Santa Clara roadways extend from 8:15 a.m. to

4:15 p.m. Monday through Friday.

17.03. Noise Pollution and Vibration

17.03.01. Noise

List applicable noise regulations and ordinance here.

Example 1 below shows the Santa Clara County noise requirements with a variance. Examples 2 and 3 show typical noise ordinances by most local cities that are either: (a) a maximum noise level for individual equipment or a maximum noise level at the property line, or (b) the allowed hours of construction activities.

EXAMPLE 1:

A. Except for the pile driving activity specified elsewhere, in no case shall the noise levels produced by the Contractor exceed any of the following maximum levels at the Project right of way line:

Single- and Two-Family Dwelling Residential Area:

Weekdays: 7 a.m. to 7 p.m.	75 dBA
Weekdays: 7 p.m. to 7 a.m.	50 dBA
Saturdays, Sundays, and Holidays:	50 dBA

Multifamily Dwelling Residential Area:

Weekdays: 7 a.m. to 7 p.m.	80 dBA
Weekdays: 7 p.m. to 7 a.m.	55 dBA
Saturdays, Sundays, and Holidays:	55 dBA

Commercial and Industrial Areas:

Weekdays: 7 a.m. to 7 p.m.	85 dBA
Weekdays: 7 p.m. to 7 a.m.	60 dBA
Saturdays, Sundays, and Holidays:	60 dBA

For areas where construction activities are adjacent to more than one land zone, the Contractor shall comply with the more restrictive noise criteria.

Steady, audible tone of equipment or machinery that must be left on continuously shall not exceed the above standards minus 5 dBA.

EXAMPLE 2:

A. No individual piece of equipment shall produce a noise level exceeding dBA (varies among local jurisdictions, typically between 85 and 87 dBA) at a distance of feet (typically between 25 and 50 feet); or

The noise level at any point outside the project right of way shall not exceed dBA (typically between 75 and 85 dBA).

EXAMPLE 3:

A. Construction activity shall not occur between p.m. (typically between 5 and 7 p.m.) and a.m. (typically between 7 and 8 a.m.) unless it meets the nighttime noise standards (typically between 50 to 55 dBA) or prior written approval is granted by appropriate local agencies and the Engineer.

EXAMPLE 4:

B. Material stockpiles and mobile equipment staging, parking, and maintenance and equipment staging areas shall be located as shown on the Drawings. *(The project team should locate the Contractor staging area as far as practicable from homes and other noise-sensitive receptors.)*

C. The Contractor shall post readily visible informational signs at the entrance to the construction site indicating that the site is a ―NOISE CONTROLLED ZONE" and that persons and machinery may be barred from the site for violations of the noise control plan and regulations.

D. The Contractor shall develop a written project noise control plan containing the specific methods of meeting the noise level requirements specified herein. The noise control plan shall be submitted to the Engineer prior to the start of work for review and approval in accordance with these Specifications, and shall be implemented by the Contractor prior to commencement of any construction activity.

E. NOISE CONTROL PLAN: The Noise Control Plan shall describe the procedure for predicting construction noise level prior to performing construction activities and the noise reduction measures to meet the noise level limitations. The Plan shall be prepared by an Acoustical Engineer, and shall include the following components:

1. A description of the anticipated construction activities

2. An inventory of construction equipment and associated noise levels, including:

   - Equipment manufacturer and model
   - Horsepower rating of the equipment
   - Equipment noise emission limit
   - Estimated noise level at 25 feet
   - Estimate date of first use on site
   - Estimated date of last use on site
   - Expected use: daytime or evening

3. Noise level calculations: Perform calculations to predict construction noise at property lines during daytime and evening periods. If greater than the limits specified, noise reduction measures will need to be included.

4. A sketch of the construction site indicating the following:

   - Contract name, Contractor's name, date, scale, legend and symbols, North arrow

   - Construction equipment locations

   - All noise receptor locations near the construction site

   - Locations and types of noise reduction measures that may be required to demonstrate compliance with the noise limits specified in the Specs.

5. A description of noise reduction measures, including the materials, equipment, and methods.

6. Calculations for noise barrier performance design predictions, and recalculations of noise levels at property lines.

7. Any drawings, sketches, materials data, and suitable calculations.

NOISE MONITORING: See instructions. Determine if the required noise monitoring should be District's or Contractor's responsibility and provide the appropriate contract language. If the noise monitoring work is extensive, set it as a separate bid item and include in the Technical Provisions.

EXAMPLE 1 (District's responsibility):

F. NOISE MONITORING: The Engineer will occasionally take sound readings with a hand-held noise level meter during construction activities and operations of any noise-producing equipment to monitor Contractor's compliance with the noise criteria. Any equipment causing incompliance with the noise criteria shall be removed from the job site as directed by the Engineer.

EXAMPLE 2 (District's responsibility):

F. NOISE MONITORING: The District will conduct noise monitoring to monitor Contractor's compliance with the noise criteria. The monitoring procedures will be in accordance with the United States Federal Highway Administration's Technical publication titled "Measurement of Highway-Related Noise," Section 7 "Construction Equipment Noise Measurements for Highway-Related Projects" dated May 1996. http://www.fhwa.dot.gov/environment/noise/measure/chap7.htm

EXAMPLE 3 (Contractor's responsibility):

F. NOISE MONITORING: Monitoring shall be performed by Contractor using a Type 1 Sound Level Meter, as specified by the latest ANSI standards, measuring a dynamic range of 40-120 dB. Noise levels shall be A-weighted with a minimum sampling rate of 64 samples per second (Fast). Root Mean Square (RMS) sound pressure levels (SPLs) shall be expressed by the descriptors L (max) and Leq(h). Microphones shall be equipped with windscreens and shall be positioned as designated by the Engineer. Monitoring shall be performed for a duration of at least 60 minutes during each work operation. Additional spot readings shall be taken as directed by the Engineer to assure the noise level during work operations are within the allowable limits. Noise monitoring equipment shall be calibrated before each work shift. The noise monitor shall print data to a serial printer, providing immediate on-site results. The Contractor shall keep a copy of all documentation and submit one copy to the Engineer on a daily basis.

G. Full compensation for conforming to the requirements of this Article including monitoring, preparing, submitting, and maintaining all reports and documentation shall be considered as included in the prices paid for the various items of work and no additional compensation will be allowed therefor.

17.03.02. Vibration Monitoring

Include specific vibration monitoring requirements beyond that specified in the Standard Provisions. See instructions. If there is none, delete this Article 17.03.02. If the contractor's vibration monitoring work is extensive, set it as a separate bid item and include in the Technical Provisions.

EXAMPLE 1 – If Vibration Monitoring Is Required (if this is a major item of work and requires a separate bid item, consider moving appropriate provisions to the Technical Provisions):

See Caltrans sample specifications in Appendix C – Sample Vibration Specifications at http://www.dot.ca.gov/hq/env/noise/pub/vibrationmanFINAL.pdf. *The sample specifications include:*

- *list of properties requiring vibration monitoring;*
- *method, equipment, materials, and personnel doing monitoring;*
- *data collection (background vs. specific construction activities);*
- *response values for vibration (including Threshold Value of 0.2 inches per second and Limiting Value of 0.3 inches per second); response values are subject to adjustment by the Engineer as indicated by prevailing conditions or circumstances. (The noted values should vary based on project specifics.)*
- *data interpretation, response action; and payment.*

EXAMPLE 2 – If Vibration Monitoring Is Required (if this is a major item of work and requires a separate bid item, consider moving appropriate provisions to the Technical Provisions):

A. This work shall consist of vibration monitoring as a means of protecting the following properties from excess vibration during certain construction activities:

List properties' addresses here.

B. Contractor's compliance with this Section does not relieve the Contractor of full responsibility for damage caused by the Contractor's operations.

C. At the above listed locations, vibration monitoring and recording shall be performed within 200 feet (*value varies based on project specifics*) of the said locations during the course of all seismic retrofit activity, and for other significant impact work as determined by the Engineer. As a minimum, all structural removal, shoring installation, demolition work, Cast-in-Drilled-Hole pile construction, pile driving and pile driving related activities shall be considered as significant impact work and shall be monitored as provided herein.

D. The first vibration monitoring prior to start of seismic activity shall establish the baseline for all subsequent recordings. The baseline recordings shall consist of uninterrupted recordings for a period of not less than 24 hours at the above listed locations. The Contractor shall have the equipment in place and functioning properly prior to any seismic retrofit activity within 200 feet of the affected property. No seismic activity occurring within this zone shall occur unless monitoring equipment is functioning properly. The equipment shall be set up in a manner such that an immediate warning is given when the resultant peak particle velocity equal to or exceeding 0.5 inches per second (*value varies based on project specifics: 0.2 for architectural damage, 0.5 for structural damage*) is produced.

E. Monitoring equipment shall be stationed within 3 feet of the exterior of designated buildings on the side facing the Contractor's work site. For buildings whose frontage exceeds 200 feet, at least 2 monitors shall be utilized at that location.

F. Prior to performing any vibration monitoring, including the baseline vibration monitoring and during significant impact work, the Contractor shall submit to the Engineer a written plan detailing the procedures for vibration monitoring. Such details shall include:

- The name of the firm providing the vibration monitoring services.
- Description of the instrumentation and equipment to be used.
- Methods for mounting the instrumentation to the ground.
- Data collection analysis procedure.
- Number of vibration monitors to be utilized at each of the facilities specified herein.
- Means and methods of providing warning when particle velocity equals to or exceeds specified limits.
- Name of the responsible person designated by the Contractor.
- A contingency plan for alternative construction methods when particle velocity equals to or exceeds specified limits.

G. Once the vibration monitoring plan is approved by the Engineer, the vibration monitoring equipment shall be furnished and installed by the Contractor at the facilities designated herein when significant work occurs within 200 feet of the said facilities. The 200 feet shall be measured from the source of vibration such as the column nearest to the actual demolition work, the location of the equipment, the pile location or from the point of probable impact of any fallen structural elements, materials, equipment, bridge elements, shoring, or debris.

H. The vibration monitoring equipment shall be capable of continuous operation with instant monitoring results and shall conform to the following requirements:

- The velocity sensing transducers shall be capable of measuring velocities on the three perpendicular axis (i.e., V_x, V_y, and V_z) simultaneously.
- Frequency response of the velocity transducers and data acquisition equipment shall cover the range from less than 5 Hz to more than 100 Hz. Sensitivity of the velocity transducers shall range below 0.001 inch per second to more than 2.000 inch per second.
- Velocity transducers shall be field calibrated prior to use.
- The data acquisition equipment shall be capable of simultaneously recording individual velocity transducers, in

digital format, time-domain data (i.e., time vs. particle velocity) for each of the transducers.

I. The vibration shall be monitored continuously by the responsible person designated by the Contractor while significant impact work is in progress. The vibration monitoring equipment at each location shall operate continuously.

J. The vibration monitoring data shall be recorded contemporaneously and plotted continuously in ink on graph by the data acquisition equipment. The graph shall conform to the following:

- Each graph shall show time-domain wave traces (particle velocity versus time) for each transducer.
- The graph shall have the same vertical and horizontal axis scale.
- The resultant particle velocity shall be plotted on the graph instantaneously.

K. The equipment shall be set up in a manner such that an immediate warning is given when the resultant peak particle velocity is equal to or greater than 0.5 inches per second. The peak particle velocity shall be derived from the component particle velocity Vx, Vy, and Vz and shall be equal to the square root of the sum of Vx2+Vy2+Vz2.

L. The warning emitted by the vibration monitoring equipment shall be instantaneously transmitted to the responsible person designated by the Contractor by means of warning lights, audible sounds, or electronic transmission. The responsible person shall have the authority to stop the work causing the vibration.

M. When the peak particle velocity reading on monitoring equipment equals to or exceeds 0.5 inches per second, work shall immediately cease and the Contractor shall implement the approved contingency plan to reduce and maintain the monitoring equipment reading below 0.5 inches per second before resuming work. The Contractor shall immediately notify the Engineer every time the vibration equals to or exceeds 0.5 inches per second. After the completion of the baseline vibration monitoring and vibration monitoring during significant impact work at each of the facilities designated herein, the Contractor shall submit to the Engineer a daily report documenting the results of the vibration monitoring. Each building or facility shall have a separate report. The reports shall be signed by an engineer who is registered as a Civil Engineer in the State of California, who is experienced in and who has expertise in the field of vibration monitoring. The report shall include the following:

- Project identification, location, project name as shown on the project plans.
- Location of monitoring equipment, including address of monitored building or facility.
- Location of vibration source (i.e., pile driving equipment).

N. The District will retain an amount equal to 25 percent (*value varies based on project specifics; determine percentage in consultation with Construction Units*) of the estimated value of the work performed during the estimate period in which the Contractor fails to submit the vibration monitoring reports conforming to the requirements of this section, as determined by the Engineer.

O. The Contractor's vibration-monitoring personnel which include those persons, firms, or entities providing vibration monitoring, recording, documentation and the production of the reports shall have the qualifications specified herein. These personnel may be on the staff of the Contractor. However, they shall not be employed nor compensated by subcontractors, or by persons or entities hired by subcontractors, who will provide other services or material for the Project.

P. The Contractor‘s vibration-monitoring personnel shall include a qualified vibration Instrumentation Engineer who is a registered Professional Engineer in the State of California, and who has at least 4 years of experience in the installation and use of vibration-monitoring instrumentation and in interpreting instrumentation data. The Vibration Instrumentation Engineer shall:

- Be on site and supervise the initial installation of each vibration-monitoring instrument.
- Supervise interpretations of vibration-monitoring data.
- The Contractor‘s vibration-monitoring personnel shall be subject to the review of the Engineer.

Q. The Contractor shall obtain written permission from each property owner prior to entering the property for the purpose of performing the work specified in this section. The Contractor shall provide to the Engineer a copy of all such permissions or refusals by property owners.

R. Full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all work involving vibration monitoring, as specified in these specifications, and as directed by the Engineer, shall

be included in the lump sum price bid for VIBRATION MONITORING AND COMPLIANCE, Bid Item No. ___.

S. Additional areas to receive vibration monitoring will be paid for as extra work as provided in the Article for Extra Work As Directed By The Engineer.

17.04. Air Pollution

Include specific air pollution requirements beyond those required in the Standard Provisions. Ensure the applicable air pollution mitigation measures in the MMRP element of the CEQA documents are addressed here. If there are none, list Article 17.04 without the title and call out "Not Used."

17.05. Spillage and Dust

Include specific spillage and dust requirements beyond those required in the Standard Provisions. As a minimum, ensure the applicable spillage and dust control requirements in the MMRP element of the CEQA documents are addressed here. If necessary and as appropriate, consult with the local community and city officials in developing the requirements, making sure they meet the community's needs and are reasonable. If there are none, list Article 17.05 without the title and call out "Not Used."

EXAMPLES:

- Vegetation in disturbed areas shall be replanted as soon as horticulturally appropriate. For example, plant material may not be ready as soon as the job is done (e.g., willow cuttings have to be collected during winter dormancy). If planting of the required vegetation is not horticulturally feasible, an acceptable temporary measure shall be installed.

And, if necessary and justified:

- Employing a full time sweeper to follow trucks at all time along the truck route.

17.06. Traffic Control

See instructions. Include other specific requirements beyond those specified in the Standard Provisions. If there are none, list Article 17.06 without the title and call out "Not Used."

EXAMPLE 1:

A. The Contractor shall prepare a Traffic Control Plan to be signed and stamped by professional civil engineer registered in the State of California.

B. The Traffic Control Plan shall address all traffic control measures as shown on the Drawings and specified in these Specifications.

C. Traffic control work shall include, but not limited to, removing and replacing traffic control systems, fencing, railing, barricades, crash cushions, channelizers, AC pavement, driveways, curb, gutters and sidewalk and pavement markings, and construction area signs necessary for traffic staging on public streets adjacent to or near the project area, and any other miscellaneous work necessary to complete the traffic control as specified in these Specifications and as directed by the Engineer.

D. If any component in the traffic control system is displaced, or ceases to operate or function as specified during the progress of the work, the Contractor shall immediately repair said component to its original condition or replace said component and shall restore the component to its original location. E. No stockpiling of materials or parking of equipment will be allowed on streets and sidewalks. F. All construction signs shall be placed in the field and shall be visible to drivers and not covered or blocked by trees or other fixed objects. G. The Contractor shall verify any sprinkler system conflicts before installing construction area signs in planting strips. Contractor shall replace landscaping upon removal of construction area signs, if needed, and as directed by the Engineer. H. The Contractor shall ensure levels of operation acceptable to the Engineer, as well as perform inspections of traffic control zones on a daily basis.

I. All streets and sidewalk areas shall be swept clean in accordance with these Specifications.

EXAMPLE 2:

P. The Contractor shall not block the one-way access road connecting the secondary construction access and the District Headquarters Building to vehicular and pedestrian traffic.

Q. The secondary construction access may be used for single event transportation deliveries of certain construction materials and equipment. Single events are defined as mobilization/demobilization of construction trailers or one time delivery of large equipment and large construction materials such as precast concrete piles.

R. The Contractor‘s attention is directed to the limiting physical constraints of the primary construction access such as the existing road width, location of vegetation, and proximity of the river‘s top of bank to the roadway. The Contractor shall restrict vehicular traffic a minimum of two (2) feet away from the river‘s top of bank. The maximum size and weight of construction equipment that will be allowed on the primary construction access will be limited to a combined loaded (truck and trailer) of no more than 17,000 pounds. Truck and trailer will be defined as a loaded (13 cubic yard) conventional end-dump truck. The Contractor shall provide the Engineer with a list of construction equipment that will use the primary construction access. The Contractor will include make, model, physical dimensions, and loaded and unloaded weight capacity.

EXAMPLE 3:

P. During delivery and export of construction materials and equipment, the Contractor shall provide traffic flaggers and signs along the access route as directed by the Engineer.

Q. The Contractor shall provide traffic control monitors to assist with monitoring truck traffic at Whitman Way and Grossmont Drive when more than twenty (20) trucks are anticipated to arrive at the plant during a single day, during the starting and ending times of Noble Elementary School and Piedmont Middle School.

R. The Contractor shall notify the Engineer at least 3 working days in advance of any single day when more than twenty (20) trucks are anticipated to arrive at the plant.

EXAMPLE 4:

P. Crossing at Matadero/Josina shall be provided with a flagperson during school hours between 1:30pm and 3:30pm. Crossings at Matadero/Laguna and Miranda/Arastradero shall be provided with a flagperson full time during construction hours.

Q. Flagpersons provided for the Project shall be trained and experienced in the proper techniques for flagging and traffic control. The flagperson shall comply with Caltrans Standards for Control of Traffic through work

zones as described in the Caltrans Traffic Manual. If a flagperson is not performing his/her duties to the satisfaction of the City of _____, the Contractor shall be required to replace the flagperson with a police officer at the Contractor's expense.

17.07. Truck Traffic and Hauling

See instructions.

EXAMPLE 1: *The truck traffic requirements below were specified for a local street in Palo Alto where residential homes were located on both sides of the street. The project team worked with the local city staff and residents in developing these requirements.*

A. The Contractor shall obtain, at Contractor's expense, the _Haul Route Permit' from the City of Palo Alto.

B. Truck Traffic on Matadero Avenue:

1. Use of Matadero Avenue shall be limited to the hours of 8:30am to 5:30pm, Monday through Friday, excluding holidays.

2. Use of Matadero Avenue shall be limited to trucks with no more than five axles and carrying only excavated materials traveling eastbound from the job site to El Camino Real. No other construction related traffic shall be permitted to use Matadero Avenue as a construction access route.

3. The Contractor shall install a mobile speed monitoring radar trailer along Matadero Avenue during the period of truck activity along Matadero Avenue.

4. Trucks shall not exceed the posted speed limit of 20mph on Matadero Avenue. Fines of $300 per violation shall be assessed by the District for any documented violation of the 20mph construction zone speed limit by construction trucks on Matadero Avenue.

5. The Contractor shall control truck traffic such that at any given time only one truck shall be permitted on Matadero Avenue.

6. During the use of Matadero Avenue for construction egress, the Contractor shall post signs warning construction vehicle operators of children crossing ahead.

EXAMPLE 2:

A. Truck traffic and hauling shall conform to the local haul route permit except as further limited herein. Truck traffic or hauling may be permitted only on Berryessa, Piedmont, and Whitman Way provided they conform to the haul route permit. No truck traffic or hauling shall be permitted on any other streets.

B. Hauling hours are strictly limited to a daily operating schedule of 8:30am to 5:00pm, unless approved in advance by the Engineer in writing.

C. The Contractor shall post information signs for truck drivers at approved locations indicating truck traffic hour restrictions. Signs shall be readily visible. Violators shall be warned or barred from the site.

D. All hauling and delivery truck schedules shall be submitted to the Engineer for review within 72 hours of actual occurrence.

E. The Contractor shall not perform any loading or unloading activities or any other related operations outside the project limits, or outside the hours of work as defined in these Specifications. In addition, no loading, unloading or any other construction related operations shall be performed at or near the water treatment plant entry gate.

17.07.01. Truck Arriving Early, Truck Idling and Queuing

See instructions.

EXAMPLE 1:

A. The District actively seeks to avoid or minimize unnecessary disturbance of the neighborhood from construction activities. Accordingly, all deliveries shall be coordinated to ensure that no delivery vehicles arrive at the site entry gate before 8:30 am to prevent disruption of the neighborhood.

B. No idling or queuing shall take place on any residential streets in the surrounding neighborhood except for reasons noted below:

- idling when the vehicle must remain motionless due to an official traffic control device, traffic control signal, or at the direction of a peace officer, or traffic conditions over which the driver has no control;

- idling when being forced to remain motionless due to adverse weather conditions or due to mechanical difficulties over which the driver has no control;
- idling to verify that the vehicle is in safe operating condition as required by Law;
- idling at the site entrance for security checks or searches by District guards.

C. The Contractor shall control truck traffic such that at any given time only ____ trucks shall be permitted on residential streets.

Include a statement of liquidated damage assessment if applicable.

B. Contractor's attention is directed to the Article for Liquidated Damage Assessment for violating the arrival time or idling/queuing requirements.

17.08. Parking

See instructions. Delineate the areas of imposed restrictions and/or allowed parking areas, if any, on the Drawings and make reference here.

A. Trucks and contractor personnel vehicles parking, and access shall be in compliance with local permits and ordinances and as further specified herein.

B. All construction equipment and worker vehicles arriving at the site shall park within the site or as indicated in the Drawings. Workers shall enter the site as soon as they arrive to the site.

Include other specific requirements.

EXAMPLE 1:

C. No trucks or worker vehicles shall be parked on residential streets. Limited parking on the south side of Whitman Way and the west side of Vista Del Mar may be allowed, but only with advance approval by the Engineer.

EXAMPLE 2:

C. Workers shall not arrive onto the site no more than thirty (30) minutes prior to the start of work nor remain on the site thirty (30) minutes after the end of work. The Contractor's access gates shall remain locked during the hours when construction is not allowed, except for the thirty

(30) minute period preceding and following the hours of construction. The Contractor‘s attention is directed to Article 17.02 – Hours of Work.

EXAMPLE 3:

C. No trucks or workers‘ vehicles shall be parked on the parking lot belonging to the Lazy Boy Furniture Store or any other private parking lot.

17.09. Discovery of Archeological Artifacts and Human Remains

When archeological studies indicate a potential for encountering archeological artifacts in the project site, provide area boundary limited to Contractor access and/or list areas where monitoring will be required. Be careful when showing the location of archeologically sensitive sites on the Drawings. We may not want to bring attention to potential looters. Consult with environmental staff and archeologists.

Reference the Standard provisions regarding burial sites and archeological discoveries.

EXAMPLE 1:

A. No known archeological sites were discovered on the site. If, however, burials or archeological artifacts are encountered during construction, the Contractor shall halt work immediately within 50 feet of the find. A ~~-no~~ work” zone shall be established utilizing appropriate flagging to delineate the boundary of this zone. The Contractor shall secure and protect the zone from vandalism. Contractor‘s attention is directed Article 6.26—Burial Sites and Article 6.28—Delay Due to Archeological Discovery for additional requirements.

EXAMPLE 2:

A. The Contractor is advised that portions of this Project are located in archaeologically sensitive areas, which may contain burials or artifacts. If burials or archaeological artifacts are encountered, the Contractor shall halt work immediately within 50 feet of the find. A ~~-no~~ work” zone shall be established utilizing appropriate flagging to delineate the boundary of this zone. The Contractor shall secure and protect the zone from vandalism. Contractor‘s attention is directed to Articles 6.26—Burial Sites and Article and 6.28—Delay Due to Archeological Discovery for additional requirements.

B. The Contractor is advised that the archeological monitoring by the District agents may be performed at several locations including the areas between Stations 3+000± to 3+880± on the Main Line, and Stations 10+400 to 10+800 on the South Milpitas/Gibraltar Loop.

17.10. Aesthetic Requirements

Refer to the MMRP element of the CEQA documents for any requirements. If necessary and as appropriate, consult with the local community and city officials.

17.11. Recreation

Refer to the MMRP element of the CEQA documents for any requirements. If necessary and as appropriate, consult with the local community and city officials.

17.12. Utilities and Service System

Refer to the MMRP element of the CEQA documents for any requirements. If necessary and as appropriate, consult with the local community, city officials, and utilities.

17.13. Payment

A. Unless noted otherwise, full compensation for work involved in complying with all requirements under Section 17 shall be considered incidental and included in the contract prices paid for the various items of work involved and no additional time or compensation will be allowed therefor.

SECTION 18. ENVIRONMENTAL

18.01. Water Quality

See instructions. Listed below are typical requirements based on the water quality objectives taken from the Basin Plan. Include additional water quality requirements from other permits as applicable, such as pH, temperature, dissolved oxygen, etc.

A. The Contractor shall take all necessary precautions to limit the increase in turbidity of any water course past the construction site as follows:

1. Where existing turbidity is between 0 and 50 Nephelometric Turbidity Units (NTU), increases shall not exceed 5 NTU;

2. Where existing turbidity is greater than 50 NTU, increases shall not exceed 10 percent.

3. For cases in which the receiving water body is a dry creek bed or storm drain, waters in excess of 50 NTU shall not be discharged from the Contractor‘s operation.

B. The Contractor shall monitor the water turbidity changes. For tidal sites, the discharge water measurements shall be made at the point where the discharge water exits the Contractor‘s water control system and 100 feet downstream of the discharge point for non-tidal sites. Existing stream turbidity measurement shall be made in the receiving water at least 100 feet upstream of the project discharge site. Existing stream turbidity measurement shall be made prior to initiation of project discharges, preferably at least 2 days prior to the commencement of operations.

EXAMPLE:

C. The Contractor shall not cause the pH of the watercourse to be depressed below 6.5 or raised above 8.5. The Contractor shall not cause the temperature of watercourse to change by more than 5 degrees Fahrenheit.

18.01.01. Discharges Covered Under NPDES General Permit

A. The Contractor shall comply with the NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities.

B. Listed here are discharges considered by the Engineer to be covered under the NPDES General Permit: (*list discharges such as excavation dewatering, pumped ground water*). The Contractor shall implement the appropriate BMP‘s for these discharges in accordance with the Article for Stormwater Pollution Prevention.

The Contractor shall list the discharges and the BMP's in the SWPPP or BMP Action Plan as required under that Article.

18.01.02. Other Discharge Permits

Include under this Article the requirements from other discharge permits. Such permits may include: a) a separate non-storm water discharge permit from RWQCB, b) 404 Permit from the Army Corps of Engineers, c) 401 Water Quality Certification from RWQCB, or d) Waste Discharge Requirements permit *from RWQCB*.

Describe a procedure for the Contractor to follow: location where contaminated water will be encountered, how the water will be contained, number of samples to be collected, sampling frequency, types of chemical analysis, laboratory turnaround time, who will review the data, and how to report to regulatory agencies prior to discharge. It will take at least 3 days for collecting a water sample and receiving laboratory chemical data and up to 5 working days for a concurrence for discharge from regulatory agency staff. This additional time needs to be considered in the construction schedule to avoid unnecessary delay claims. List the requirements and procedures to be performed by the Contractor here. The requirements and procedures should be consistent with the permit conditions.

A. Listed below are the discharges covered by other discharge permits and the procedures to be implemented by Contractor.

EXAMPLE:

1. Excavation dewatering in areas between Sta. XX to Sta. XX;
2. Water from disinfection of the 1,500 feet of 48″ water pipeline;
3. Pumped groundwater in the vicinity of Ozonation Building;
4. etc.

B. The Contractor shall implement the following procedures:

(*List procedures*)

18.02. Compliance With NPDES General Permit *(Alternative 1)*

The new NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities was adopted by the SWRCB on September 2, 2009 and will become effective on July 1, 2010. See attached link for the new permit and requirements.
http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/wqo_2009_0009_complete.pdf.
See instructions in front and revise the specifications accordingly to comply with the new Permit.

The instructions and template language here are based on the current Permit.

Based upon the current law, a SWPPP will not be required on all projects. Accordingly, the project team must determine if a SWPPP (Alternative 1) or a Best Management Practices (BMP) Action Plan (Alternative 2) is required. The conditions to be evaluated are as follows:

1. When a project site or sites (including sites from different stages or phases of the work) are 1 acre or over 1 acre, a Notice of Intent must be filed by the District with the SWRCB and a SWPPP is required from the Contractor per Alternative 1.

2. When a project site or sites are less than 1 acre but the project team believes that compliance with the General Permit is appropriate, a Notice of Intent is not filed by the District but a SWPPP is still required from the Contractor.

3. When a project site or sites are less than 1 acre and the Project Engineer believes there is no potential for pollution due to stormwater or other factors, no Notice of Intent is filed and no SWPPP is required from the Contractor. However, a BMP Action Plan will be required of the Contractor per Alternative 2.

The SWPPP will be reviewed by engineers who have received SWPPP training.

18.02.01. General

A. The Contractor shall comply with the requirements of the State Water Resources Control Board (SWRCB) National Pollutant Discharge Elimination System (NPDES) General Permit for Discharges of Stormwater Associated with Construction Activity (Construction General Permit Order # 99-08-DWQ). A copy of this NPDES General Permit is provided in Appendix _____. In compliance with this NPDES General Permit, the Contractor shall prepare and submit to the Engineer the SWPPP for all work, including the Contractor's storage, maintenance, staging, and work areas within or outside the right of way in accordance with the Article 9.02.

18.02.02. Storm Water Pollution Prevention Plan

A. The Contractor shall prepare and submit to the District the SWPPP as required under General Permit for Discharges of Stormwater Associated with Construction Activity. The SWPPP shall be submitted to and have been favorably reviewed by the Engineer prior to commencement of any work at the site(s) of the Project. The SWPPP shall be based on a template available from the California BMP Handbooks website at http://www.cabmphandbooks.com/Documents/Construction/Appendix_B.pdf, and the SWPPP checklist available from the State of California at http://www.waterboards.ca.gov/stormwtr/docs/const_swppp.doc. The SWPPP shall incorporate the stormwater BMP's and the pollution prevention and control measures specified herein and any others as necessary to comply with the NPDES General Permit.

B. The SWPPP shall be certified and stamped by a Registered Civil Engineer in accordance with applicable regulations.

C. The District will make available the following: base maps for Contractor‘s use in preparing the vicinity and site maps for General Permit; a copy of pre-existing site and site design information; a copy of the completed Notice of Intent, if required. Post-Construction Stormwater Management Section will be prepared by the District and provided to the Contractor for inclusion into the SWPPP.

D. The SWPPP will be reviewed by the Engineer for compliance with the regulations of the SWRCB. Review by the Engineer shall not relieve the Contractor of responsibility for the completeness of the SWPPP, the accuracy of assumptions, data, and information used and procedures contained in the Contractor‘s SWPPP or the adequacy thereof.

E. The SWPPP shall be revised and/or amended by the Contractor, as necessary, during the progress of work to comply with local, state, and federal regulations and the requirements of these Specifications. All revisions and amendments shall be submitted to the Engineer in accordance with the Article 9.02. Revisions and/or amendments to the SWPPP shall be considered incidental to this item of work and no additional payment shall be made therefor.

If a Notice of Intent is to be filed, insert the following sentences:

F. The District will prepare and file a Notice of Intent with the SWRCB for this Project.

G. The Contractor‘s personnel supervising the earthwork, site work, erosion control, sedimentation control, and inspecting erosion controls shall be required to read the SWPPP. A copy of the SWPPP shall be maintained at the construction site by the Contractor and shall be available at all times for review by all contractors, District, or regulatory agency personnel.

18.02.03. Implementation of BMPs

A. The BMP listing below and the pollution prevention and control measures specified herein are not intended to be a complete listing of BMP‘s for stormwater pollution prevention and control. The Contractor shall be responsible to implement all BMP‘s applicable to the project construction in complying with the NPDES General Permit.

B. Stormwater BMPs

1. Stormwater BMP‘s shall be in accordance with California Stormwater Quality Association ~~S~~tormwater Best Management Practice Handbook," Construction, 2003, which is available at www.cabmphandbooks.com.

2. At a minimum, the Contractor shall incorporate and implement the following stormwater BMP's as part of the SWPPP:

Include the BMP's listed below. Identify and include additional BMP's that are salient to this Project in consultation with Construction Unit and Stream Water Quality Unit. Refer to the California Stormwater Quality Association "Stormwater Best Management Practice Handbook," Construction, 2003 which is available at www.cabmphandbooks.com.

Erosion Control BMP's:

- Hydroseeding (EC-4)
- Soil Binders (EC-5)
- *(Include other BMP's as deemed necessary.)*

If an "Erosion Control Measures" section is included as a separate section in the specifications, include the following sentence:

- Mulching and/or seeding operations shall conform to the requirements of Section _____ "Erosion Control Measures" of these Specifications.

Sediment Control BMP's:

- Street Sweeping and Vacuuming (SE-7)
- Sandbag Barrier (SE-8)
- Straw Bale Barrier (SE-9)
- Storm Drain Inlet Protection (SE-10)
- *(Include other BMP's as deemed necessary.)*

Wind Erosion Control BMP's:

- Wind Erosion Control (WE-1)

Tracking Control BMP's

- Stabilized Construction Entrance/ Exit (TR-1)
- Stabilized Construction Roadway (TR-2)
- *(Include other BMP's as deemed necessary.)*

Non-stormwater Management BMP's:

- Dewater Operations (NS-2)
- Clear Water Diversions (NS-5)
- Vehicle and Equipment Fueling (NS-9)
- Vehicle and Equipment Maintenance (NS-10)
- *(Include other BMP's as deemed necessary.)*

Waste Management and Materials Pollution Control BMP's:

- Material Delivery & Storage (WM-1)
- Stockpile Management (WM-3)
- Spill Prevention and Control (WM-4)
- Hazardous Waste Management (WM-6)
- Contaminated Soil Management (WM-7)
- Liquid Waste Management (WM-10)
- *(Include other BMP's as deemed necessary.)*

3. Unless noted otherwise as below, the Contractor shall design, construct, operate, inspect, and maintain the BMP's in accordance with the instructions provided in the fact sheets from the California Stormwater Quality Association "Stormwater Best Management Practice Handbook," Construction, 2003.

If necessary, include a copy of BMPs' fact sheets in the Appendix and make a reference here.

Review and evaluate all the BMPs' fact sheets listed for the Project and, in consultation with Construction Unit and Stream Water Quality Unit, modify or clarify them as needed. The modifications and clarifications may be general or specific to certain BMP's, and include construction materials, design configurations, or frequency of inspection.

C. Stormwater Runoff Contamination

1. The Contractor shall designate separate areas for loading, unloading, and storage of construction materials; for storage and/or maintenance of vehicles and equipment used in constructing the work; for concrete truck wash down if concrete will be placed as part of this work; and for temporary storage of site debris, excess construction materials, demolition materials, excess excavated soil, and rubbish resulting from the work. Construction materials include, but are not limited to, any material used in the construction of the work, paper, packing material, fuel, oil, hydraulic fluid, chemicals, polymers, paint, solvents, glue, fertilizers, defoliants, soil sterilants, herbicides, pesticides, disinfectants, reactants, construction equipment, soil, vegetation, and demolition materials.

2. Enclosures or flow barriers shall be erected by the Contractor around these designated areas to prevent stormwater flows from entering the designated areas and to prevent sediments and other pollutants discharged in stormwater flows from leaving the designated areas.

In the following paragraph, fill in the applicable region of the RWQCB—i.e., San Francisco Bay or Central Coast.

3. If stormwater flows enter the designated areas, the Contractor shall determine if the stormwater has become contaminated or may be allowed to be discharged to the storm drains or stream channels. If the stormwater flows have become contaminated due to contact with the construction materials, the Contractor shall provide for disposal of the stormwater flows at no additional costs to the District in a manner acceptable to the Engineer and/or the _____ RWQCB. The Contractor shall immediately notify the Engineer of incident(s) of stormwater flows entering designated areas and decisions and measures taken to remedy the situation.

4. If discharges occur in the designated areas, the Contractor shall immediately notify the Engineer and, at the Contractor's sole cost, contain and cleanup the discharge to prevent spilled material from entering storm drains, stream channels, or groundwater, or from being absorbed by the underlying pavement or soil.

D. Erosion and Sediment Control Implementation

1. The purpose of erosion and sediment control is to eliminate discharge of sediment from the work site to the storm drains and stream channels. The Contractor shall preserve existing vegetation and revegetate, if necessary, as soon as feasible. At a minimum, the Contractor shall complete placing erosion and sediment control measures on October 1, maintain the control measures, and make sure they remain effective until April 15 of the following year. In the event of a predicted storm during the non-rainy season between April 15 and October 15, the Contractor shall immediately install the erosion and control measures to control sediment discharges.

2. For exposed soils, the Contractor shall cover, drain, or otherwise protect the surfaces to minimize erosion. Erosion control measures may include, but are not limited to: temporary pavement, jute matting, hydro-seeding, protective sheets, mulch to provide temporary soil protection, upgradient water diversions such as culverts, or water bars; sediment barriers such as straw bales or sandbags; or appropriate surface contouring.

3. The Contractor shall ensure that stormwater and/or streamflows can flow through the sediment barriers without causing flooding, or the Contractor shall provide temporary flow diversion measures to route excessive surface water flows around the sediment barriers. In the event that sediment barriers cause flooding, the Contractor shall respond immediately to remedy the situation.

4. The Contractor shall implement and maintain the erosion control measures and sediment barriers. The Contractor shall be responsible for inspecting and maintaining the erosion controls and sediment barriers at least once every day. The inspections are to be documented in

accordance with the requirements of the General Permit. If the erosion controls and/or sediment barriers do not operate properly and sediment or other construction materials enter storm drains or stream channels, the Contractor shall notify the Engineer. If the Engineer determines that the storm drains or stream channels require cleaning or other remedial work, the Contractor shall provide this cleaning or other remedial work at no additional cost to the District. The Contractor shall be responsible for obtaining permits from the appropriate regulatory agencies for this cleaning or other remedial work.

18.02.04. Monitoring and Reporting

A. Monitoring and Inspection

1. The Contractor shall monitor and inspect all stormwater BMP's and pollution prevention and control measures at least once every day, and shall immediately repair or replace any SWPPP facilities that are not operating properly.

2. The Contractor shall develop a Daily Inspection Documentation Form for maintaining on-site daily written records of monitoring and inspection results. The Daily Inspection Documentation Form shall be submitted with the SWPPP for review and acceptance prior to the implementation of protective measures. Copies of the completed daily Inspection Documentation Forms shall be provided weekly to the Engineer by the Contractor. The Contractor shall retain all records of inspections, compliance certifications, and noncompliance notifications for a period of at least 3 years following completion of construction. The District and the _____ RWQCB shall have access to and the right to examine any of these records.

3. Prior to the raining season and no later than September 1 each year, the Contractor shall submit to the Engineer an erosion and sediment control implementation plan. The plan shall describe the erosion and sediment control measures, the status, and the implementation schedule for the incoming rain season.

B. Annual Certification

1. The Contractor shall certify annually that its construction activity is in compliance with the requirements of the SWRCB, NPDES General Permit for Stormwater Discharges Associated with Construction Activity, and the Contractor's SWPPP. Certifications shall comply with the requirements of the General Permit. This certification shall be provided to the District in writing by July 1 of each year. Certification is not required if the Notice to Begin Work is issued after July 1 and the Engineer determines in the final inspection that the work has been completed before July 1 of the following year. The certification shall be based upon the monitoring and

inspection specified herein. If the Contractor cannot certify compliance by July 1 due to noncompliance, as noted below, the Contractor shall certify compliance following achievement of compliance.

In the following paragraphs, fill in the applicable region of the RWQCB—i.e., San Francisco Bay or Central Coast.

2. The Contractor shall notify the Engineer and the _____ RWQCB in writing, as required by the General Permit, if the Contractor cannot certify compliance in accordance with the requirements of the previous paragraph.

3. The Contractor shall also notify the Engineer verbally of any incidents of noncompliance within 24 hours of identification of noncompliance. Written noncompliance notification shall be submitted to the Engineer and the _____ RWQCB within 30 days of identifying a noncompliance incident. The notification shall include the type(s) of noncompliance, describe the actions necessary to achieve compliance, and include a time schedule, subject to modification by the _____ RWQCB, indicating when compliance will be achieved.

C. Final Certification

1. Following completion of the work and the final inspection, the Contractor shall certify that construction activity has been completed, that all elements of the SWPPP have been implemented (excepting Post-Construction Stormwater Management), that construction and equipment maintenance waste have been disposed of properly, and that the site(s) is in compliance with all local stormwater management requirements, including erosion/sediment control requirements, policies, and guidelines. This certification shall be provided to the Engineer in writing before acceptance of the work by the Board of Directors.

Consult with Construction Units and Legal Counsel if remedies other than the above, such as liquidated damages, are required.

18.02.05. Regulatory Fines

A. The Contractor shall be responsible for any penalties or fines imposed upon the District by the RWQCB or other regulatory body due to the Contractor's noncompliance with the requirements of the NPDES permit, except for any penalties or fines imposed upon the District for noncompliance with the "Post-Construction Stormwater Management" section of the SWPPP following the completion of construction. The actual cost of such penalties or fines will be subtracted from the amount due, or that may become due, the Contractor.

18.02.06. Payment

Option 1 (if work is extensive)

A. Full compensation for doing all work necessary to prepare the SWPPP and to design, furnish, install, inspect, and maintain the stormwater BMP's and other required pollution prevention and control measures, including all materials, labor, equipment, service, supervision, documentation, and submittals shall be included in the lump sum price bid for COMPLIANCE WITH NPDES GENERAL PERMIT, Bid Item __.

Option 2 (if work is minimal)

A. Full compensation for doing all work necessary to prepare the SWPPP and to design, furnish, install, inspect, and maintain the stormwater BMP's and other required pollution prevention and control measures, including all materials, labor, equipment, service, supervision, documentation, and submittals shall be considered incidental and included in the other items of work and no additional compensation will be made therefore.

If a Stormwater Pollution Prevention Plan (SWPPP) is NOT required, use the following ALTERNATIVE 2—BMP Action Plan.

18.03. Best Management Practices Action Plan *(Alternative 2)*

A. The Contractor is solely responsible for identifying and implementing all storm water BMP's and pollution prevention control measures necessary to prevent storm water pollution and the discharge of illicit materials into storm drains and water conveyance channels.

Include references to BMP's for activities that will be performed as part of this Project. Review the BMP sources listed below for BMP's to address all pertinent activities for this Project. The site activities referenced below are typically included as a minimum on all projects.

B. Stormwater BMP's shall be in accordance with California Stormwater Quality Association "Stormwater Best Management Practice Handbook," Construction, 2003 which is available at www.cabmphandbooks.com. At a minimum, the Contractor shall identify and implement the following BMP's as part of the BMP Action Plan:

Include the BMP's listed below. Identify and include additional BMP's that are salient to this Project in consultation with Construction Unit and Stream Water Quality Unit. Refer to the California Stormwater Quality Association "Stormwater Best Management Practice Handbook," Construction, 2003 which is available at www.cabmphandbooks.com.

Erosion Control BMP's:

- Hydroseeding (EC-4)
- Soil Binders (EC-5)
- *(Include other BMP's as deemed necessary.)*

If an "Erosion Control Measures" section is included as a separate section in the specifications, include the following sentence:

- Mulching and/or seeding operations shall conform to the requirements of Section _____ "Erosion Control Measures" of these Specifications.

Sediment Control BMP's:

- Street Sweeping and Vacuuming (SE-7)
- Sandbag Barrier (SE-8)
- Straw Bale Barrier (SE-9)
- Storm Drain Inlet Protection (SE-10)
- *(Include other BMP's as deemed necessary.)*

Wind Erosion Control BMP's:

- Wind Erosion Control (WE-1)

Tracking Control BMP's

- Stabilized Construction Entrance/ Exit (TR-1)
- Stabilized Construction Roadway (TR-2)
- *(Include other BMP's as deemed necessary.)*

Non-stormwater Management BMP's:

- Dewater Operations (NS-2)
- Clear Water Diversions (NS-5)
- Vehicle and Equipment Fueling (NS-9)
- Vehicle and Equipment Maintenance (NS-10)
- *(Include other BMP's as deemed necessary.)*

Waste Management and Materials Pollution Control BMP's:

- Material Delivery & Storage (WM-1)
- Stockpile Management (WM-3)
- Spill Prevention and Control (WM-4)
- Hazardous Waste Management (WM-6)
- Contaminated Soil Management (WM-7)
- Liquid Waste Management (WM-10)
- *(Include other BMP's as deemed necessary.)*

C. Unless noted otherwise as below, the Contractor shall design, construct, operate, inspect, and maintain the BMP's in accordance with the instructions provided in the fact sheets from the California Stormwater Quality Association –Stormwater Best Management Practice Handbook," Construction, 2003.

If necessary, include a copy of BMPs' fact sheets in the Appendix and make a reference here.

Review and evaluate all the BMPs' fact sheets listed for this Project and, in consultation with Construction Unit and Stream Water Quality Unit, modify or clarify them as needed. The modifications and clarifications may be general or specific to certain BMP's, and include construction materials, design configurations, or frequency of inspection.

18.03.01. Submittal

A. The Contractor shall prepare and submit to the Engineer, in accordance with Article 9.02, a BMP Action Plan that identifies all potential pollutants present on-site, the sources of the pollutants, and the potential pathways of release to the environment. The BMP Action Plan will also describe the BMP's that will be implemented and maintained throughout the duration of the Project. The Engineer must favorably review the BMP Action Plan prior to the commencement of any work activities in the field. The Contractor shall be responsible for implementing the approved BMP Action Plan.

B. The BMP Action Plan shall include, but is not limited to, the following items:

1. Identification of all potential pollutants (e.g., chemicals, washwater, and sediment).

2. Identification of all pollution control measures for each potential pollutant.

3. Inspection measures for BMP's to verify they are effectively controlling pollution. For stormwater BMP's, the Contractor shall specify the frequency of inspection before and after rain events and for non-stormwater BMP's.

4. A site map illustrating where construction activities will occur, where materials, equipment, and potential pollutants will be stored, and where control measures will be implemented to prevent materials and chemicals from entering the storm drain network or waterway.

5. A diagram of site stormwater drainage patterns including the local storm drain system and the receiving waterway.

18.03.02. Payment

Option 1

A. Full compensation for doing all work necessary to prepare the BMP Action Plan and to design, install, inspect, and maintain the required stormwater BMP's, including all materials, labor, equipment, services, supervision, documentation, and submittals, shall be included in the lump sum price bid for BMP ACTION PLAN, Bid Item ____.

Option 2 (if incidental work)

A. Full compensation for doing all work necessary to prepare the BMP Action Plan and to design, install, inspect, and maintain the required stormwater BMP's, including all materials, labor, equipment, services, supervision, documentation, and submittals, shall be considered incidental and included in the other items of work and no additional compensation will be made therefore.

18.04. Water Pollution Nuisance

A. The Contractor shall remedy immediately any public nuisance or deficiency arising from, or in consequence of Contractor's failure to perform the work specified under Article 18.02 (*or Article 18.03*).

B. Upon the Contractor's failure to make appropriate and timely remedies as directed by the Engineer in the best interests of the public, the Engineer may employ private or public work forces and equipment to perform the work. The actual cost of employing such forces and equipment shall be doubled and then subtracted from the monies due, or that may become due, the Contractor. Such action(s) taken by the Engineer shall not preclude the Engineer from taking other appropriate actions, and shall not relieve the Contractor of responsibility to comply with these Specifications.

18.05. Regulated Material Management

18.05.01. Asbestos Management

18.05.02. Lead Management

18.06. Solid Materials Management

See instructions.

18.06.01. Definitions

Certified Facility—A reuse, recycling, composting, or materials recovery facility meeting the required diversion percentages set forth in this specification which the Engineer has determined can accept diverted materials, has obtained all applicable federal, state and local permits and is in full compliance with all applicable regulations for reuse, recycling, composting and/or materials recovery.

Construction Waste—Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste does not include any of the above-specified materials/solid waste that contains contaminated or hazardous substances. Construction waste does not include excavated soil or groundwater.

Demolition Waste—Building and site improvement materials resulting from demolition or selective demolition operations. Demolition waste does not include any of the above-specified materials/solid waste that contains contaminated or hazardous substances.

Disposal—Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

Divert/Diversion—To use material for any lawful purpose other than disposal in a landfill or transformation facility.

Post-Consumer Recycled Content—The percentage of a new product which contains material that was recycled from product that was used by the end consumer and then collected for recycling.

Recycle—Recovery of demolition or construction waste for subsequent processing in preparation for use in some other form.

Salvage—Recovery of demolition or construction waste and subsequent sale or reuse in the same form in another facility.

Transformation Facility—A facility whose function is to convert, combust or otherwise process solid waste by incineration, pyrolysis, destructive distillation, or gasification or to chemically or biologically process solid waste for the purpose of volume reduction, synthetic fuel production or energy recovery. A composting facility is not a transformation facility.

18.06.02. Construction and Demolition Waste Management

See instructions.

EXAMPLE 1: If Recycling/Salvaging is Required

A. The Contractor shall prepare and implement a Solid Materials Management Plan that results in a minimum end-of-project rate of recycle/salvage of 50 percent by weight of total construction and demolition waste generated by the work. Construction and demolition waste shall consist of the following materials: _____.

B. The Contractor shall submit a Solid Materials Management Plan identifying procedures to be used for management of construction and demolition waste generated by the work, including the facilities to be used for both disposal and recycling/salvaging and the estimated quantities and percentages (by weight) of construction demolition waste disposed and recycled/salvaged categorized by waste type. For each facility listed in the waste management plan, the Contractor shall provide facility name and address and facility owner name and contact information. This submittal shall be approved by the Engineer prior to commencement of any work on the project site.

C. The Contractor is directed to the City of San Jose's Construction and Demolition Deposit Program Certified Facility List (http://www.sjrecycles.org/business/pdf/cddd_certified_list.pdf) for local construction and demolition waste recycling service provider listings. Additional recycling resources are available at www.ciwmb.ca.gov/condemo/ and www.crra.com/cdc/index.html.

D. *Alternative A: If Construction Will Be Completed In One Year*

At the conclusion of the Project, the Contractor shall complete a Solid Materials Management Report Form which documents materials recycled/salvaged and disposed and demonstrates compliance with the requirements specified herein, facilities utilized, and weights of construction and demolition waste generated by the Project, as well as attach receipts that verify materials and quantities disposed and recycled/salvaged. This Form shall be submitted with the request for final payment. The Form is included in Appendix ___.

Alternative B: If Construction Will Occur Over Multiple Years

Annually on the 25th of January, the Contractor shall complete and submit a Solid Materials Management Report Form which documents materials recycled/salvaged and disposed and demonstrates compliance with the requirements specified herein, facilities utilized, and weights of construction and demolition waste generated by the Project, as well as attach receipts that verify materials and quantities disposed and recycled/salvaged. The Form and receipts shall be

included as a part of the Contractor's monthly progress pay request. This Form is included in Appendix ___. The Contractor shall also complete and submit the Form with the request for final payment.

The following applies to both Alternative A and Alternative B if a separate bid item is not specified:

E. Full compensation for preparing the Solid Materials Management Plan and for completing the Solid Materials Management Report Form shall be considered as included in the contract price for various items of work involved and no additional compensation will be allowed therefore.

EXAMPLE 2: If Recycling/Salvaging Is Not Required and Reporting Only is Required

A. The Contractor shall submit a Solid Materials Management Plan identifying procedures to be used for management of construction and demolition waste generated by the work, including the facilities to be used for both disposal and recycling/salvaging and the estimated quantities and percentages (by weight) of construction demolition waste disposed and recycled/salvaged categorized by waste type. For each facility listed in the waste management and recycling plan, the Contractor shall provide facility name and address and facility owner name and contact information. This submittal shall be approved by the Engineer prior to commencement of any work on the project site.

B. The Contractor is directed to the City of San Jose's Construction and Demolition Deposit Program Certified Facility List (http://www.sjrecycles.org/business/pdf/cddd_certified_list.pdf) for local construction and demolition waste recycling service provider listings. Additional recycling resources are available at www.ciwmb.ca.gov/condemo/ and www.crra.com/cdc/index.html.

C. *Alternative A: If Construction Will Be Completed In One Year*

At the conclusion of the Project, the Contractor shall complete and submit a Solid Materials Management Report Form which documents materials recycled/salvaged and disposed and demonstrates compliance with the requirements specified herein, facilities utilized, and weights of construction and demolition waste generated by the Project, as well as attach receipts that verify materials and quantities disposed and recycled/salvaged. The Contractor shall complete and submit the Form with the request for final payment. The Form is included in Appendix ___.

Alternative B: If Construction Will Occur Over Multiple Years

Annually on the 25th of January, the Contractor shall complete and submit a Solid Materials Management Report Form which documents materials recycled/salvaged and disposed during the previous calendar year and demonstrates compliance with the requirements specified herein, facilities utilized, and weights of construction and demolition waste generated by the Project, as well as attach receipts that verify materials and quantities disposed and recycled/salvaged. The Form and receipts shall be included as a part of the Contractor's monthly progress pay request. This Form is included in Appendix ___. The Contractor shall also complete and submit the Form with the request for final payment.

The following applies to both Alternative A and Alternative B if a separate bid item is not specified:

D. Full compensation for completing the Solid Materials Management Plan and for completing the Solid Materials Management Report Form shall be considered as included in the contract price for various items of work involved and no additional compensation will be allowed therefore.

18.06.03. Post-Consumer Recycled Content Requirements

See instructions.

EXAMPLE 1: If a Minimum Percent of PCRC Is Required

A. The Contractor shall demonstrate in the Solid Materials Management Plan specified in Article 17.16.02 that the following materials to be furnished or installed contain 10 percent or more post-consumer recycled content: _____.

B. At the conclusion of the Project, the Contractor shall list the materials furnished/installed that contain post-consumer recycled content and document that the percent content for each of these materials equals or exceeds 10 percent as well as attach documentation certifying the percentage of post-consumer recycled product content contained in these materials. This information shall be included in the Solid Materials Management Report Form specified in Article 17.16.02. As specified herein, this Form shall be submitted with the request for final payment, payment will be withheld until the completed Form is submitted, and no interest on withheld amounts will be due the Contractor.

C. Full compensation for documenting the above-specified information in the Solid Materials Management Report Form shall be considered as included in the contract price for various items of work involved and no

additional compensation will be allowed therefore.
EXAMPLE 2: If a Minimum Percent of PCRC Is Not Required And Reporting Only of PCRC Is Required. A. At the conclusion of the Project, the Contractor shall list the materials furnished/installed that contain post-consumer recycled content and document the percent content for each material item listed. This information shall be included in the Solid Materials Management Report Form specified in Article 17.16.02. B. Full compensation for documenting the above-specified information in the Solid Materials Management Report Form shall be considered as included in the contract price for various items of work involved and no additional compensation will be allowed therefore.

18.07. Migratory Birds

18.07.01. Regulatory Requirements

List other project permit conditions related to migratory birds from other agencies (such as Department of Fish and Game and Fish and Wildlife Service) as applicable.

A. The Contractor shall carry out all activities in a manner consistent with the Migratory Bird Permit Memorandum (Appendix _____), issued by the U.S. Fish and Wildlife Service dated April 15, 2003. Except as may be noted elsewhere in this Article, active nests are those containing either an egg (or eggs) or young, and/or nests used by birds of prey (i.e., members of the orders Falconiformes and Strigiformes, known as raptors) regardless of the presence of eggs or young; whereas inactive or partially-built nests of species other than raptors do not contain any eggs or young. To determine the occupancy of nests, the Contractor shall rely upon the professional expertise of a qualified biologist. See Article 17.17.03.

B. The Contractor shall coordinate several measures, including; awareness of which migratory bird species are protected, their nesting seasons and seasonal variability; surveys to determine the presence of nesting birds in the project area; establishment of protective buffer zones around nests; installation and maintenance of exclusion devices; and periodic monitoring to assure the adequacy of the compliance measures.

18.07.02. Scope of Work

A. The Contractor shall be aware of migratory bird nesting seasons and variability; monitor the project site; perform preventative and deterrence measures to prevent birds from nesting; preserve and protect pre-established protective buffer zones; perform surveys to determine the potential for protected species to be in the project area; establish new protective buffer zones around unprevented nests, as required; maintain and install exclusion devices, such as netting and/or wire mesh screens; periodically monitor to assure the adequacy of the compliance measures; and perform any other work as specified herein to comply with all applicable statutes.

B. Prior to the District releasing the site to the Contractor, the Engineer and the Contractor shall assess the site to determine the presence of nesting birds protected by all applicable statutes, as well as the existing protective buffer zones and exclusion devices within or near the construction areas.

C. The Contractor shall provide a District-approved biologist to monitor regulatory compliance and to coordinate with the Engineer, in conformance with: i) this Article; ii) the project-specific Mitigation Monitoring and Reporting Program (MMRP) requirements relating to this Article; and iii) all applicable permit conditions.

D. The District will have monitored and controlled the site, including management of vegetation, installing and maintaining protective buffer zones and exclusion devices, as necessary, until the issuance of the Notice to Begin Work, at which time the site will be released to the Contractor. Upon accepting the site, the Contractor shall assume complete responsibility for the site, including vegetation management, existing protective buffer zones and exclusion devices, and shall perform all required work as specified herein.

18.07.03. Contractor Biologist

The language below requires Contractor to hire its own biologist. Determine if a District-provided biologist is preferable and modify the language appropriately.

A. The Contractor shall employ a biologist meeting the qualifications of ―Contractor Biologist" as listed in Appendix _____ to supervise all work under this Article. At anytime during the Contract, the District reserves the right to request a replacement biologist due to non-performance or for reasons outlined in Article 9.05 of these Specifications.

B. The Contractor Biologist shall:

- Monitor the project site for nest starts and occurrences of active bird nests.
- Document the location, status, and species of bird for each active nest.

- Monitor the Contract Work to ensure that protected birds are not disturbed in a manner that could result in non-compliance.
- Establish additional protective buffer zones around active nests, as specified herein.
- Ensure protective buffer zones are maintained and nests are not disturbed. Advise when protective buffer zones are no longer needed and can be removed.
- Monitor the maintenance and effectiveness of bird exclusion devices.
- Provide recommendations concerning vegetation management, installation of additional exclusion devices and maintenance of such devices to prevent bird nesting.

18.07.04. General Nesting Seasons

A. The nesting season in the project area is generally considered to be from February 1st through August 31st. However, annual variation in climatic conditions can alter these periods by several weeks.

18.07.05. Migratory Bird Surveys

A. The Contractor shall perform migratory bird surveys prior to any project-related activity that could pose the potential to affect migratory birds.

B. The Contractor shall notify the Engineer in writing at least 15 days and no more than 30 days in advance of initiation of project-related activities, such as movement of equipment, materials stockpiling, bridge work, clearing, grubbing, excavation, establishment of site access, etc.

18.07.06. Protective Buffer Zones

Refer to MMRP element of the CEQA documents and regulatory permit requirements for mitigation measures related to the establishment of project-activity protective buffer zones for the protection of migratory birds.

A. Existing protective buffer zones, if any, are shown on the Drawings or will be communicated to the Contractor prior to District releasing the site. In addition to District established buffer zones, new protective buffer zones will be required if a nest is established or discovered during the construction period. In the event that an active nest of a protected species is discovered in the construction area during construction, or in adjacent areas considered to have the potential to be disturbed by construction, the Contractor shall notify the Engineer and establish a protective buffer zone around the nest at the direction of the Engineer. The exact location of the boundaries of protective buffer zones shall be established by the Engineer. The Contractor shall install fence (Type ____) at the boundary of each

new protective buffer zone, except as otherwise directed by the Engineer. The Contractor shall preserve and protect all protective buffer zones, including existing ones, at all times.

B. The Contractor shall be responsible for any added costs or schedule delays as a result of establishment of new nests or new protective buffer zones due to the Contractor‘s failure to perform the bird exclusion responsibilities as specified under this Article.

C. The Contractor shall monitor protective buffer zone operations during construction. Requirements for the protection of active nests may vary depending on the location and the species involved. The following are general guidelines to be followed by the Contractor when an active nest is encountered:

- Stop any activities that may harm the nest.
- Contact the Engineer immediately.
- Only the Contractor‘s biologist should approach the nest, and only if necessary.
- The Contractor shall inform employees of the presence of an active nest and take steps, described above, to avoid disturbing it.
- Until inspected by the Engineer, a 20-foot radius protective buffer zone shall be established around the nest of any non-raptor, ground-nesting bird, and a 50-foot radius protective buffer zone around nests established in shrubs, trees, on structures, on equipment, etc., except for raptor nests. Furthermore, the protective buffer zone shall be 250 feet for hawks, owls (including burrowing owls), herons, and egrets. The Contractor‘s biologist may recommend, for approval by the Engineer, modification of these perimeters.

18.07.07. Installation and Maintenance of Exclusion Devices

A. The Contractor shall install nesting exclusion devices to prevent potential establishment or occurrence of a nest during the construction period. The Contractor shall maintain all nesting exclusions devices, including existing ones, throughout the nesting season, or until completion of work in an area makes the devices unnecessary. The Contractor shall be responsible for the maintenance, repair, or replacement of exclusion devices until all of the work is complete. The Contractor shall remove and dispose of all exclusion devices when work in the area is complete. Any exclusion devices installed by the District prior to construction start must also be removed and disposed of by the Contractor when completion of work in the area makes the devices unnecessary, and no additional compensation will be provided therefor.

B. Bird exclusion devices shall be installed during the non-nesting season (September 1 through January 31). The Contractor shall obtain approval from the Engineer when installing bird exclusion devices during the nesting season (February 1 through August 31). All exclusion devices shall be inspected daily by the Contractor and weekly by the Contractor Biologist to ensure integrity of the devices, and to prohibit birds from nesting without causing them harm.

18.07.08. Vegetation Management for Nest Prevention

A. The Contractor is hereby notified that all areas to be cleared of vegetation may be suitable nesting habitat for migratory birds. The Contractor shall perform all necessary clearing prior to the nesting season, if at all possible. If clearing must occur during the nesting season, the Contractor shall obtain prior approval from the Engineer. If vegetation must be cut and maintained to prevent birds from nesting, it must be cut to less than 6 inches in height and removed. Cutting and removing vegetation in channels from October 15 through April 15, and as specified in project-specific permit conditions (Appendix _____), shall be limited to hand tools only, unless approved otherwise by the Engineer.

B. The Contractor is to inspect/monitor gravel areas prior to commencement of the nesting season and as frequently as necessary thereafter to provide deterrence measures and prevent nesting by birds such as killdeer. Bare areas and gravel areas shall be monitored to prevent ground-nesting birds, such as killdeer, from establishing a nest.

C. Removal of vegetation (trees, shrubs, grasses, and herbaceous plants) shall be limited to areas shown on the Drawings designated for vegetation removal unless approval is obtained from the Engineer to remove vegetation from additional areas. No vegetation shall be trimmed back unnecessarily, including trees and/or shrubs growing near the right of way, which overhang onto the work site. Such overhanging foliage shall be protected and tied back if necessary. Landscaped areas and irrigation systems outside of the construction areas shall be preserved and protected from damage by the Contractor‘s operation.

D. Wetlands (*if applicable*): Vegetation management in wetlands shall conform to the terms and conditions of all applicable permits (e.g., Section 404 permit, Section 401 Water Quality Certification, Streambed Alteration Agreement, etc.).

E. Pre-Established Vegetation Management Areas: Some areas of vegetation removal, clearing, and eradication indicated on the Drawings and in this Article may be established and cleared by the District before the Contractor‘s starting date as noted in the Notice to Begin Work (or Notice to Proceed). In these areas, the Contractor shall be responsible for the continued clearing and eradication of all resprouts.

18.07.09. Monitoring

Refer to MMRP element of the CEQA documents and regulatory permit requirements for mitigation measures related to ongoing site monitoring.

A. The Contractor is responsible for ongoing monitoring to assure that migratory birds, their active nests, eggs, and young are not harmed in any way.

B. Prior to the beginning of the nesting season, the Contractor shall inspect all project areas that may be impacted by construction and, at the direction of the Engineer, remove any inactive bird nests, with the exception of raptor nests. During the nesting season, the Contractor shall inspect all project areas that may be impacted by construction, including all vegetation, grounds, and bridge(s), with sufficient frequency as needed, to identify any new and partially-built nests.

C. The Contractor shall be responsible for the removal of any partially-built nests, with the exception of raptor nests. No birds, nests with eggs, or nests with hatchlings shall be disturbed, nor shall raptor nests be removed.

18.07.10. Submittals

A. Submit resumé of qualifications of Contractor Biologist for the Engineer's review. The Contractor Biologist's qualifications must meet the minimum requirements as specified for "Contractor Biologist" listed in Appendix ____. The resumé shall be submitted and must be favorably reviewed by the Engineer prior to any commencement of work at the site.

B. Submit migratory bird survey reports to the Engineer within two days upon completion of the survey and at least two days prior to commencement of the project-related activities.

C. Submit to the Engineer, no later than 15th day of each month, a monthly report prepared and signed by the Contractor Biologist that documents the activities of the Contractor including, at a minimum, the status of the installation, maintenance, or removal of any bird exclusion devices or protective buffer zones, and their locations, as well as report the current status of previously documented bird nests.

D. Maintain and, when requested by the Engineer, submit a log, including photo-documentation, weekly documenting the time, date, condition of nests, and any nest prevention actions taken during inspections.

E. Provide product data for nesting exclusion devices, fencing for protective buffer zones, and any shop drawings as deemed appropriate by the Engineer.

F. If Contractor wishes to modify the dimensions of any protective buffer zone, or to modify any bird exclusion device, a written proposal of such modification must be submitted for review and approval by the Engineer. The submittal must contain

the Contractor Biologist's written justification for the proposed modification and shall include a description of the anticipated effects on the active nest and nesting birds.

18.07.11. Payment

Payment should be based, to a certain extent, on the level of effort required to meet the requirements. Normally, contract language should be as indicated per Option 1; however, use Option 1 when work is minimal and consult with Construction Units and District's Biologists as necessary.

Option 1

A. Full compensation for providing all labor and materials for doing all work necessary to prevent bird nesting, including providing a qualified biologist for migratory bird monitoring and surveying; establishing, installing, maintaining, reconfiguring and removal of protective buffer zones and/or exclusion devices; and performing all other work as specified in this Article shall be included in the lump sum price bid for MIGRATORY BIRD, Bid Item No.____.

Option 2 (for incidental work)

A. Full compensation for work involved in complying with the requirements of this Article shall be considered as included in the contract prices paid for the various items of work involved and no additional time or compensation will be allowed therefor.

18.08. Other Wildlife and Fish Species

Refer to MMRP element of the CEQA documents and regulatory permit requirements for mitigation measures necessary for the protection of other special status species such as red legged frog, western pond turtle, and fish.

EXAMPLE: *The following example is from the Bollinger Bridge Project.*

A. The sensitive species that could be present along the Calabazas Creek project site include, but not limited to: western pond turtle (*Clemmys marmorata*), pallid bat (*Antrozous pallidus*), Townsend's big-eared bat (*Plecotus townsendii*) long-legged myotis (*Myotis volans*), purple martin (*Progne subis*), yellow warbler (*Dendroica petechia brewsteri*), sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperi*). The Contractor Biologist shall survey for sensitive plants and animal species in the project vicinity.

B. Animal species surveys shall be done within 30 days of construction start date. For mobile species (e.g. western pond turtle) which may

occur on-site during the work period, surveys shall be conducted as close to the start of work as is practical (no more than 7 days prior to start of work). If sensitive animals such as western pond turtles are found, the Contractor Biologist shall remove them to suitable habitat outside of the project limits. Relocating animals shall be performed in a manner consistent with the applicable California Department of Fish and Game permit.

C. If western pond turtles are observed during the pre-construction survey, the Contractor Biologist shall relocate the turtles to an appropriate location upstream of the project site. The turtles will be retained within the Calabazas Creek Watershed. In addition, the construction site will be routinely monitored for the presence of turtles in case other ~~"~~walkabouts" enter the immediate vicinity of the construction. The Contractor Biologist shall be familiar with western pond turtle biology and shall be responsible for the routine monitoring of the construction site for the presence of Western pond turtles. The Contractor Biologist shall survey the entire project area and an additional 500 feet upstream and downstream of the project area at least once every seven calendar days during construction. The surveys are to be conducted between the hours of 10 am and 3 pm to maximize detection.

D. If bat species are identified by the Contractor Biologist during the pre-construction survey as using the bridge, the District will provide a replacement roosting facility in the form of either a bat house or several bat boxes, immediately adjacent to the project site to the extent feasible. The District will be responsible for monitoring the replacement roosting facility to document bat utilization.

18.09. Payment

A. Unless noted otherwise, full compensation for work involved in complying with all requirements under Section 18 shall be considered incidental and included in the contract prices paid for the various items of work involved and no additional time or compensation will be allowed therefor.

SECTION 19. QUALITY ASSURANCE REQUIREMENTS

19.01. Submittal Procedures

A. This Article includes requirements and procedures for preparing and submitting submittals, including shop drawings, product data, samples, testing plans, preconstruction submittals, and other information required by the Contract Documents.

19.01.01. General Requirements

A. Submittals shall be in accordance with Article 9.02 of the Standard Provisions unless otherwise modified herein.

B. Master Submittal List: Within 30 days after the Notice to Begin Work, the Contractor shall submit a master submittal list (6 paper and 6 electronic copies on diskette or CD) to the Engineer for review and approval. This list shall be in Microsoft Excel spreadsheet format and identify all originally planned submittals. The purpose of this list is to assist planning for submittal creation and review. Items on this list shall be arranged in the same order as these Specifications and shall include as a minimum the following information:

1. Item number.

2. Reference specification section number and paragraph.

3. Product, material, or description.

4. Original preparer of the submittal, as designated by the Contractor. Name, address, telephone number, and fax number of each preparer shall be appended to this master submittal list.

5. Estimated date for submission to the Engineer by the Contractor.

C. The Contractor shall identify in the master submittal list the submittals that may require long lead times for manufacturing and/or delivery and that must be submitted early to the Engineer for review.

D. Immediate Submittals

For projects that require the immediate submission of certain submittals after the Notice to Begin Work, identify and list these submittals here. Include and reference liquidated assessments for delay in submitting these submittals.

The Contractor shall submit the submittals listed below within 45 days after the date of the Notice to Begin Work. See Article 11.07 for Liquidated Damage assessment for delay in submitting these submittals.

EXAMPLE:

1. Section XX—Stormwater Pollution Prevention Plan
2. Section XX—Injury and Illness Prevention Plan
3. Section XX—Valve Vault Shoring
4. Section XX—Structural Steel for Reservoir Roof Structure
5. Section XX—Vertical Mixed Flow Pump
6. etc.

E. Make other submittals promptly in accordance with the approved project progress schedule, and in such sequence as to cause no delay in the work. The time allowed by the Contractor for submittal review shall also provide sufficient time for disapproval and resubmission.

F. The Contractor shall make a complete and acceptable submittal to the Engineer at least by the second submission. The cost associated with re-review of submittal due to Contractor's failure to comply with submittal requirements shall be borne by the Contractor per Standard Provision Article 9.02. The multiplier to be applied to the actual wages of the Engineer and/or Engineer's consultant will be X.XX.

Confirm with the Technical Review Committee for the most current multiplier. This number, provided by the Budget Office each fiscal year, includes the benefits and general fund overhead rates.

EXAMPLE:

G. Each submittal, appropriately submitted in accordance with this Article, will be returned within XX days following receipt of submittal by the Engineer.

Article 9.02 of Standard Provisions specifies 20 days for submittal return. Determine if this is adequate based on project specifics. If not, include a different return period here. A submittal return period that falls outside the 20 to 30 days range is probably unreasonable.

H. The number of copies of submittals described here supersedes the submittal copy requirements described in Standard Provisions Articles 9.02 and 10.03. The number of copies required is as follows:

1. Shop drawings and product data: Sufficient copies to allow 5 copies to be retained by the Engineer plus 1 copy to be returned to the Contractor for Contractor's use.

2. Samples: Sufficient numbers to allow 2 samples of all structural and architectural products involving color, finish, texture, or the like, and 1 sample of other products to be retained by the Engineer plus 1 sample to be returned to the Contractor for Contractor's use.

3. It shall be the Contractor's responsibility to copy and/or conform reviewed submittals in sufficient numbers for its files, subcontractors, and vendors.

4. For up to 20 selected submittals, the Engineer will request additional copies of submittal for use by the Engineer and District—up to 10 copies in total. The Contractor shall provide these additional copies.

Articles 9.02 and 10.03 of Standard Provisions specify 5 copies of each submittal required. Determine if this is adequate based on the project specifics. If not, provide additional requirements. The above paragraph is an example.

19.01.02. Shop Drawings, Product Data, and Samples

A. Shop Drawings

1. Shop drawings include, but are not necessarily limited to, custom-prepared data such as fabrication on erection/installation (working) drawings, scheduled information, setting diagrams, actual shop work manufacturing instructions, custom templates, special wiring diagrams, coordination drawings, individual system or equipment inspection and test reports including performance curves and certifications, as applicable to the work.

2. Submittal of shop drawings by simply annotating copies of the Contract Drawings is subject to rejection.

B. Product Data

1. Product data as specified in individual Sections or Articles, include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data or ~~c~~uts"), such as the manufacturer's product specification and installation instructions, availability of colors and patterns, manufacturer's printed statements of compliance and applicability, roughing-in diagrams and templates, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare parts listing and printed product warranties, as applicable to the work.

C. Samples

1. Samples specified in individual Sections or Articles, include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens of coordination of visual effect, graphic symbols and units of work to be used by the Engineer or others for independent inspection and testing, as applicable to the work.

D. Concrete Reinforcement Submittals

1. Submittals for concrete reinforcement shall not simply be annotated copies of the Contract Drawings. New scale drawings shall be prepared showing plans, all vertical structure elevations, sections, and details as required to clearly delineate the reinforcing to be furnished and installed. Submittals shall show and tabulate reinforcement dimensions, sizes, grades, shapes, splices, laps, splice locations, dowel lengths, and all similar information needed for construction, material take-offs, and Engineer‘s review to determine compliance with the structural design. Submittals shall show reinforcement dimensioning and placement which reflects the Contractor‘s intended and approved concrete placement sequence.

E. Electrical and Instrumentation Equipment Submittals

1. Submittals as described herein shall be provided for all electrical and instrumentation equipment and systems furnished as part of products and systems specified in these Specifications. These submittals shall include, but not necessarily be limited to, the following:

   a. Equipment list tabulating all components furnished followed by the manufacturer‘s name, manufacturer‘s model number, and a cross reference to its location on the submittals.

   b. A complete conduit riser diagram and conduit schedule shall be prepared and submitted for the interconnection of all electrically powered equipment. The riser diagram and conduit schedule shall detail conduit identification numbers as shown on the Drawings, size, wires, and location. Where the riser diagram requires either more wires or larger conduits than detailed in the Drawings, the Contractor shall coordinate any required changes with the electrical subcontractor, if any, before installation begins.

   c. Interior and exterior panel elevation drawings for all panels, consoles, and equipment enclosures. The elevations shall be drawn to scale and detail all equipment in or on the panel. Nameplates, conduit access locations, mounting provisions, panel construction details, manufacturers model number, panel color (or color samples), shall be included.

d. Drawings and descriptive data and brochures of each item of equipment. Electrical characteristics and requirements, enclosure types, manufacturer and model number shall be included. Sheets or drawings showing more than the particular item under consideration shall have crossed out all but the description of the item for which review is requested.

e. Schematics and connection diagrams. A manufacturer‘s standard connection diagram or schematic showing more than one scheme of connection will not be accepted, unless it is clearly marked to show the intended work-specific connections. Terminal numbers shall be included. A written operation theory shall be included for all complex control schemes.

2. For each instrument furnished with mechanical systems, submittals shall include an ISA S20 Data Sheet, and technical bulletins or brochures. The summary data sheets and the technical bulletins shall include, but not necessarily be limited to:

a. Tag numbers per the Process and Instrumentation Drawings.

b. The manufacturer‘s model or other ordering designation.

c. Product (item) names used on the Drawings.

d. Physical location where installed.

e. Input-output characteristics.

f. Range, size, and graduations as required.

g. Physical size with dimensions and mounting details.

h. Quantity and quality requirements for electric power, air, and/or water supply.

i. Materials of construction of components in contact with or otherwise exposed to the process.

j. Certified calibration and/or calibration curves where applicable.

k. Detailed Instrumentation, Systems, and Automation Society (ISA) loop wiring diagrams showing requirements for each instrument which is furnished under this Section. The diagram shall identify all device terminal points as well as any intermediate terminal blocks. Power supplies, loop grounds, wire/cable number, etc., shall be detailed. Such loop wiring diagrams shall be prepared per ANSI/ISA-S5.4. Optional items 1, 3, 4, 6, and 7 from

paragraph 5.3 of S5-4 are also required. Note that the District loop numbering protocol used in these documents and required for submittals does not comply with ISA standards.

3. Submittal of motor data for acceptance shall include complete nameplate data in accordance with NEMA Standards and, in addition, the following information for motors typical of the units furnished:

   a. Ambient temperature setting.
   b. Service factor.
   c. Efficiency at 1/2, 3/4 and full load.
   d. Power factor at 1/2, 3/4 and full load.
   e. Motor outline, dimensions and weight.
   f. Descriptive bulletins, including full description of insulation system.
   g. Bearing design data.
   h. Special features (i.e., space heaters, temperature detectors, etc.).

19.02. Quality Control

A. This Article includes quality control requirements and procedures for materials, products, equipment, and workmanship; inspection procedures and limitations; sampling and testing of materials; and Contractor‘s quality assurance/quality control program.

19.02.01. Materials, Product, Equipment, and Workmanship

A. All materials, products, and equipment shall be new, of the specified quality, and free of defects. Where samples have been submitted, the materials, products, and equipment incorporated into the work shall be equal to the samples that have been approved. Should materials, products, and equipment required by the work not be specified or described on the Drawings, the Contractor shall provide materials, products, and equipment of a high generally accepted quality standards that are comparable to the work and meet the identifiable needs of the work.

B. Materials, products, equipment, and work not conforming to the requirements of the Contract Documents shall be considered defective and will be subject to rejection. Defective materials, products, equipment and work, whether in place or not, shall be removed immediately from the site by the Contractor, at no additional cost to the District.

C. Perform and complete work in a careful, thorough manner.

   1. The Contractor shall report apparent errors, conflicts, discrepancies, or omissions in the Contract Documents to the Engineer and request instructions before proceeding with the work.

2. Engineer will issue written clarification or interpretation of Contract Document requirements in response to Contractor‘s requests and other sources of information.

D. Materials, products, and equipment that are specified to require testing and inspection at the point of origin shall receive and pass such testing and inspection prior to being shipped to the project site.

19.02.02. Inspection

A. All work, materials, products, equipment, and functionality are subject to testing by the Engineer. Inspection of the work or receipt of payment shall not relieve the Contractor of the obligation to fulfill all conditions of the Contract, and improper work shall be subject to rejection. Work and materials, products, and equipment not complying with the Contract Documents shall be corrected or removed and replaced with conforming work, materials, products, and equipment at no additional cost to the District.

B. Inspection does not waive or alter the requirements or provisions of the Contract Documents.

C. Inspection does not include the Contractor‘s means, methods, techniques, sequences, or procedures for construction.

19.02.03. Sampling of Materials

A. The Contractor shall furnish samples of materials as specified and as requested by the Engineer at no additional cost to the District. Samples will be obtained and tested whenever necessary to determine the quality of the material and compliance with the Contract Documents.

B. The Contractor shall assist the Engineer, District staff, regulatory agency personnel and third parties in collecting or providing samples.

C. The Contractor shall not use materials specified to be tested in the work until such testing indicates satisfactory compliance with the Contract Documents.

19.02.04. Testing Services

A. Prior to the Contractor performing any test that require the services of an independent laboratory, the Contractor must first obtain written approval from the Engineer to utilize such independent commercial testing firm. Such laboratory is to be listed in the Contractor‘s QA/QC Program as detailed herein. The testing firm‘s laboratory shall be staffed with experienced technicians, properly equipped and fully qualified to perform the tests in accordance with the specified standards. Any and all personnel that are expected to perform such tests must be listed in the Contractor‘s QA/QC Program with resumes detailing each individual‘s experience.

B. The Contractor shall pay all costs for these testing services.

C. The Contractor's independent testing laboratory shall be accredited by the American Association of State Highway and Transportation Officials (AASHTO) for the tests they will perform and as appropriate to the construction work being performed. The Contractor's laboratory shall also be AASHTO accredited in: ASTM C1077, "Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation"; ASTM D3740, "Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design/Construction"; and ASTM D3666, "Specifications for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials."

D. The Engineer shall have the right to inspect work performed by the independent testing laboratory both at the Project and at the laboratory. This shall include inspection of the independent testing laboratory's internal quality assurance records (quality assurance manual, equipment calibrations, proficiency sample performance, etc.).

E. Testing Services furnished by Contractor: Unless otherwise specified, and in addition to all other specified testing requirements, the Contractor shall obtain independent testing services to complete the following testing at no additional cost to the District. Test reports shall be submitted in accordance with Article 19.01. Testing shall be completed in accordance with the specified standards. Where no standard is specified, testing shall be completed in accordance with the applicable ASTM standards.

1. Concrete materials and mix designs.

2. Expansion and adhesive anchorage testing.

3. Classification tests for embankment, fill, backfill, and aggregate base being used (or proposed for use) in the work.

4. Quality control testing of all precast concrete.

5. All other tests and engineering data required for Engineer's review of materials and equipment proposed to be used in the work.

6. Other testing as required in the Contract Documents.

F. Transmittal of Test Reports: Written reports of tests and engineering data furnished by Contractor for Engineer's review of materials and equipment proposed to be used in the work shall be submitted as specified in Article 19.01.

G. The testing firm retained by Contractor for material testing shall furnish five copies of written report of each test. Three copies of each test report will be

transmitted to the Engineer within three Work Days after each test is completed. Each report for each type of test shall be consecutively numbered.

19.02.05. Testing by District

A. Testing services provided by District, if any, are for the sole benefit of District. The District will obtain independent testing services to perform routine testing of materials and all costs therefore will be borne by the District at no cost to the Contractor except that the costs of any retest resulting from unsatisfactory test results shall be backcharged to the Contractor. Testing will include:

1. Routine tests as determined by the Engineer to confirm compliance with the Contract Documents.

2. Soil moisture content and in-place soil compaction.

3. Concrete air content, slump, compressive strength, shrinkage, and other properties.

4. Masonry mortar and grout compressive strength.

5. Coating thicknesses.

B. The Engineer will furnish the Contractor one copy of each field and laboratory QA/QC test that is performed by the District.

19.02.06. Plumbing and Piping Quality

A. The Contractor shall consult with industry and manufacturer‘s representatives for all piping materials being used in the work. The purpose of this consultation is to ensure that Contractor‘s personnel are fully trained, knowledgeable, possess written instructions on proper assembly, and have all of the recommended tools for quality work. Consultation shall also include discussions between industry and manufacturer‘s representatives and Contractor management and construction staff on the causes of past plumbing and piping failures and problems and methods of avoidance. The Contractor shall provide training for its forces as required to produce consistent, high quality work, without failed tests and warranty problems.

19.02.07. Right of Rejection

A. In accordance with Standard Provisions Article 9.01 the Engineer shall have the right at all times and places to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the work at the Site.

B. If the Contractor fails to promptly remove and replace rejected work, the Engineer may, after 7 Days notice, terminate the Contractor‘s right to proceed with the affected work. The Engineer may remove and replace the affected work with District resources. The Engineer will issue a backcharge to the Contractor covering the District‘s cost for performing the work in accordance with Standard Provisions Article 9.08.

19.02.08. Contractor’s Quality Assurance/Quality Control Requirements

Not all projects require a Contractor’s QA/QC program. QA/QC programs may be required on large and complicated projects or federal funded projects.

A. The Contractor shall establish and execute a Quality Assurance/Quality Control (QA/QC) program for the services that are being procured from the Contractor. The program shall provide the Contractor with adequate measures for verification of and conformance to defined Contract requirements by the Contractor‘s personnel and lower-tier subcontractors (including fabricators, suppliers, and sub-subcontractors). This program shall be described in a Plan responsive to this Section.

B. Within the submittal requirements under Article 19.01, the Contractor shall furnish the Engineer a project specific QA/QC Plan. The QA/QC Plan shall contain a comprehensive account of Contractor‘s QA/QC procedures as applicable to this work. The detailed requirements for this QA/QC Plan are delineated in the following paragraphs. No payments will be made to the Contractor until the QA/QC Plan is fully accepted by the Engineer.

C. The QA/QC Plan shall describe and define the personnel requirements described herein. The Contractor shall provide personnel with assigned QA/QC functions reporting to a Field QA/QC Representative. The Field QA/QC Representative shall report to a senior manager of the Contractor and shall have no supervisory or managerial responsibility over the work force. Persons performing QA/QC functions shall have sufficient qualifications and organizational freedom to identify quality problems and to initiate and recommend solutions. The Field QA/QC Representative(s) shall be on-site as often as necessary (but not less than the daily hours specified in the Contract Documents) to remedy and demonstrate that work is being performed properly and to make multiple observations of all work in progress. The QA/QC Plan shall include a statement by the Contractor‘s senior manager designating the Field QA/QC Representative(s) and specifying the authority delegated to the Field QA/QC Representative to direct cessation or removal and replacement of defective work.

D. The Contractor‘s QA/QC program shall ensure the achievement of adequate quality throughout all applicable areas of the Contract. The QA/QC Plan shall describe the program and include procedures, work instructions and records. In addition, the Plan shall describe methods relating to areas that require special testing and procedures as noted in the Specifications.

E. Identification and Control of Items and Materials: Procedures to ensure that items or materials that have been accepted at the site are properly used and installed shall be described in the QA/QC Plan. The procedures shall provide for proper identification and storage, and prevent the use of incorrect or defective materials.

F. Inspection and Tests: The Contractor shall have written procedures defining a program for control of inspections performed and these procedures shall be described in the QA/QC Plan.

1. Inspections and tests shall be performed and documented by qualified individuals. At a minimum, ~~"~~qualified" shall mean having performed similar QA/QC functions on similar type projects. Records of personnel experience, training and qualifications shall be maintained and made available for review by the Engineer upon request.

2. The Contractor shall maintain and provide to the Engineer, within two working days of completion of each inspection and test, adequate records of all such inspections and tests. Inspection and test results shall be documented and evaluated to ensure that requirements have been satisfied.

3. The Contractor is to immediately inform the Engineer of all test results obtained in the field. All such information is to be shared with the Engineer at the time of each inspection and test. The Contractor is required to submit a Daily QC Report (as detailed below in Paragraph No. 4b) at the end of each working day or no later than prior to the beginning of the next working day.

4. Procedures shall include:

   a. Specific instructions defining procedures for observing all work in process and comparing this work with the Contract requirements (organized by specification section).

   b. Maintaining and providing Daily QC Reports. Such reports shall, at a minimum, include the following:

      (1) Item(s) inspected
      (2) Quality characteristics in compliance
      (3) Quality characteristics not in compliance
      (4) Corrective/remedial actions taken
      (5) Statement of certification
      (6) Field QC Representative's signature

   c. Specific instructions for recording all observations and requirements for demonstrating through the reports that the work observed was in compliance or a deficiency was noted and action to be taken.

d. Procedures to preclude the covering of deficient or rejected work.

e. Procedures for halting or rejecting work.

f. Procedures for resolution of differences between the Field QA/QC Representative(s) and the production representative(s).

5. The QA/QC Plan shall identify all contractual hold/inspection points as well as any Contractor imposed hold/inspections points.

6. The QA/QC Plan shall include procedures to provide verification and control of all testing provided by Contractor including:

a. Maintaining and providing to the Engineer Daily Testing Records. Such records shall, at a minimum, contain the following:

(1) Date and time of test
(2) Item(s) tested
(3) Quality characteristics in compliance
(4) Statement of correctness & certification
(5) Quality characteristics not in compliance
(6) Corrective/remedial actions taken
(7) Field QC Representative‘s signature

Such records are to be completed and submitted to the Engineer at the end of each working day but no later than prior to the beginning of the following workday.

b. Individual test records will contain the following information:

(1) Date and time of test
(2) Item tested –item number and description
(3) Test results
(4) Test designation
(5) Test work sheet including location sample was obtained
(6) Acceptance or rejection
(7) Date sample was obtained
(8) Retest information, if applicable
(9) Control requirements
(10) Tester signature
(11) Initials of Contractor‘s staff completing this testing

c. Providing for location maps for all tests performed or location of work covered by the tests.

d. Maintaining copies of all test results.

e. Ensuring Engineer receives independent copy of all tests.

f. Ensuring testing lab(s) are functioning independently and in accordance with the specifications.

g. Ensuring re-tests are properly taken and documented.

G. Control of Measuring and Test Equipment: Measuring and/or testing instruments shall be adequately maintained, calibrated and adjusted to maintain accuracy within prescribed limits. Calibration shall be performed at specified periods against valid standards traceable to nationally recognized standards and documented.

H. Supplier Quality Assurance: The QA/QC Plan shall include procedures to ensure that procured products and services conform to the requirements of the Specifications. Requirements of these procedures shall be applied, as appropriate, to lower-tier suppliers and/or subcontractors.

I. Deficient and Nonconforming Work and Corrective Action: The QA/QC Plan shall include procedures for handling of Deficiencies and Non-conformances. Deficiencies and Non-conformances are defined as documentation, drawings, material, equipment or work not conforming to the contractually specified requirements or procedures. The procedure shall prevent Non-conformances by identification, documentation, evaluation, separation, disposition and corrective action to prevent recurrence. Conditions having adverse effects on quality shall be promptly identified and reported to the Contractor‘s senior level management and the Engineer. The cause of conditions adverse to quality shall be determined and documented and measures implemented to prevent recurrence. In addition, at a minimum, this procedure shall address:

1. Personnel responsible for identifying deficient and non-complying items within the work.

2. How and by whom deficient and non-compliant items are documented ~~in~~ the field.”

3. The personnel and process utilized for logging deficient and non-compliant work at the end of each day onto a Deficiency Log.

4. Tracking processes and tracking documentation for deficient and non-compliant items.

5. Personnel responsible for achieving resolution of outstanding deficiencies.

6. Once resolved, how are the resolutions documented and by whom.

J. Special Processes and Personnel Qualifications

1. The QA/QC Plan shall include detailed procedures for the performance and control of special process (e.g. welding, soldering, heat treating, cleaning, plating, nondestructive examination, etc.).

2. Personnel performing special process tasks shall have the experience, training and certifications commensurate with the scope, complexity, or nature of the activity. The Engineer shall approve them before the start of work on the Project.

K. Audits: The Contractor‘s QA/QC program shall provide for documented audits to verify that QA/QC procedures are being fully implemented by the Contractor as well as its subcontractors and suppliers. Audit records shall be made available to the Engineer upon request.

L. Documented Control/Quality Records:

1. The Contractor shall establish methods for control of Contract Documents, which describe how Drawings and Specifications are received and distributed to assure the correct issue of the document being used. The methods shall also describe how as-built data are documented and furnished to the Engineer.

2. The Contractor shall maintain evidence of activities affecting quality, including operating logs, records of inspections and tests, audit reports, material analyses, personnel qualification and certification records, procedures, and document review records.

3. Quality records shall be maintained in a manner that provides for timely retrieval, and traceability. Quality records shall be protected from deterioration, damage, and destruction.

4. The Contractor shall provide a list with specific records as specified in the Contract Documents, which will be furnished to the Engineer at the completion of activities.

M. Acceptance of QA/QC Plan: Engineer‘s review and acceptance of the Contractor‘s QA/QC Plan shall not relieve the Contractor from any of its obligations for the performance of the work. The Contractor‘s QA/QC staffing is subject to the Engineer‘s review and continued acceptance. The Engineer, at its sole option, without cause, may direct the Contractor to remove and replace the Field QA/QC Representative. No work covered by the QA/QC Plan shall start until Engineer‘s acceptance of Contractor‘s QA/QC plan has been obtained.

N. Engineer may perform independent quality assurance audits to verify that actions specified in Contractor‘s QA/QC Plan have been implemented. No Engineer audit finding or report shall in any way relieve Contractor from any requirements of this Contract.

19.03. Product Requirements

A. This Article includes general product requirements and requirements for delivery, storage, packing, loading, unloading, transportation, protection, and selection of materials and equipment. Additional specific requirements for delivery, handling, protection, loading, and unloading may be specified with the technical specification for materials and equipment.

B. Contractor‘s attention is directed to Article 10.10 – Equal, Sole or Single Source, and Substitution.

19.03.01. General Product Requirements

A. Only new materials and equipment shall be incorporated into the work. All materials and equipment furnished by Contractor shall be subject to the inspection and approval of the Engineer. No material or equipment shall be delivered to the work without prior approval of submittals by the Engineer.

B. Provide products by same manufacturer when products are of similar nature, unless otherwise specified. Provide identical products when products are required in quantity. Provide products with interchangeable parts whenever possible.

C. Require each equipment manufacturer to have maintenance facilities meeting the following requirements:

1. Minimum 3 years operational experience.
2. Location in continental United States.
3. Equipment and tools capable of making repairs.
4. Staff qualified to make repairs.
5. Inventory of maintenance spare parts.

19.03.02. Transportation and Delivery

A. The Contractor shall:

1. Transport and handle items in accordance with manufacturer‘s instructions.

2. Schedule delivery to reduce long-term on-site storage prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer.

3. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged, or sensitive to deterioration.

4. Deliver products to the site in manufacturer‘s original sealed containers or other packing systems, complete with Material Safety Data Sheets (MSDS) and instructions for handling, storing, unpacking, protecting, and installing.

B. The Contractor may store his/her equipment and materials only in those locations approved by the Engineer. The Contractor will be responsible for maintaining and restoring any areas as required by the Engineer.

C. All items delivered to the site shall be unloaded and placed in a manner which will not: (1) hamper the Contractor‘s normal construction operation or those of subcontractors and other contractors; (2) interfere with the flow of necessary traffic; and (3) interfere with District‘s normal operations and maintenance activities. In addition, the Contractor shall:

1. Provide necessary equipment and personnel to unload all items delivered to the site.

2. Promptly inspect shipment to assure that products comply with requirements, quantities are correct and items are undamaged. For items furnished by others (i.e., District, other Contractors), perform inspection in the presence of the Engineer. Notify Engineer verbally, and in writing, of any problems.

19.03.03. Storage and Protection

A. Store and protect products in accordance with the manufacturer‘s instructions, with seals and labels intact and legible. Storage instructions shall be studied by the Contractor and reviewed with the Engineer. Instructions shall be carefully followed by the Contractor. Arrange storage to permit ready access for inspection by the Engineer.

B. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

C. Cement, lime, and similar moisture sensitive materials shall be stored under a roof and off the ground and shall be kept completely dry at all times. All structural, miscellaneous, and reinforcing steel shall be stored off the ground or otherwise to prevent accumulations of dirt or grease and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical. Precast concrete shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping or cracking. Brick, block, and similar masonry products shall be handled and stored in a manner to reduce breakage, cracking, and spalling to a minimum.

D. All mechanical and electrical equipment and instruments subject to corrosive damage by the atmosphere if stored outdoors (even though covered) shall be stored in a weathertight building to prevent damage. The building may be a

temporary structure on the site or elsewhere, but it must be newer than 5 years old, recently painted in a neutral color, and no larger than required. This building shall be provided with adequate ventilation to prevent condensation. Maintain temperature and humidity within range required by the equipment or instrumentation manufacturer.

1. All equipment shall be stored fully lubricated with oil, grease, and other lubricants unless otherwise instructed by the manufacturer.

2. Moving parts shall be rotated in accordance with the manufacturer‘s instructions to ensure proper lubrication and to avoid metal-to-metal ~~w~~elding.” Upon installation of the equipment, the Contractor shall start the equipment, at least half load, once weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.

3. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants shall be put into the equipment at the time of acceptance.

4. Prior to Project Completion, the Contractor shall have the manufacturer inspect any equipment valued at more than $2,500 and stored longer than 3 months and certify that its condition has not been detrimentally affected. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested, and accepted in a minimum time period. As such, the manufacturer shall guarantee the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor‘s expense. Certification does not relieve the Contractor from meeting all testing requirements.

E. Material and equipment storage areas shall be suitably fenced and secured, if necessary, to protect the public, workers, District staff, and the materials and equipment from damage or theft.

F. Unless otherwise designated in the Contract Documents, locations and arrangements for storage sites for materials and equipment outside the District‘s property lines, limits of work, or right-of-way, shall be selected and maintained by the Contractor at Contractor‘s expense. Full compensation for furnishing such storage sites as may be necessary or required by the Contractor shall be considered as included in bid price and no additional compensation shall be allowed therefor. District shall be specifically exempted in any agreement from any liability incurred from the use of private property for construction purposes. Use of portions of the District‘s area at the site for materials and equipment storage shall be permitted only upon the approval of the Engineer.

G. The storage and handling of potential pollutants and hazardous materials, including, but not necessarily limited to, gasoline, diesel, oils, paint, and solvents, shall be in accordance with all local, State, and Federal laws and other requirements. Temporary special storage enclosures, double walled tanks, berms, or other protective facilities shall be provided as required by law. All hazardous materials shall be stored and handled in strict accordance with the Material Safety Data Sheets for each product. A copy of each Material Safety Data Sheet shall be submitted to the Engineer at the time of delivery of the products to the project site. See Section 17 for Storm Water Pollution Prevention requirements.

H. All materials and equipment which, in the opinion of the Engineer, have become so damaged as to be unfit for the use intended or specified, shall be promptly removed from the site of the work, and the Contractor shall receive no compensation for the material or equipment so removed or its removal costs.

SECTION 20. PAYMENT PROCEDURES

20.01. Schedule of Bid Items

20.01.01. General Requirements

A. Refer to Attachment A, Proposal Form, for the listing of Bid Items.

B. Unless otherwise indicated, all bid items include labor, materials, tool, equipment, and incidentals in accordance with the Drawings and Specifications to complete the items.

C. No separate payment will be made for any item that is shown on the Drawings and/or specified in these Specifications but not specifically set forth in Schedule of Bid Items, and all cost therefor shall be included in the prices named in the Schedule of Bid Items for the various appurtenant items of work.

D. Where there is an overlap in the work paid for under different bid items, the work will be paid for only once under the appropriate bid item(s), as determined by the Engineer.

20.01.02. Description of Bid Items

EXAMPLE:

1. Bid Item No. 1—MOBILIZATION
2. Bid Item No. 2—CLEARING AND GRUBBING
3. Bid Item No. 3—AQUA AMMONIA TREATMENT SYSTEM
4. Bid Item No. 4—CONCRETE FLOODWALL
5. …

Listing of bid items may be expanded to include detailed description of work and measurement and payment methods, if not done so in the Technical Provisions. The example below may be more applicable to multi-discipline projects.

EXAMPLE:

1. Bid Item No. 1—MOBILIZATION

   a. Scope of work: This bid item shall include all preparatory work and appurtenant preconstruction operations, including, but not limited to those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; building and removing any temporary construction areas; installation and removal of temporary facilities necessary for work on the Project; other work and operations which must be performed or costs incurred prior to beginning work on the various Contract

items on the project site; and other work as specified in these Specifications.

b. Measurement and Payment: Full compensation for furnishing all work and materials for Mobilization shall be included in the lump sum price bid for MOBILIZATION, Bid Item No. 1. Progress payments will be made in accordance with Section 11 of the State Specifications.

c. Refer to Sections __ and __.

2. Bid Item No. 2—CLEARING AND GRUBBING

a. Scope of work: This bid item include furnishing all labor, materials, tools, equipment, and incidentals necessary for doing clearing and grubbing as shown on the Drawings and specified in these Specifications. It shall include clearing and grubbing only those areas where construction is required including removal and plugging of abandoned facilities, removal and disposal of trees where designated, removal and disposal of debris, fences, rubble, asphalt pavement, and all objectionable materials from the work site, and other miscellaneous work as required.

b. Measurement and Payment: Full compensation for furnishing all labor and materials for Clearing and Grubbing shall be included in the lump sum price bid for CLEARING AND GRUBBING, Bid Item No. 2.

c. Refer to Sections __, __, and Plans.

3. Bid Item No. 3—AQUA AMMONIA TREATMENT SYSTEM

a. Scope of work: This bid item includes furnishing all labor, materials, tools, equipment, and incidentals necessary to construct the Aqua Ammonia Treatment System as shown on the Drawings and specified in these Specifications. It shall include all work within the aqua ammonia containment area: structural excavation, structural backfill, concrete containment structure; tanks, pumps, piping, instrumentation, equipment and appurtenances; local control panels; seismic anchorage of tanks, piping, and other equipment; electrical wiring and conduit; chemical resistant coatings; testing, startup, O&M manuals, spare parts and all training required for the aqua ammonia system.

b. Measurement and Payment: Full compensation for furnishing all labor and materials for the Aqua Ammonia Treatment System

shall be included in the lump sum price bid for AQUA AMMONIA TREATMENT SYSTEM, Bid Item No. 3.

c. Refer to Sections __, __, __, __, and Plans.

4. Bid Item No. 4—CONCRETE FLOODWALL

a. Scope of work: This bid item includes furnishing all labor, materials, tools, equipment, and incidentals necessary to construct the concrete floodwall as shown on the Drawings and specified in these Specifications. It shall include structural excavation, structural backfill, permeable materials, architectural treatment, concrete, color concrete, samples, and other incidental work as required.

b. Measurement and Payment: Measurement shall be by the cubic yard of concrete floodwall computed from neat line dimensions shown on the Drawings. Full compensation for furnishing all labor and materials to install the floodwall shall be included in the unit price per cubic yard of CONCRETE FLOODWALL, Bid Item No. 4.

c. Refer to Sections __, __, and Plans.

20.02. Progress Payments and Schedule of Values

This Article applies only to projects that include lump sum items, or projects that will be paid for on a lump sum basis.

A. This Article includes requirements for the preparation, format, and submission of the Schedule of Values.

B. Progress payments will not be made until the Schedule of Values has received favorable review by the Engineer.

C. No progress payment made to the Contractor or its sureties will constitute a waiver of the liquidated damage under Article 7.06 of these Specifications.

20.02.01. Preparation

A. Prepare preliminary and final Schedule of Values identifying costs of all bid items. For lump sum bid items, include costs of all major components of work under that bid item. No component of lump sum bid items shall have a duration exceeding 15 days except concrete curing, submittal review, equipment fabrication, and deliveries, or a value greater than $50,000.

B. Assign prices to major components of lump sum bid items totaling the bid item price. Base prices on costs associated with scheduled activities based on the Progress Schedule for each major component of work. Each bid item and each component of lump sum bid items shall include a directly proportional amount of the Contractor's overhead and profit. The Contractor's overhead and profit shall be completely distributed among all bid items of work, including components of lump sum bid items. Provide additional cost documentation to the Engineer when requested so that values can be verified.

C. Submit the preliminary Schedule of Values within 14 days from the date of the Notice to Begin Work and revise to incorporate Engineer's comments until a final Schedule of Values is agreed upon. This information shall be used in the preparation of the Progress Schedule under Section 11.

D. For all construction change order authorizations, provide change order authorization breakdown to append to the final Schedule of Values items for at least the following components: (a) site work, (b) structure, (c) electrical, (d) mechanical, (e) instrumentation, (f) heating, ventilation, and air conditioning, (g) demolition, (h) submittals, operation and maintenance manuals, and training; and (i) testing and startup. Provide additional cost documentation to the Engineer when requested.

E. The Contractor shall not change the final approved Schedule of Values without the approval of the Engineer. The Schedule of Values has a one-to-one direct relationship to the list of activities on the Contractor's Progress Schedule. Additions or deletions of activities on the Contractor's Progress Schedule will require an addition or deletion of line item value to the Schedule of Values. The Contractor must submit requested changes to the approved Schedule of Values to the Engineer for approval.

F. The Contractor shall list and maintain all values for items of equipment that will be submitted for material on-site payment separately on the Schedule of Values and on the Progress Schedule. These material items will not be ~~"p~~rogressed" as a part of the physical progress assessment.

20.02.02. Submittals

A. Submit corrected Schedule of Values within 10 days upon receipt of reviewed Schedule of Values comments, but no later than 10 days prior to anticipated submittal of the first Application for Payment.

20.02.03. Preliminary Schedule of Values

A. Table 20.02.03.A below is an acceptable form for the preliminary Schedule of Values.

B. The preliminary and final Schedule of Values shall be prepared into a Microsoft Excel format onto 8½-inch by 11-inch paper. Identify the schedule with:

1. Project Name and Project No.
2. Name and address of Contractor.
3. Date of submission.

20.03. Cost Summaries

A. Prepare a ―Summary of Cost Information" on each major item of work listed in the Schedule of Values. Identify the value of work completed for both the payment period and job to date.

B. Prepare a ―Cash Flow Summary," and a corresponding ―Cash Flow ―S' Curve," indicating the total dollar amount of work planned for each month of the Project. Equate sum of monthly amounts to the Total Bid Price. Update the Cash Flow Summary and Cash Flow ―S" Curve every 60 days or as directed by the Engineer.

20.04. Partial Payment—Inclusion of Materials On-Site

A. Payments will be made by the District to the Contractor for materials and equipment furnished and delivered to the site by the Contractor and not yet incorporated into the work subject to the following requirements:

1. Materials, as used herein, shall be considered to be those items that are fabricated and manufactured goods and equipment. Only those materials for which the Contractor can transfer clear title to the District will be qualified for partial payment. Temporary construction materials (e.g., shoring) do not qualify for partial payment. Materials that are not on site will not be considered for payment.

2. Only materials that have received favorable review of submittals will qualify for consideration.

3. Eligible materials must be delivered, properly stored, protected, and maintained in a manner favorably reviewed by the Engineer at the site.

4. Only the Contractor's actual net cost for materials may be paid prior to inclusion in the work. The Contractor's actual net cost for the materials must be supported by furnished invoices of suppliers, and other documentation requested by the Engineer.

5. Materials delivered to the site less than 30 days prior to their scheduled incorporation shall not qualify for partial payment consideration.

6. Final payment shall be made only for materials actually incorporated into the work. Upon acceptance of the work, all materials remaining for which advance payments had been made shall revert to the Contractor, unless otherwise agreed, and partial payments made for these items shall be deducted from the final payment for the work.

7. Partial payments for materials on site shall not be deemed to be final payment for the material nor relieve the Contractor of its obligations under the Contract.

8. Partial payments for materials on site shall be subject to retention per Article 8.03.

9. See Article 20.05 for additional documentation required for partial payment for materials on site.

20.05. Applications for Payment

A. This includes procedures for the preparation and submission of monthly Applications for Payment.

20.05.01. General

A. Applications for payment shall be based upon actual progress as measured on the Progress Schedule developed under Section 11 and its approved assignment of the Schedule of Values developed under Article 20.02.

B. Fill in the information required on this form.

C. Provide a list of materials on site but not yet incorporated into the work that are sought for partial payment and supporting documentation.

D. When change order authorizations are executed, add each such authorization to the applicable bid items, or separately at end of listing of Schedule of Values items, as appropriate.

1. Identify the change order authorization by number and description.
2. Provide the value of change order authorization in appropriate column.

E. After completing, submit Application for Payment.

F. Engineer will review application for accuracy. When accurate, Engineer will transmit application for processing of payment. Engineer will return inaccurate and/or incomplete Applications for Payment with comments for Contractor action.

G. Each Application for Payment shall be transmitted under the signature of the responsible officer of the Contractor.

20.05.02. Substantiating Data

A. Provide substantiating data with cover letter identifying:

1. Project Name and Project No.

2. Application number and date.

3. Detailed list of enclosures.

4. For all stored materials (fabricated and manufactured goods and equipment only) on site, but not yet included in the work, with item number and identification on the application, Contractor shall complete the District form ―Request for Payment for Materials on Hand." The ―Project Inspector" described on this form shall be the Engineer. The Contractor shall provide a description of each specific material, quantity, value, submittal review status, substantiating evidence of purchase and cost, complete the affidavit, and physically separate and identify the material as property of the District. References to off-site storage on District form ―Request for Payment for Materials on Hand" are not applicable to this work.

5. Submit ―certified" payroll.

6. Description of record drawing completion status.

20.05.03. Submittals

A. Submit 5 copies of Application for Payment and substantiating data with cover letter.

TABLE 20.02.03.A Preliminary Schedule of Values		
Item No.	**Description of Item**	**Value ($)**
1	**Bid Item No. 1—MOBILIZATION**	
1.1	Work under Section __.	
1.2	Work under Section __.	
…	…	
2	**Bid Item No. 2—CLEARING and GRUBBING**	
2.1	Work under Section __.	
2.2	Work under Section __.	
…	…	
3	**Bid Item No. 3—AQUA AMMONIA TREATMENT STATION**	
3.1	Work under Special Provisions Sections __ through __for submittals, O&M manuals, training only.	
3.2	Work under Special Provisions Sections __ through __ for testing and startup only.	
3.3	Work under Technical Provisions Section __.	
3.4	Work under Technical Provisions Section __.	
3.5	Work under Technical Provisions Section __.	
3.6	Work under Technical Provisions Section __.	
3.7	Work under Technical Provisions Section __.	
…	…	
4	**Bid Item No. 4—CONCRETE FLOODWALL**	
4.1	Work under Technical Provisions Section __.	
4.2	Work under Technical Provisions Section __.	
…	…	
5	**Bid Item No. 5—_____**	
5.1	Work under Technical Provisions Sections __.	
5.2	Work under Technical Provisions Sections __.	
	…	
	TOTAL BID PRICE	

SECTION 21. CONTRACT CLOSEOUT

21.01. Project Completion and Acceptance

21.01.01. Use Before Acceptance

A. District has the right to utilize or place into service any item of equipment or other usable portion of the work before acceptance of the entire Project. Whenever District plans to exercise said right, the Engineer will notify Contractor in writing, identifying the specific portion or portions of the work to be so utilized or otherwise placed into service, hereinafter referred to as "Use Before Acceptance."

B. Until the Engineer issues such written notification, Contractor is responsible for all care and maintenance of all items or portions of the work.

C. Upon District's issuance of written notice of Use Before Acceptance, District accepts responsibility for the protection and maintenance of all such items or portions of the work described in the written notice, excepting any injury or damage resulting from Contractor's actions or negligence.

D. If, by reason of District's Use Before Acceptance, the premium for the Contractor's bodily injury and property damage insurance is increased, District will reimburse the Contractor for the additional amount necessarily incurred, allocable to the area and the period of District's occupancy, up to the date of acceptance of the work.

E. District's Use Before Acceptance does not constitute acceptance of the work, or any portion of the work, by District, nor will it relieve the Contractor of responsibility for correcting defective and/or deficient work or materials found at any time before acceptance of the work or during the guaranty period after District's Acceptance. However, when the Project includes separate buildings, and one or more of the buildings is complete and entirely occupied by District, then upon written request by the Contractor and by written consent from District, the guaranty period on the building entirely occupied by District will commence to run from the date of District occupancy of such building or buildings.

F. Notwithstanding any Use Before Acceptance, Contractor retains full responsibility for fulfillment of all the requirements of the Contract documents.

G. Should the District elect to partially occupy or use portions of the work prior to acceptance, Contractor must perform final cleaning for those portions of the work prior to their being so occupied or used.

21.01.02. Contractor's Responsibility to Manage Incomplete and Deficient Work

A. The Contractor is responsible for identifying and managing incomplete and deficient work. Incomplete and deficient work includes, but is not limited to: non-compliance items, re-work items, and non-conforming tests; deficiencies

relating to inspections by the Building Official; and items of work not complete per the Contract.

B. The Preliminary and Final Inspection will not be conducted until:

1. The entire work of the Milestone/Project is complete;

2. Cleaning has occurred pursuant to Articles 18.03 and 21.06; and

3. Deficient work identified in all outstanding non-compliance notices has been corrected.

C. For each Milestone completion, the Contractor must include activities for conducting the Preliminary Final Inspection, completion of Deficiency List, and Final Inspection in Contractor's Progress Schedule.

21.01.03. Milestone Completion Preliminary Final Inspection

A. When the Contractor believes the work of a Milestone or Project is complete, including final cleaning of the work area associated with the Milestone, the Contractor shall submit to the Engineer three (3) copies of a written certification that the work of the Milestone is complete and request a Preliminary Final Inspection of the work of the Milestone by the District.

B. Prior to requesting the inspection, the Contractor shall furnish the following Milestone Completion Certification to District:

"To the best of my knowledge, all work of Milestone (#) has been completed, inspected, tested and is in full compliance with the requirements of the Contract."

Certified by Contractor: _____ *Date:* _____
(Signature)

C. Within seven (7) days of receipt of the Contractor's certification that all work of a Milestone/Project is complete, the Engineer will conduct a Preliminary Final Inspection with the Contractor.

For projects with time constraints that require the Engineer to conduct the inspection sooner than seven (7) days, revise the number accordingly.

D. If the Engineer determines that, based on the results of the Preliminary Inspection, the incomplete/deficient work identified is greater in substance and/or volume, than can be appropriately declared as Deficiency List, then the work is not complete enough to complete the Preliminary Final Inspection. The Contractor will be so notified in writing. Contractor must complete the work and re-initiate procedures for another Preliminary Final Inspection. Any costs to District for more than two (2) Preliminary Inspections may be charged to the Contractor.

E. If the results of the Preliminary Final Inspection are satisfactory to the Engineer, a Deficiency List will be prepared and issued to the Contractor. Neither the District's preparation of the Deficiency List, nor any omission from the Deficiency List of items of Incomplete and/or Deficient Work, relieves the Contractor from completing all the work required by the Contract.

21.01.04. Milestone Completion Final Inspection

A. Prior to requesting the Milestone Completion Final Inspection, the Contractor shall furnish the following Milestone Completion Certification to the District:

"The work of Milestone (#) has been completed, inspected, tested and is in full compliance with the requirements of the Contract. All Deficiency List items identified during the Preliminary Final Inspection have been completed."

Certified by Contractor: _____ *Date:* _____
(Signature)

B. Upon delivery of such certification to the Engineer, and if the Engineer agrees with the Contractor's certification, a Final Inspection will occur within ten (10) calendar days of the Contractor's delivery of Milestone Completion Certification.

For projects with time constraints that require the Engineer to conduct the inspection sooner than ten (10) days, revise the number accordingly.

C. If the Engineer determines the work is deficient, Contractor will again be furnished with a Deficiency List identifying the observed deficiencies in the work. After all deficiencies have been corrected, Contractor must initiate procedures for another Final Inspection. If more than two (2) Final Inspections are required any costs to the District for additional Final Inspections may be charged to the Contractor.

D. After acceptance of the Contractor's Milestone Completion Certification following the Final Inspection, the Engineer will issue a Milestone Completion letter to the Contractor. This letter will establish the date of the completion of the Milestone. The assessment of Liquidated Damages, if applicable, will cease accruing as of the date of Milestone Completion.

E. Contractor's Progress Schedule must include activities for Final Inspection of Milestones.

21.01.05. Project Completion

A. The Contractor shall certify that the entire work of the Project is complete. Completion of the Project includes submission to and acceptance by the District of all Milestone completion submittals. Article 21.05.02 describes in greater detail the submittal requirements for Contract Close-out.

B. Prior to the Engineer issuing the Project Completion letter, the Contractor shall furnish the following Project Completion Certification to District. This certification is in addition to any intermediate Milestone Completion certifications:

–The entire work of the Project has been completed, inspected, tested and is in full compliance with the requirements of the Contract documents. All Deficiency List items have been completed. All items on the rework list have been completed. All Close-out Documents required by Article 21.05.02 have been submitted to and accepted by the Engineer."

Certified by Contractor: _____ *Date:* _____
(Signature)

C. The Contractor's certification shall also include the completion of all Deficiency List work and the correction of all rework.

D. After acceptance of the Contractor's final certification, the Engineer will issue a Project Completion letter to the Contractor. This letter will establish the date of the Completion of Project. The assessment of Liquidated Damages, if any, will cease accruing as of the date of Project Completion.

21.01.06. Acceptance of Work

A. After issuing the Project Completion letter, the Engineer will recommend that the District Board of Directors formally accept the work.

B. Acceptance of the work will be made by the District Board of Directors only in regular session and only after the Engineer has recommended acceptance.

C. After the Board of Director's formal acceptance of the work, the Clerk of the Board will record a Notice of Completion and Acceptance.

D. District's acceptance establishes conformity with the Contract except for delays in completion, latent defects, fraud, or such gross errors as amount to fraud, willful misconduct, or gross negligence, and subject to any Guarantee and Warranty, express or implied. Determinations by Engineer that the work is complete or acceptance of the work by the Board of Directors does not bar any action by the District against the Contractor pursuant to Article 21.02.

21.02. Guaranty and Guaranty Bond

21.02.01. Guaranty

A. The guaranty period for any item of equipment or usable portion of the work that the District utilizes or places into service shall commence on the date of the Notice of Completion and Acceptance of the entire Project.

B. The Contractor hereby agrees to make, at its own expense, all repairs or replacements necessitated by defects in materials or workmanship, pavement subsidence or pavement damage, supplied or constructed under the terms of this Contract, and to pay for any damage to other works resulting from such defects, that becomes evident within a minimum of three years after the date of Notice of Completion and Acceptance of the entire Project or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract documents. The Contractor further assumes responsibility for a similar guarantee for all work and materials provided by subcontractors or manufacturers of package equipment components. Packaged equipment components are defined to include equipment furnished under the Technical Provisions. (*List Specification Sections or Articles*). The Contractor also agrees to indemnify, defend and hold the District harmless from liability of any kind arising from damage due to said defects.

C. The Contractor shall execute and submit a completed Guaranty Form in the format appended to this Section for the work. The Guaranty Form shall be submitted to the Engineer in accordance with Article 3.11 of the Standard Provisions.

D. The Contractor shall, upon receipt of notice in writing from the District, promptly make all repairs arising out of defective materials, workmanship, or equipment. The District is hereby authorized to make such repairs, and the Contractor and its Surety shall be liable for the cost thereof, if ten days after giving of such notice to the Contractor, the Contractor has failed to make or undertake the repairs with due diligence. In case of emergency, where in the opinion of the District delay could cause serious loss or damage, repairs may be made without notice being sent to the Contractor, and the expense in connection therewith shall be charged to the Contractor, and its Surety shall be liable for the cost thereof.

E. Prior to the expiration of the Guaranty period, the District reserves the right to hold a meeting and require the attendance of the Contractor and relevant subcontractors and suppliers. The purpose of the meeting is to review guaranties, bonds, and maintenance requirements and determine the required repair or replacement of defective items.

F. For the purpose of this Section, acceptance of the work or a portion of the work by the District shall not extinguish any covenant or agreement on the part of the Contractor to be performed or fulfilled under this Contract which has not, in fact, been performed or fulfilled at the time of such acceptance. All covenants and agreements shall continue to be binding on the Contractor until they have been fulfilled.

21.02.02. Guaranty Bond

A. The Contractor shall furnish a written Guaranty Bond. Unless noted otherwise, this Guaranty Bond shall be for a period of three years after the date of Notice of Completion and Acceptance and shall cover all work. It shall be furnished, in a

form acceptable to the Engineer in the format of the attachment to this Section, prior to final payment.

B. The amount of the Guaranty Bond shall be no less than 15 percent of the Total Contract Price.

SANTA CLARA VALLEY WATER DISTRICT

GUARANTY FORM

Guaranty for
(Project Name and Project Number)

San Jose, CA

We hereby guarantee the Project commonly known as _____ has been completed in accordance with the requirements of the Contract documents and further agree that the work to be free of defects in workmanship, equipment and materials and to remain free of such defects for a period of three (3) years from the date of acceptance of the work by the District's Board of Directors, unless a longer/shorter period(s) is called for by the Contract documents.

We agree that if any defects in materials, workmanship, or equipment become evident, we will, within ten days after written notice of such defects, commence to repair or replace the same together with any other work that may be damaged or displaced in so doing.

In the event of our failure to comply with the above mentioned conditions within a reasonable time after being notified, or should the emergencies of the case require repairs or replacements to be made before we can be notified or respond to notification, we do hereby authorize the Santa Clara Valley Water District to proceed to have the defect repaired and made good at our expense, and we will pay the cost therefor upon demand.

The Guaranty provided herein shall not be in lieu of, but shall be in addition to any warranties or other obligations otherwise imposed by the Contract documents and by law.

Contractor: _____

Signed: _____

Title: _____

Date: _____

SANTA CLARA VALLEY WATER DISTRICT

GUARANTY BOND

BE IT KNOWN BY THESE PRESENTS: That

WHEREAS, the Santa Clara Valley Water District, State of California, has awarded to _____ (hereinafter designated as ―Principal") a Contract for _____; and

WHEREAS, said Principal is required under the terms of said Contract to furnish a Guaranty Bond for the faithful performance of said Contract's Guaranty.

NOW, THEREFORE, we, the Principal and _____ _____ as Surety, are held and firmly bound unto the Santa Clara Valley Water District (hereinafter called ―District") in the sum of _____ _____ Dollars ($_____) lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that if the above Principal, or heirs, executors, administrators, successors, or assigns shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions and agreements in the said Contract and any alteration thereof made as therein provided, to be kept and performed at the time and in the manner therein specified, and in all respects according to their true intent and meaning, and shall indemnify and save harmless District, its officers, agents, and employees, as therein stipulated, then this obligation shall become null and void; otherwise it shall be and remain in full force and effect.

And the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration, or addition to the terms of the Contract or to the work to be performed thereunder or the Specifications accompanying the same shall in any wise affect its obligation on this bond, and does hereby waive notice of any such change, extension of time, alteration, or addition to the terms of the Contract or to the work or to the Specifications.

In the event suit is brought upon this bond by District and judgment is recovered, Surety shall pay all costs incurred by District in such suit, including a reasonable attorney's fee to be fixed by the Court.

IN WITNESS WHEREOF two identical counterparts of this instrument, each of which shall for all purposes be deemed an original thereof, have been duly executed by Principal and Surety above named, on the _____ day of _____, 20_____.

_____	(Seal)	_____	(Seal)
_____	(Seal)	_____	(Seal)
_____	(Seal)	_____	(Seal)
Principal		Surety	

Address _____

_____

NOTE: Signature of those executing for Surety must be properly acknowledged.

21.03. Training

This Article is not applicable to flood protection projects.

A. This Article includes requirements for training of District staff on the equipment, products, and systems furnished under these Contract documents, including Contractor videotaping of training instruction.

21.03.01. General Requirements

A. The objective of the training included under this Section shall be to convey the knowledge needed by District operations, maintenance, and engineering staff to safely operate, maintain, and repair the equipment and systems furnished under this work. Focus training to the skills and job classifications of the staff attending the classes, e.g., water treatment plant operator, maintenance technician, electrician. Provide supporting documentation to assist the instruction learning process and to serve as a source of information to District staff after training. Provide videotapes of training sessions to be used to train District staff who could not attend the scheduled sessions.

B. Unless specifically noted otherwise, conduct all training in accordance with the following general requirements. Facilities shall be fully functional before training is begun.

1. Scheduling of classes: Training shall be planned in accordance with the overall project progress schedule by the Contractor. The Engineer must approve and confirm class schedules. All classes shall be scheduled in the project progress schedule.

2. Schedule specific classes a minimum of 3 weeks in advance to allow District staffing arrangements to take place. Generally, not more than 2 classes per week shall be scheduled. Classes shall be provided during the time periods of 7 AM to 7 PM Monday to Saturday, as requested by the District.

3. Class agenda: Prepare a class agenda and submit it to the Engineer at least four weeks in advance of the date of the first corresponding class. The agenda shall include a listing of subjects to be discussed, the training goal(s), the methods to be used to achieve the training goal(s), time estimated for each subject, list of documentation to be used or provided to support training, a period for the instructor to question staff members to ensure that the training was successful, and instructor name. Agendas shall include an allocation of time for District staff to ask questions and discuss the subject matter. The District may request that particular subjects be emphasized and the agenda shall be adjusted to accommodate these requests. Copies of the agenda shall be distributed to each student at the beginning of each training class.

4. Number of students: It is estimated that XX persons will attend each training class. The actual number of students will be determined by the District. The Engineer will provide an estimated ~~"h~~headcount" two days prior to the class if requested by the Contractor.

5. Training location: Unless otherwise noted, conduct all training at indoor on-site training facilities. If necessary and appropriate as determined by the Engineer, conduct training at off-site locations or the actual installed location of the equipment, product, or system, as approved by the Engineer.

6. Length of training: Each class shall be planned to be completed within XX hours, including two 20 minute breaks. Requests for longer class periods must be approved by the Engineer.

7. Instructor qualifications: Instructors shall be completely knowledgeable in the products and systems for which they are providing training, and experienced in conducting classes. Sales representatives are not qualified instructors unless they possess the detailed operating and maintenance knowledge required for proper class instruction. If, in the opinion of the Engineer, the scheduled training was not provided by an appropriately knowledgeable person, such training shall be rescheduled and repeated with a suitable instructor at the Contractor's expense.

8. Training aids: Each instructor is encouraged to use audio-visual devices, models, charts, and so forth to increase the transfer of knowledge. The business conducting the training shall provide all such equipment (televisions, video cassette recorder/player, projectors, screens, easels, etc.), models, charts, and so forth for each class. It shall be the responsibility of the business conducting the training to confirm in advance that the class room will be appropriate for the types of audio-visual equipment to be employed.

9. Training at the actual equipment (~~"h~~ands-on") shall be a part of each class. This portion of the instruction shall include operation, preventative maintenance points, calibration (wherever applicable), troubleshooting, common repairs, and manufacturer recommended servicing.

10. Classroom documentation: For training on equipment, systems, or products which are required to provide an operations and maintenance manual, this operations and maintenance manual shall be complete and used during the classroom instruction. Supplemental documentation handouts shall be provided to support instruction.

11. The Contractor shall create a VHS format tape of each class with sound and appropriate lighting to document the training. Taping shall take place during all portions of the instruction, including at the actual equipment. Questions from students and answers shall be taped to the extent

feasible. Each class shall be filmed if more than one class is taught. The District acknowledges that the manufacturer's written operation and maintenance documentation takes precedence over the classroom training (including viewing of the video) and will be consulted prior to and during maintenance and operations. The Contractor shall submit a separate VHS tape of each class within one week of the class date. Each tape and case shall be affixed with a word processed label stating as a minimum:

a. Subject.
b. Date of class.
c. Company providing the training.
d. Reference specification section.
e. Summary of class subjects.
f. WTIP Stage 2.

Videotapes that are incomplete, not readily audible, or clear shall require the class to be repeated with new videotaping.

12. District videotaping, photographing, audio recording, and other documentation of training classes: In addition to the videotaping being completed by the Contractor, the District reserves the right to videotape, photograph, audio record, and otherwise document any or all training classes provided under this work. The business(s) conducting the training and the Contractor shall cooperate with the District in making such videotapes, photographs, or audio recordings, which shall remain the exclusive property of the District.

13. If the instructor cannot answer relevant product questions by students during the training, these questions shall be recorded by the instructor and a written response shall be submitted to the Engineer within 3 weeks.

C. Additional training requirements for specific equipment and systems may also be specified in these Specifications.

D. Training List: List all equipment, systems, and processes that require training. For each item, identify the type of training (maintenance or operations), duration of each class in consecutive days, number of classes per day, the total number of classes, and minimum number of instruction hours per class.

21.03.02. Submittals

A. Submit an overall schedule of all classes for the Engineer's approval at least 6 weeks in advance of the date of the first class.

B. Submit class agendas to the Engineer in accordance with this Article.

21.04. Testing and Facility Startup

This Article is not applicable to flood protection projects, except if there are irrigation systems that require testing.

A. This Article includes requirements for materials, equipment, instrumentation, structure, and process system testing and startup.

21.04.01. Testing and Startup Overview

A. Certain portions of the work will be modified and completed at scheduled interim dates before completion of the Project. Consequently, testing and startup activities will be taking place throughout much of the duration of the work.

B. See other provisions in these Specifications for detailed testing requirements that shall be completed in the framework of the testing and startup overview described herein.

C. The general sequence of testing and startup will proceed as follows. Variations to this general sequence may be authorized by the Engineer where necessary to meet constraints described in these Contract documents and permits from authorities having jurisdiction.

1. General construction testing. For example: soils compaction and moisture content, welding, concrete properties, coating application, carrier piping pressure, dielectric flange isolation, double containment piping pressure, etc.

2. Special construction testing. For example: HVAC balancing, pump vibration, pump flow and head measurements, fire sprinkler system testing, equipment noise testing, etc.

3. Water containing structure watertightness testing. For example: water basins, containment areas, storage tank areas, etc.

4. Submittals. All submittals relevant to installation practices, equipment, piping, anchorage calculations, instrumentation, materials, and testing plans have been submitted to the Engineer and received No Exceptions Noted review status.

5. Factory testing. Where required prior to the shipment of equipment to the site, complete factory testing. Such testing may be both unwitnessed and witnessed by the Engineer and/or District staff as specified and at their discretion.

6. Operations and maintenance manuals. Operations and maintenance manuals for equipment shall be submitted and receive No Exceptions Noted review status.

7. Construction complete. Construction is complete so that facility is ready to be used for its intended purposes. Signage is posted.

8. Electrical testing. Testing, calibration, and setting of electrical conductors, equipment, protective devices, grounding, and other components as specified in Technical Provisions prior to equipment startup. This also includes jogging all motors to verify the direction of rotation.

9. Mechanical equipment and valve testing. Individual inspection and testing to ensure and demonstrate that equipment and valves operate properly and reliably. Equipment that is capable of automatic or remote operation shall be tested first in manual mode. Manufacturer‘s representatives shall confirm that all equipment and valves are properly installed before first operation and shall conduct/oversee the initial operation and testing. Limit switches shall be set and adjusted on all valves so equipped. Setpoints on all pressure regulating, pressure relief, vacuum relief, and other valves with setpoints shall be confirmed and reset as directed by the Engineer.

10. Training. Training of District staff as specified for equipment and facility operation and maintenance before each associated system is placed into service.

11. Instrumentation wiring wring-out. Test each conductor, fiber optic cable, and other wiring components for proper installation, termination, and identification.

12. Calibration and adjustment of instrumentation. Test, calibrate, and complete reports for each field instrument.

13. Loop tuning. Complete the tuning of all loops as specified in Technical Provisions.

14. Operational readiness test (ORT). Complete the operational readiness test for the process in question as specified in Technical Provisions. Correct deficiencies noted in the ORT and re-test until all deficiencies are corrected.

15. Control system configuration and testing. Complete the control system configuration and testing for each area of work before startup. Remaining configuration work must be completed to the point that unscheduled disruptions to systems placed into service do not occur.

16. Functional test (FT). Complete the functional test for the process in question as specified in these Specifications. Correct deficiencies noted in the FT and re-test until all deficiencies are corrected.

17. Regulatory agency approvals. Conduct inspections by and tests for regulatory agencies (Fire Marshals, Department of Environmental Health, BAAQMD, etc.) and receive approvals needed to operate system. Provide written information required by regulatory agencies. This may also include the receipt of authorization by the State Department of Health Services to amend the treatment plant operating permit to allow the new/modified process.

18. Confirm the facility or plant readiness to accept new process system. The District will not normally take possession of new facilities prior to Acceptance. In some cases chemicals may need to be purchased and loaded into new facilities. A comprehensive testing plan and meeting scheduled completion dates are vital to allowing the startup on new and modified process systems.

19. Written occupancy agreement completed. For only for those facilities that the District has agreed to place into service prior to Acceptance, an occupancy agreement must be written and agreed upon by the District and Contractor prior to the start of the System Commissioning Test. This document shall list the responsibilities of each party after the successful completion of the System Commissioning Test and identify remaining work. The Project guaranty period for all facilities starts at the Project Notice of Completion date.

20. System Commissioning Test. After satisfactory completion of the Functional Test and procurement of District readiness to operate the system, the system shall be placed into normal operation. This test shall be completed and shall be judged as defined in these Specifications. This test may last significantly longer than the number of days specified if deficiencies are found and the test is restarted one or more times.

21. Removal of replaced system. In some cases after the successful completion of the System Commissioning Test, a replaced system exists that is subsequently removed.

21.04.02. Watertightness Testing

A. Prior to the application of damproofing or waterproofing materials on exterior concrete surfaces or backfilling, and, for certain structures, prior to and after the application of the chemical resistant coating, each structure listed below shall be tested for watertightness.

List structures that require watertightness testing. For example: water basins, containment areas, storage tank areas, etc.

B. Each structure shall be filled to its maximum normal water surface elevation. For structures equipped with overflows, it shall be filled to the overflow weir elevation. The duration of the test shall be as follows:

List the duration required for each structure. For example: Containment areas: 48 hours; Water Basins: 72 hours.

C. After filling, each structure shall be inspected by the Contractor and Engineer. Inspection shall include, but not be limited to, walls, floors, footings, sumps, piping penetrations, and underdrains. The water level will be accurately measured over the test period to measure the drop in water level for comparison with allowable leakage. Evaporative losses and rainfall gains shall be measured and deducted/added to determine the net water leakage. The net water leakage for any 24 hour period shall not exceed the calculated value of 0.0005 times the structure nominal volume; nor shall damp spots on the exterior wall surfaces be permitted; nor shall there be measurable leakage at any wall/footing joint. Damp spots are defined as locations where moisture can be picked up by a dry hand. Where leakage rates are defined by regulatory agencies, testing shall meet those requirements.

D. All leakage over the allowable value and all damp spots shall be repaired until they are eliminated.

21.04.03. Operational Readiness Testing (ORT)

A. Demonstrate proper rotation, alignment, speed, flow, pressure, vibration, sound level, adjustments, and calibration. Perform initial checks in the presence of and with the assistance of the manufacturer‘s representative.

B. Demonstrate proper operation of each instrument loop function including alarms, local and remote controls, instrumentation and other equipment functions. Generate signals with test equipment to simulate operating conditions in each control mode.

C. Complete Items C.1 to C.13 per Article 21.04.01.

D. Certificate of Proper Installation

1. At completion of Operational Readiness Testing: Contractor shall furnish written report prepared and signed by manufacturer‘s authorized representative, certifying equipment:

   a. Has been properly installed, adjusted, aligned, and lubricated.

   b. Is free of any stresses imposed by connecting piping or anchor bolts.

   c. Is suitable for satisfactory full-time operation under full load conditions.

   d. Operates within the allowable limits for vibration.

e. Controls, protective devices, instrumentation, and control panels furnished as part of the equipment package are properly installed, calibrated, and functioning.

21.04.04. 3-Day Functional Testing (FT)

A. Plant shall be brought into a mode of operations sufficient to perform the Functional Testing to be completed by the Contractor within the FT period following the completion of the Operational Readiness Testing.

B. District will provide operations personnel, power, fuel for duration of 3-Day Functional Test.

C. All Contractor supplied equipment and systems shall operate for a continuous 72 hours without failure before this test will be considered successful.

21.04.05. 7-Day System Commissioning Testing (SCT)

A. District staff will perform the System Commissioning Testing for 7 consecutive days following satisfactory completion of the Functional Testing.

1. The District will monitor equipment or systems for performance within the normal modes of operation and parameters. The District will log and notify the Contractor of any abnormalities.

2. The District will monitor basins, containment areas, pipelines, conduits, water and air systems for any leakage. The District will log and notify the Contractor of any leakage is detected.

3. For each malfunction or failure or multiple malfunction(s) or multiple failure, occurring during a 24-hour period, which requires a system or the plant to be taken out of service, the District will restart the 7-Day System Commissioning Testing Period.

a. If any installed equipment fails to operate properly during the testing period, the test may be stopped. The Contractor shall assist the District in determining the cause of the problem. If the cause of the problem is Contractor-supplied equipment, then the Contractor shall fix the problem at no additional cost to the District. After the problem has been fixed by the Contractor, the Engineer will determine if the entire test will be repeated from the beginning or if the test period can resume from when it was stopped.

21.04.06. Submittals

A. Submit the following documentation at least 30 days prior to the first scheduled activity for the new facility or existing process system testing.

1. Individual testing plans for each major new facility and modified existing process system. Testing plans should summarize all planned work leading to the startup and System Commissioning Testing of each modified and new process system. As a minimum, testing plans shall be submitted for:

   List the facilities or process systems requiring a testing plan.

2. Blank test forms and checklists showing data to be recorded and checkout procedures prior to each test, whether factory or on-site.

3. Completed test forms and records after testing is completed.

21.05. Submission of Closeout Items

21.05.01. Record Drawings and Specifications

A. At completion of construction, and prior to the final acceptance of the work by the District, the Contractor shall deliver the following Contract record documents to the Engineer in the following form:

   1. Marked-up Contract Drawings (2 copies): Bound into sets of convenient size for ease of handling.

   2. Marked-up Specifications (2 copies): Bound into 3-ring vinyl binders with clear plastic spine label pockets.

   3. Field Test Records (2 copies): Bound into 3-ring vinyl binders with clear plastic spine label pockets. Number all pages. Provide a complete, neat, word-processed table of contents for each binder, with page numbers for each entry.

   4. Field survey record documentation.

B. Accompany the final record document submittal with a transmittal letter in duplicate, containing:

   1. Date
   2. Santa Clara Valley Water District and (Project Name and Project Number)
   3. Contractor‘s name and address
   4. Title and number of each record document
   5. Certification that each document as submitted is complete and accurate
   6. Signature of Contractor

21.05.02. Closeout Documents

A. At completion of construction, and prior to the final acceptance of the work by the District, the Contractor shall deliver the following Closeout Documents to the Engineer:

1. Evidence of compliance with and approval of Contractor-obtained permits and associated inspections of authorities issuing the permits.

   (On water utilities projects, Contractor is typically responsible for obtaining permits for Fire Sprinkler and Alarm systems as they provide the design and installation.)

2. Copies of all special guarantees, warranties, and bonds.

3. Evidence of release of all liens and stop notices.

4. Release of claims as outlined in the Standard and Special Provisions.

B. Provide records indicating District's receipt and acceptance of all tools, spare parts, and extra materials as specified in the Technical Provisions.

C. Provide records indicating District's receipt and acceptance of all O&M manuals as specified in these Specifications.

21.05.03. Keys

A. Turn over all keys to new and existing facilities to the Engineer. This includes keys that were loaned (if any) to Contractor staff by the District for use during the construction period. Provide a written description or schedule to describe which keys correspond to which doors, gates, or other feature.

21.06. Final Cleaning

21.06.01. Schedule for Final Cleaning

A. Final cleaning is separate work from the cleaning done throughout the Project to maintain the project site in a safe and presentable condition. Final cleaning shall be a comprehensive clean up of all new and selected existing facilities begun and finished within 30 days of District's acceptance for continuous use and occupancy. Final cleaning may be performed separately by structure or area at different time periods only if approved by the Engineer.

B. Completion of this work shall be planned and scheduled to accommodate the operational requirements of this District facility.

21.06.02. Structures

A. Structures shall have the interiors and exterior surfaces cleaned by a professional industrial janitorial service, fully knowledgeable in proper and effective cleaning methods. These structures include:

List structures.

B. The above structures shall be thoroughly cleaned and shall include, but not be limited to, the following cleaning activities:

1. Paint, glazing compounds, and other materials shall be removed from glazing and skylights. Glazing and skylights shall be washed and polished on both sides. Care shall be exercised so that the glazing is not scratched or damaged.

2. Interior surfaces including walls, ceilings, light fixtures, doors, jambs, sills, piping, ducts, equipment, electrical panels and conduits, handrails, guardrails, gratings, pipe trenches, drains, and miscellaneous fixtures shall be cleaned. Stains, spots, dirt, and dust shall be removed.

3. Temporary floor protections shall be removed; floors shall be vacuumed and washed; floors other than concrete shall be waxed and buffed.

4. Door and window hardware shall be cleaned and polished after all traces of stains, dirt, paints, and blemishes are removed.

5. Casework and plastic laminate surfaces shall be cleaned and polished.

6. Marks, stains, fingerprints, soil, and blemishes shall be removed from painted, decorated, or stained interior surfaces.

7. Spots, soil, paint, grout, plaster, concrete, and similar substances shall be removed from tile and the tile shall be washed.

8. Exterior walls, doors, and louvers shall be washed.

9. All interior and exterior signage shall be cleaned.

C. All concrete decks and floors shall be swept and washed. Stains, including oil stains, metal rust, and weld splatter, shall be removed. Spills of construction materials including paint, concrete, grout, adhesives, insulating materials, chemicals, and similar materials, shall be removed and the underlying surfaces cleaned.

21.06.03. Streets, Roadways, Concrete Slabs, Sidewalks, and Paved Areas

A. Streets, roadways, concrete slabs, and paved areas shall be cleaned and pressure washed so that they are free of debris, soil, and paint or construction material spills. Painted construction markings on concrete and pavement shall be removed.

21.06.04. Storm Drainage Facilities

A. All gutters, V-ditches, swales, storm drain pipe inlets, catch basins, drop inlets, and manholes shall be cleaned of soil, vegetation, and debris.

21.06.05. Unpaved Areas

A. Unpaved areas between new facilities and between new and existing facilities shall be cleaned of all debris and construction materials. These areas shall be graded or raked to a smooth uniform surface without holes, depressions, or tire tracks.

APPENDIX 3C-2

100% DESIGN REPORT R4-6A

PRELIMINARY
DESIGN REPORT

For

Lower Silver Creek
Flood Protection and Creek Restoration Project
Reaches 4, 5 and 6A

City of San Jose,
Santa Clara County, California

January 29, 2010

Prepared for:

Santa Clara Valley Water District
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SECTION 1
PROJECT SUMMARY

1.1 Introduction and Background

The Santa Clara Valley Water District (District) and the Natural Resources Conservation Service (NRCS), United States Department of Agriculture (USDA) jointly sponsored a program to reduce floodwater and related damages resulting from the 1% storm event in Lower Silver Creek Watershed (LSCW).

Lower Silver Creek is one of the many intermittent streams within the LSCW which flow from Lake Cunningham. Downstream of Lake Cunningham the man-made earthen and concrete channel flows to its confluence with Coyote Creek. This portion of the Lower Silver Creek downstream of Lake Cunningham is susceptible to flooding during a 1% storm event.

From a series of alternatives the District and the NRCS selected a creek program improvement plan, which included the construction of a combination of vegetated earth channel, rectangular concrete channels, and pile wall channels.

The map below shows the general location of the project reaches and the sections which were identified by the program plan. (Figure 1.1)

On November 30, 2009 the District engaged the services of Ruggeri, Jensen, Azar & Associates (RJA), to update the design and prepare construction documents for Reaches 4, 5, and 6A based on the recommendation of the District and NRCS.

This Preliminary Design Report presents the findings and recommendations of the Basis of Design update Phase for Reaches 4, 5, and 6A, and includes the following:

- Hydraulic Report (including freeboard report and HEC cross sections and one percent water surface profile)
- Updated Aerial and Topographic Surveys
- Civil Design Update
- Structural Design Update
- Revegetation, Landscape and Irrigation Update
- Geotechnical Report with boring logs
- Outline of technical specifications

This Preliminary Design Report (PDR) has been developed by RJA to serve as a basis for preparation of the 90% construction documents. Presented herein are the preliminary design criteria and findings for the project.

1.2 Objectives

The project objectives are:

- Provide channel improvements for flood protection from a 1% storm event.
- Confine the improvements to the existing Santa Clara Valley Water District Right-of-Way.
- Incorporate SCVWD and NRCS guidelines into the project design.
- Provide creek restoration, riparian vegetation and community beautification.
- Provide maintenance access and long term ease of channel maintenance.
- Incorporate January 13, 2010 workshop comments into the design.

FIGURE 1.1

LOWER SILVER CREEK

SAN JOSE, CALIFORNIA

JANUARY 28, 2010

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SHEET 1 OF 1 SHEETS

SECTION 2
PROJECT DESCRIPTION

2.1 DESIGN CRITERIA

2.1.1 Hydraulic Design Discharge

The Design Discharge for the 1% storm event used for lower Silver Creek Reach 4, 5 and 6A were determined by the Project Hydraulics Engineer as 3670 cfs at South Babb Creek, 4160 cfs at North Babb Creek, and 4210 cfs at Interstate 680.

2.1.2 Sediment Transport

A sediment transport channel has been included in this design. The Schaff & Wheeler analysis shows that the sediment will be transported downstream. The maximum particle size transported will be 6 mm. Jackson Avenue to Capitol expressway, 9 mm Capitol Expressway to Story Road and 2 mm Story Road to Moss Point Drive.

2.1.3 Flood Walls and Free Board

The minimum free board criteria provided by the District has been incorporated into the design. When the minimum free board requirements could not be maintained within the established top of banks, flood walls were provided and the top of flood walls were set based on the free board requirements of the District, NRCS and NFIP. (See appendix 5 for Hydraulic analysis results)

2.1.4 Geotechnical Evaluation

Supplemental Geotechnical investigations were performed to augment the previously prepared Geotechnical Reports. An engineering soils analysis was performed and design recommendations are included in the Soils Report. (See Appendix 6)

A slope stability analysis using the District's criteria and based on a design side slope of 0.25:1 with vegetated block walls was originally proposed. The District directed the design change to replace the vegetated block walls with native earth at 1.5:1 slope and soldier pile walls. The slope stability analysis for the 1.5:1 design slope was performed for this submittal. The geotechnical consultant and the District feel the construction of an earth channel with 1.5:1 side slopes is feasible.

2.1.5 Hazardous Material Report

A Phase I Environmental Site Assessment (ESA) for this project was provided by the District. A Phase II sampling and material testing program was performed by GEOCON, Geotechnical and Environmental Consultants for the original project in 2001.

A Supplemental Sampling and Analysis Plan for the Phase II investigation was prepared and was reviewed and approved by the District. Materials from the site will be sampled and tested for variations from previous 2001 test results. GEOCON will document the findings and recommendations in its Site Investigation Report.

2.1.6 Riparian Habitat

Using the NRCS lower Silver Creek Watershed Mitigation and Monitoring Program, and the District's direction on plant types, we have prepared the Revegetation, Landscape and Irrigation update.

SECTION 3
DESCRIPTION OF IMPROVEMENTS

3.1 DESCRIPTION OF IMPROVEMENTS

3.1.1 Channel Improvements

The Channel Improvements are composed of four (4) different cross sections. The varying cross sections were required to confine the improvements within the existing District Right-of-Way while providing space for access and vegetation areas. Reach 4A between Interstate 680 and Jackson Avenue is proposed to be improved as a concrete lined rectangular channel. Reach 4B between Jackson Avenue and Capitol Expressway is proposed to be improved as a trapezoidal channel with earthen bottoms and side slopes. Reaches 4C and 5A between Capitol Expressway and Story Road are proposed to be improved with concrete pile walls on both sides. Reach 5B and Reach 6A between Story Road and Moss Point Drive will be improved as pile walls on the east side and earthen side slopes on the west side.

3.1.2 Maintenance Road

An elevated maintenance road 3.5 feet above the channel bottom is proposed to be constructed. The maintenance road will be 18 feet wide with rip rap for side slope and cut off wall protection. The structural section is proposed to be 12" of Class 2 aggregate base rock on 95% compacted subgrade. A 6" concrete section will be provided at locations where high velocities require its use.

3.1.3 Box Culvert Improvements

The existing 2-cell box culvert at Jackson Avenue is proposed to be removed and replaced with a cast in place 5-cell Reinforced Concrete Box Culvert. The existing box culverts in Capitol Expressway will remain and an additional precast box culvert added. The existing box culverts in Story Road will be shortened and an additional precast box added. No changes are proposed for the Murtha Drive and Moss Point Drive structures.

3.1.4 Flood Walls

Based on the free board requirements, flood walls are to be installed at the top of the bank in areas where the freeboard above the 1% base flood is above the existing top of bank elevation. These flood walls will be concrete and will be located inside the right-of-way line to provide room for construction and maintenance access.

3.1.5 Maintenance Road Access Ramps

Maintenance Road Access Ramps will be constructed at the channel intersections with Jackson Avenue, Capitol Expressway, Story Road, Murtha Drive and Moss Point Drive.

3.1.6 Revegetation

Revegetation is proposed for the channel bench area provided along the length of the project. Revegetation of the channel slopes will be limited to the earthen bank areas.

3.2 GEOMETRICS

3.2.1 Reach 4A

Reach 4A between Interstate 680 and Jackson Avenue will be constructed as a concrete rectangular channel with vertical side walls and the invert will match the Jackson Avenue low flow box culvert.

3.2.2 Reach 4B

Reach 4B between Jackson Avenue and Capitol Expressway will be an earthen channel with 1.5:1 side slopes. The north side of the channel will include an 18' wide maintenance road, a flood wall at the top of slope and an 8' wide space behind the floodwall for a future trail by the

City of San Jose. The south side will include a vegetated bench and 1.5:1 slope with a flood wall at the top of bank.

3.2.3 Reach 4C

Reach 4C between Capitol Expressway and North Babb Creek will have soldier pile walls on each side with an 18' wide maintenance road on the north side and vegetated bench on the south side.

3.2.4 Reach 5A

Reach 5A between North Babb Creek and Story Road will have soldier pile walls on each side with an 18' wide maintenance road on the east side and vegetated bench on the west side.

3.2.5 Reach 5B and 6A

Reaches 5B and 6A between Story Road and Moss Point Drive will have soldier pile walls and an 18' wide maintenance road on the east side and 1.5:1 earthen slopes and a vegetated bench on the west side.

(See Appendix 1 for Channel Sections)

3.3 RIGHT-OF-WAY IMPACTS

3.3.1 Existing Easement

Five (5) areas have been identified for right-of-way acquisition necessary to construct the proposed improvements.

1. A 30' access easement is needed for maintenance purposes along the South bank of the concrete channel between Interstate 680 and Jackson Avenue. This easement would be over existing Caltrans property.

2. Easements will be required at Capitol Expressway for the new box culvert and the proposed access ramp on the west side of Capitol Expressway. These easements would be over existing County of Santa Clara, VTA property.

3. Additional Right-of-Way is required at 3160 Story Road for the proposed maintenance ramp. This right-of-way would be over existing private property.

4. Additional Right-of-Way is required at 2885 Murtha Drive for the proposed maintenance ramp. This right-of-way would be over existing private property.

5. Additional Right-of-Way is required at 1307 Farringdon Drive for the proposed Murtha Drive maintenance ramp. This right-of-way would be over existing private property.

(See Appendix 4 for Right-of-Way Exhibits)

3.4 UTILITIES CONFLICTS

3.4.1 Pacific Gas and Electric

1. PG&E has three (3) major gas lines which cross the creek near station 143+00 between Jackson Avenue and Capitol Expressway. These pipe lines were potholed and it was determined they are in conflict with the proposed improvements. There are also minor gas lines at Jackson Ave., Capitol Expressway and Story Road which are within the area of the proposed improvements and will need to be relocated.

2. There are existing overhead power lines, guy wires and poles which will need to be relocated to accommodate proposed improvements.

3.4.2 Pacific Bell

1. Pacific Bell and possibly other utility providers have existing overhead lines on the joint poles with PG&E; and may also need to be relocated.

3.4.3 San Jose Water Co.

1. San Jose Water Co. has a 12" water main in Jackson Avenue, Capitol Expressway and Story Road which will need to be realigned or protected. They will design and construct any realignment.

3.4.4 City of San Jose

2. The City of San Jose has three (3) sanitary sewer siphons, one at Jackson Avenue, one near 144+50, and one at Capitol Expressway. All three (3) siphons will be impacted by the channel improvements, and will be relocated.

3.4.5 Utility Coordination

1. The District has researched the existing utilities and, made initial contact with the utility owners. RJA has shown all known utilities on the plan and profile sheets. The District will make all follow up contacts with the utility companies.

SECTION 4
HYDRAULICS ANALYSIS

4.1 METHODOLOGY

4.1.1 General

Schaaf and Wheeler Consulting Engineers, (S&W), developed the HEC-RAS model for Lower Silver Creek based on information provided by the District and assumed channel improvements as recommended by the NRCS.

4.1.2 Channel Design

Based on supplemental topo and revegetation requirements the initial channel design grades and section were further developed by RJA and additional hydraulic analysis was made. Using the proposed channel sections in the analysis, the water surface profile plus free board results show flood walls are required along much of the channel.

4.1.3 Final Design

In an effort to maximize the creek's revegetation, the southerly and westerly sides of the channel have been designated for planting and riparian habitat area and the northerly and easterly sides of the channel have been committed to flood conveyance.

(See Appendix 5 for Hydraulic Analysis)

SECTION 5
STRUCTURAL ENGINEERING

5.1 GENERAL PLANS

The following items will be designed in accordance with the requirements of the SCVWD and NRCS.

- Five (5) cell reinforced concrete box culvert at Jackson Avenue.
- Maintenance Road concrete access ramp retaining walls.
- Concrete rectangular channel between Jackson Avenue and Interstate 680.
- Reinforced Concrete Box Culvert wing walls and aprons.
- Concrete flood walls with drilled pier foundations.
- Soldier Pile Walls.
- Precast Reinforced Concrete Box Culverts at Capitol Expressway and Story Road.
- Concrete confluence structures at North and South Babb Creek.

SECTION 6
CONSTRUCTION IMPACTS

6.1 TRAFFIC HANDLING

Construction of the Jackson Avenue, Capitol Expressway and Story Road box culverts will need to occur in four (4) stages in order to minimize impact to existing traffic and provide adequate working space.

6.1.1 Traffic Flow

The four (4) stage construction shown on the plans will provide continued two way vehicle and pedestrian traffic during construction.

6.1.2 Traffic Signal

Minimal disturbance will be required to the signalized intersections. Although the signals are owned by the City of San Jose, the signal that controls traffic from the Interstate 680 off ramp and will need to be coordinated with CalTrans.

6.2 CONSTRUCTION ENCROACHMENT PERMITS

6.2.1 Permits

The District will obtain the necessary permits for the project. These permits will include but may not be limited to the following:

a. The Regional Water Quality Control Board

b. California Department of Fish and Game

c. U.S. Army Corp. of Engineers

6.2.2 Encroachment Permits

a. The District will also need to obtain encroachment permits from The City of San Jose for work within the right-of-way of Jackson Avenue and Bambi Lane.

b. The District will need to obtain an encroachment permit from the County of Santa Clara for the work to be done within the right-of-way of Capitol Express way.

c. The District will need to obtain an encroachment permit from Caltrans for work in the I-680 right-of-way.

SECTION 7
HAZARDOUS MATERIAL INVESTIGATION

7.1 PURPOSE

The primary objective of the proposed investigation is for general characterization of sediment, soil, and groundwater that may be encountered during project construction. Specifically, the investigation will confirm the previous analytical results obtained from investigation conducted by Geocon and others in 2001. The current investigation will evaluate baseline concentrations of metals, petroleum hydrocarbons, pesticides, polychlorinated biphenyls (PCBs), and volatile organic compounds (VOCs) along Reaches 4, 5 and 6A.

7.2 INITIAL SITE ASSESSMENT

Geocon reviewed the following reports pertaining to the Site prior to identifying proposed sampling locations and laboratory analyses for our investigation:

- Geocon, *Draft Site Investigation Report, Lower Silver Creek, Reach 4, San Jose, California,* July 2001.

- Parsons, *Phase II Hazardous Materials Investigation Report, Santa Clara Valley Water District, Lower Silver Creek Reaches 5 & 6 Project,* March 2001.

- D & M Consulting Engineers, Inc., *Environmental Site Assessment Report, Lower Silver Creek Confluence to Aborn Road, San Jose, CA, Project 1445,* September 2000.

7.3 RESULTS

The Environmental Site Assessment Report did not identify and specific Recognized Environmental Conditions (RECs) that had the potential to impact Reaches 4, 5 and 6A. The investigation reports indicated the presence of low levels of metals in sediment, soil and groundwater samples. However, the reported metals concentrations were below ten times their respective Soluble Threshold Limit Concentrations (STLCs) for California hazardous waste classification in the sediment and soil samples. Groundwater results indicated that selected metals were reported at concentrations at or above their respective California Maximum Contaminant Levels for drinking water (MCLs). Low levels of petroleum hydrocarbon compounds, pesticides and PCBs were also reported in the sediment and surface soil samples, at concentrations below applicable standards for hazardous materials and human health risks.

The previous investigation reports concluded that the reported analyte concentrations in sediment and soil were below applicable regulatory levels for hazardous materials, and therefore would not require special handling if taken offsite, or pose unacceptable human health risks. The metals reported in the groundwater samples at or above MCLs were attributed to the presence of sediment. Therefore, it was recommended that engineering controls be implemented during project construction to allow 1) water rentention, sampling and potential treatment prior to discharge, and 2) reduction in suspended sediment load and discharge rate.

The information obtained from the current investigation will be used to evaluate disposal options and identify health and safety concerns.

SECTION 8
GEOTECHNICAL ENGINEERING INVESTIGATION

8.1 PURPOSE

The Geotechnical Engineering Investigation was performed for augmenting the previously prepared Geotechnical Reports and for the investigation and evaluation of the strength parameters of the soil for engineering purposes. The investigation included supplemental field borings and cone penetration testing along Reaches 4, 5 and 6A. Reports to be updated include the Geotechnical Investigation Report, Reach 4, prepared by Parikh, Inc., dated August 2003 and the Geotechnical Design Report, Reaches 5 and 6, by GTC, dated June 2002.

8.2 RESULTS

The results of the findings and recommendation are listed and summarized in the Soils Report as prepared by Parikh Consultants Inc. (See Appendix 6)

SECTION 9
REVEGETATION INVESTIGATION

9.1 PURPOSE

The purpose of this investigation is to ensure that the project is designed and constructed in accordance with the project needs and meets the CEQA documents and regulatory permit requirements.

9.2 REVEGETATION INVESTIGATION

A meeting was held with the District Biologist and the environmental permitting staff for the project. District staff provided the project requirements and insight into lessons learned on previous completed Reaches.

9.3 REVEGETATION RECOMMENDATIONS

Revegetation recommendations are made on the attached revegetation plan, which is included in the project drawings. (See Appendix 3)

SECTION 10
PROJECT SCHEDULE

10.1 PROJECT SCHEDULE

10.1.1 Schedule Background

A project schedule was developed during the contract negotiations period and further up dated after the initial kick off meeting.

Major Project milestones are:

1. Basis of Design Update Submittal **January 29, 2010**

2. The 90% design review workshop is scheduled for **March 30, 2010**

3. The 95% design review workshop is scheduled for **May 4, 2010**

4. The 100% design is expected to be completed in the late **May/June** timeframe, followed immediately by bidding

5. First construction season to begin in **July, 2010**

6. It is anticipated two (2) construction seasons will be required to complete the work.

SECTION 11
OPINION OF PROBABLE CONSTRUCTION COST

11.1 OPINION OF PROBABLE CONSTRUCTION COST

11.1.1 Basis of Opinion
The basis of this opinion is the unapproved Basis of Design Preliminary Engineering Plans dated January 29, 2010 as prepared by RJA. (See Opinion of Cost Appendix 1)

11.1.2 Cost Figures
The cost figures shown are estimates only. Actual costs are dependent on the cost figures at the time of bidding, the general market situation, the contractor's work load, and seasonal factors in labor and material costs.

11.1.3 City and Agency Fees
City and Agency fees are not included in the above.

11.1.4 Unit Prices
Unit Prices are based on historical information and are subject to change.

11.1.5 Right-of-Way Costs
Right-of-way costs are not included.

11.1.6 Engineering Design and Surveying Costs
Engineering Design, Survey, and Inspection are not included.

11.1.7 Gas, Electric and Telephone
Utility relocation costs are not included.

(See Appendix 2 for Preliminary Opinion of Probable Cost)

MEMO

Project Name:	**Silver Creek Stream Bank Restoration**
Project Number:	090018.00
Date:	January 27, 2010
To:	Jim Schul, RJA
Cc:	Arminta Jensen, RJA Carrie Wright, RJA Chuck Anderson, Schaaf & Wheeler Gary Parikh, PARIKH Consultants, Inc. Mahvash Harms, Biggs Cardosa Dennes Furia, Biggs Cardosa Steve Sutherland, SSA Alison Hobbs, SSA
From:	Briana Cox, SSA
Re:	**Silver Creek Revegetation Design Coordination**

SSA has identified three outstanding items that need to be reviewed and approved by the SCVWD in order to further our design process.

The three items and recommendations for each include:

1. **Erosion Control Mesh Specification**
2. **Two-Year Phasing for Planting**
3. **Vine/Shrub Planting Versus Decorative Wall at Floodwalls**

Below are detailed descriptions of each item followed by cut sheets and pictures for reference.

1. **Erosion Control Mesh Specification**

We recommend the use of an erosion control mesh to blanket all disturbed slopes and benches within the project limits within the first 12-18 months of the project. The use of an erosion control net will reduce erosion and protect/stabilize a growing environment for hydroseed to establish quickly and successfully. Given the high flows (12.5 ft/s worst case), limited maintenance and restricted construction access we recommend a product that would meet the same performance specifications as North American Green C125 BioNet (BN).

The product is a double net mat of 100% coconut fiber between woven jute netting and can function for up to 36 months, although the longevity spec is for 24 months. The C125BN is one of the longest functioning of the biodegradable control blankets on the market. The C125BN is also designed for success on 1:1 and greater slopes and is used most commonly on wetland, mitigation and bioengineering projects (see below).

We propose that a layer of hydroseed (along with any fertilizers and amendments) be applied to the slope followed by the C125BN to protect the newly seeded slope. The double layered net will adequately protect the newly seeded slope. Applying

C125BN™
Double Net Coconut Blanket

C125BN™ features a 100% coconut fiber matrix stitched with biodegradable thread between a leno woven jute top netting and a woven jute bottom netting. The combined strength of the coconut fiber and double netting structure offers the highest levels of durability, longevity and effectiveness available in a biodegradable erosion control blanket. C125BN is ideal for use in applications where vegetation will require 18 to 24 months for establishment, on slopes with a 1:1 or steeper gradient, and in high-flow channels, streambanks or shorelines.

1:1 Slopes*

High-Flow Channels*
2.35 lbs/ft^2 (112 Pa)
Max. Shear Stress

Shorelines and
Streambanks*

*NOTE: This guide is for general purposes only. Actual project design and product selection should be developed using North American Green's Erosion Control Materials Design Software (ECMDS®). Visit www.nagreen.com for more information about ECMDS®.

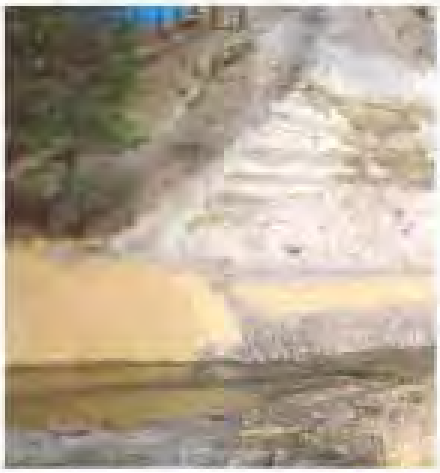
Netting – Top
Leno woven, 100% biodegradable,
natural jute fiber
9.30 lbs/1,000 ft^2 (4.53 kg/100 m^2)
approximate weight

Matrix Material
100% coconut fiber
0.50 lbs/yd^2 (0.27 kg/m^2)

Netting – Bottom
100% biodegradable,
natural jute fiber
7.70 lbs/1,000 ft^2 (3.76 kg/100 m^2)
approximate weight

Stitching
Biodegradable thread on 1.5-inch centers

Standard Roll Specifications
Width: 6.67 ft (2.03 m)
Length: 108 ft (32.92 m)
Weight: 52 lbs (23.69 kg) approx.
Area: 80 yd^2 (66.89 m^2)



Arid and semi-arid climates can be harsh, often requiring additional time for vegetation establishment. The C125BN provides up to 24 months of high-performance seed and soil protection in a wildlife-friendly manner.

MATERIAL SPECIFICATION

C125BN

The long-term coconut fiber erosion control blanket shall be a machine-produced 100% biodegradable blanket with a 100% coconut fiber matrix with a functional longevity of up to 24 months (NOTE: functional longevity may vary depending upon climatic conditions, soil, geographic location, and elevation).

The blanket shall be of consistent thickness with the coconut fiber evenly distributed over the entire area of the blanket. The blanket shall be covered on the top and bottom sides with 100% biodegradable woven, natural, organic fiber netting. The top netting shall consist of machine directional strands formed from two intertwined yarns with cross directional strands interwoven through the twisted machine strands (commonly referred to as a Leno weave) to form an approximate 0.50 x 1.00 inch (1.27 x 2.54 cm) mesh. The blanket shall be sewn together on 1.50 inch (3.81 cm) centers (50 stitches per roll width) with biodegradable thread.

The C125BN shall meet requirements established by the Erosion Control Technology Council (ECTC) Specification and the U.S. Department of Transportation, Federal Highway Administration's (FHWA) *Standard Specifications For Construction of Roads and Bridges on Federal Highway Projects, FP-03 2003 Section 713.17* as a *Type 4. Long-term Erosion Control Blanket*.

The C125BN is also available upon request with the DOT System™. The DOT System™ consists of installation staple patterns clearly marked on the erosion control blanket with environmentally safe paint. The blanket shall be manufactured with a colored line or thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) to ensure proper material overlapping.

The long-term erosion control blanket shall be C125BN as manufactured by North American Green **and** Distributed by: Jen-Hill Construction Materials (Phone. 1-800-452-4435),or equivalent.

The coconut fiber erosion control blanket shall have the following properties:

Material Content

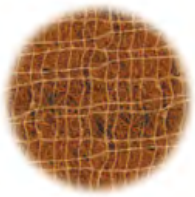
Matrix	100% coconut fiber (0.50 lb/yd²) (0.27 kg/m²)
Netting	Top - Leno woven 100% biodegradable organic jute fiber (9.30 lbs/1,000 ft² [4.50 kg/100 m²] approximate weight) Bottom - 100% biodegradable organic jute fiber (7.7 lbs/1,000 ft² [3.76 kg/100 m²] approximate weight)
Thread	Biodegradable

C125BN is Available with the Following Physical Specifications Per Roll [English Units (Metric Units)]

Width ± 5%	6.67 ft (2.03 m)
Length ± 5%	108.00 ft (32.92 m)
Weight ± 10%	52.22 lbs (23.69 kg)
Area	80.00 yd² (66.89 m²)

Stitch Spacing for All Rolls = 1.50 inches (3.81 cm)

PERFORMANCE SPECIFICATION



C125BN

The North American Green C125BN erosion control blanket is constructed of 100% biodegradable materials containing a 100% coconut fibre matrix and has a functional longevity of approximately 24 months. (NOTE: functional longevity may vary depending upon climatic conditions, soil, geographic location, and elevation). The coconut fiber shall be evenly distributed over the entire area of the mat. The blanket shall be covered on the top and bottom with 100% biodegradable natural organic fiber netting woven into an approximate 1.27 x 2.54 cm mesh. The blanket shall be sewn together with biodegradable thread on 3.81 cm centers. The following list contains further physical properties of the C125BN erosion control blanket.

Property	Test Method	Typical
Thickness	ASTM D5199/ECTC	6.60 mm
Resiliency	ECTC Guidelines	85 %
Mass per Unit Area	ASTM D6475	300 g/m²
Water Absorption	ASTM D1117/ECTC	155 %
Swell	ECTC Guidelines	40 %
Stiffness/Flexibility	ASTM D1388/ECTC	1,218 mg-cm
Light Penetration	ECTC Guidelines	16.40 %
Smolder Resistance	ECTC Guidelines	Yes**
MD Tensile Strength	ASTM D5035	4.98 kN/m
MD Elongation	ASTM D5035	7.60 %
TD Tensile Strength	ASTM D5035	3.08 kN/m
TD Elongation	ASTM D5035	11.10 %

**Material is smolder resistant according to specified test
MD – Machine Direction
TD – Transverse Direction

Slope Design Data **Channel Design Data**

Cover Factors (C)				Channel Roughness Coefficients	
	Slope Gradient (S)			Flow Depth	Manning's 'n'
Slope Length (L)	≤ 3:1	3:1 – 2:1	≥ 2:1	0.15 m	0.022
6 m	0.00009	0.018	0.050	0.15-0.60m	0.022-0.014
6m to 15m	0.003	0.040	0.060	0.60 m	0.014
15.2 m	0.007	0.070	0.070	Max. Permissible Shear Stress 112.0 Pascal	

Bench Scale Shear Test*
Unvegetated = 153 Pascal

Approximate Max Flow Velocity
3.05 m/s

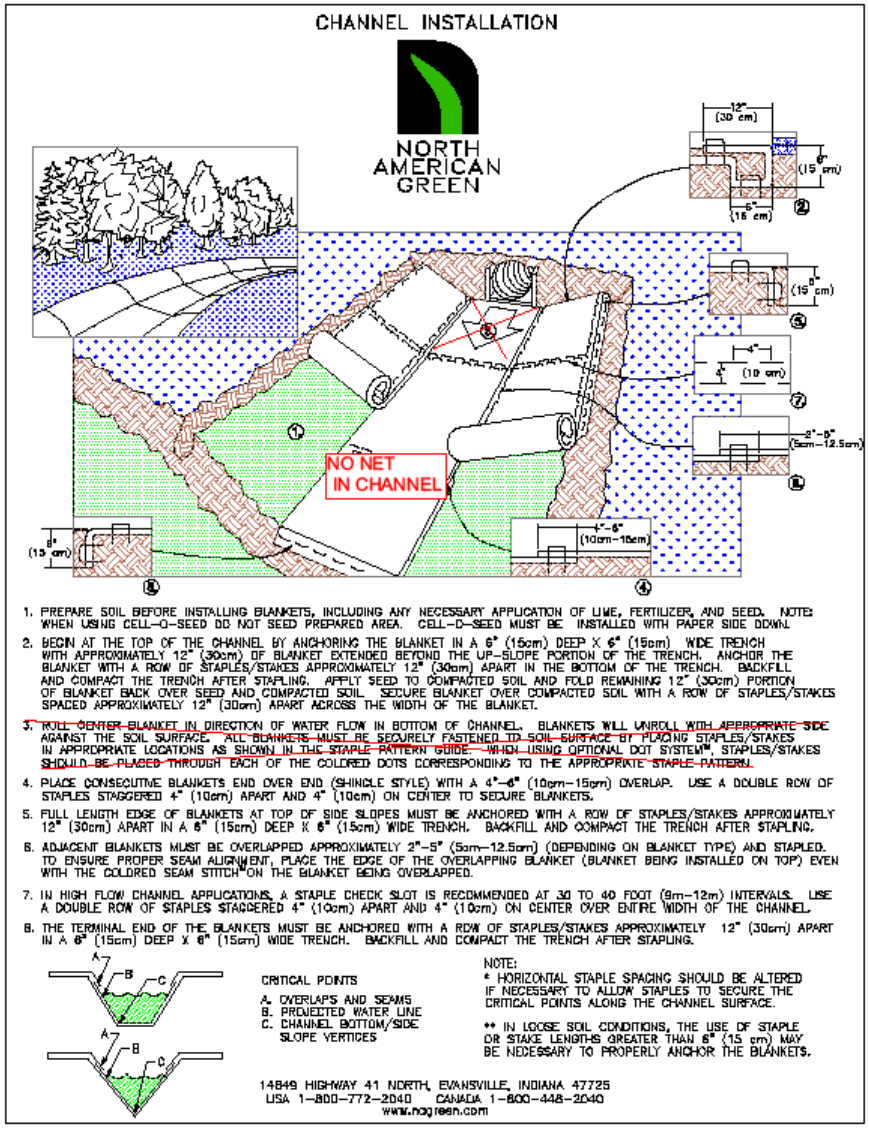
For most accurate design data consult ECMDS™
Manning's 'n' expressed in English units for unvegetated blankets

***Bench Scale Testing**
Bench scale tests are index property tests. These tests are not indicative of field performance and therefore should not be used in design to establish performance levels for rolled erosion control products. Bench scale tests are performed according to methods developed by the Erosion Control Technology Council (ECTC).

Updated 1/2007

an additional layer of seed on top of the net will not be necessary or effective and will only hinder seed from penetrating the soil. Pregermination of the seed will be required in order for quick establishment and to ensure a high survival rate.

We recommend using the optional staple pattern provided on the blanket for easier and consistent installation along with biodegradable 12 inch long wooden EcoStakes to provide a secure anchor and to maintain the natural design of the project (see below cut sheet). Please review and comment if this material and strategy will be acceptable. If there are no concerns and the product seems feasible for the purposes of the Silver Creek Stream Bank Restoration project, we will move forward with including the C125BN in our design package.



BioNet® Product Application Guide

Product	Description	Longevity	Applications	Permissible Shear Stress	Maximum Flow Velocity	FHWA FP-03 Category
S75BN	Single Net Straw Blanket	Up To 12 Months	4:1 - 3:1 Slopes Low-Flow Channels	1.60 lbs/ft^2 (76 Pa)	5 ft/s (1.52 m/s)	Type 2.C
S150BN	Double Net Straw Blanket	Up To 12 Months	3:1 - 2:1 Slopes Moderate-Flow Channels	1.85 lbs/ft^2 (88 Pa)	6 ft/s (1.83 m/s)	Type 2.D
SC150BN	Double Net Straw-Coconut Blanket	Up To 18 Months	2:1 - 1:1 Slopes Medium-Flow Channels	2.10 lbs/ft^2 (100 Pa)	8 ft/s (2.44 m/s)	Type 3.B
C125BN	Double Net Coconut Blanket	Up To 24 Months	1:1 & Greater Slopes High-Flow Channels	2.35 lbs/ft^2 (112 Pa)	10 ft/s (3.05 m/s)	Type 4

NOTE: This guide is for general purposes only. Actual project design and product selection should be developed using North American Green's Erosion Control Materials Design Software (ECMDS®). Visit www.nagreen.com for more information about ECMDS®.

BioNet Fastener and Installation Options

SureLock® II Convertible Staple Gun

Efficiently and effectively install 4" (10.16 cm) or 6" (15.24 cm) BioSTAKEs® or 6" (15.24 cm) wire cartridge staples with the SureLock® II Convertible Staple Gun. Available in manual and pneumatic-drive models, the SureLock II can be easily converted from one drive system to the other. Features all composite metal components for reduced wear and easy cleaning and maintenance.

BioSTAKEs®

Our BioSTAKEs® are available in 4" (10.16 cm) and 6" (15.24 cm) lengths, and provide an environmentally friendly alternative to metal staples. Sturdy and rigid when used, BioSTAKEs will break down over a period of one to three years after being driven into the ground.

EcoSTAKEs®

Our wooden EcoSTAKEs® are available in 6" (15.24 cm), 12" (30.48 cm), 18" (45.72 cm) and 24" (60.96 cm) lengths. They are ideal for use in bioengineering, streambank and other critical applications requiring greater anchoring capability of longer stakes.

North American Green is a leading erosion control solution provider with a worldwide network of qualified distributors with trained Erosion Control *Specialists*. In addition to offering a full line of rolled erosion control products, North American Green's Erosion Control *Specialists* are trained to provide site-specific project design and product specification assistance using North American Green's Erosion Control Materials Design Software (ECMDS®); and offer the most comprehensive guarantee in the industry, the Ultimate Assurance Guarantee. More information about North American Green products and services is available at www.nagreen.com or by calling (800) 772-2040.

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NORTH AMERICAN GREEN
Eco-STAKE™ (12 inch)
Specification

The North American Green Eco-STAKE is a 100 % biodegradable "1"- shaped hardwood pin designed to safely and effectively secure erosion control blankets. The wood stake must exhibit ample rigidity to enable being driven into hard ground, with sufficient flexibility to resist breakage. The wood stake shall be the North American Green Eco-STAKE or approved equal, with the following dimensions:

Leg Length:	11.00 in. (27.94 cm)
Head Width:	1.25 in. (3.18 cm)
Head Thickness:	0.40 in. (1.02 cm)
Leg Width:	0.60 in. (1.52 cm) (tapered to point)
Leg Thickness:	0.40 in. (1.02 cm)
Total Length:	12.00 in. (30.48 cm)

Updated 1/1/2002

2. Two Year Phasing for Planting

A multi-phased revegetation strategy has been proposed with which SSA is in agreement. This would take place over two growing seasons and would help with the following:

- Increase slope stabilization by establishing immediate vegetation through hydroseeding without additional planting disturbances.
- Increase the success rate of plant establishment in the second season since hydroseed will increase soil moisture retention, soil complexity, and allow for easier installation.
- Decrease disturbance to the slope and compaction of soils during planting of larger trees and shrubs since hydroseed root zones will increase soil complexity and stabilize soils.
- Decrease potential for erosion as soon as possible.
- Decrease risk of slope failures.

The first phase would be to hydroseed, possibly with a cover crop, along with an application of an erosion control net for immediate establishment. This would protect the slopes and provide a good planting environment for the next phase which would occur in the second season of construction. During this second phase, native trees, shrubs, perennials, and forbes would be planted. These natives will have a much higher survival rate if planted in the established hydroseed for the following reasons:

- Established hydroseeded soils are more fertile, have better soil structure than disturbed soils, and make the moisture content within the soil more consistent, all of which are very important for the establishment of native plants.
- Plants will receive irrigation more consistently because there will be less runoff as it will be slowed by the established hydroseed cover.
- Planting techniques will be easier to execute since the slope will be more stable. Additionally, by the time of planting the erosion net will have begun to break down making it easier for the contractor to plant through.

Allowing for a two-year planting window will improve plant establishment, save money over time, and help to ensure long-term planting success. Working to re-establish a healthy soil profile by hydroseeding first sets the stage for the natural revegetation of a native landscape.

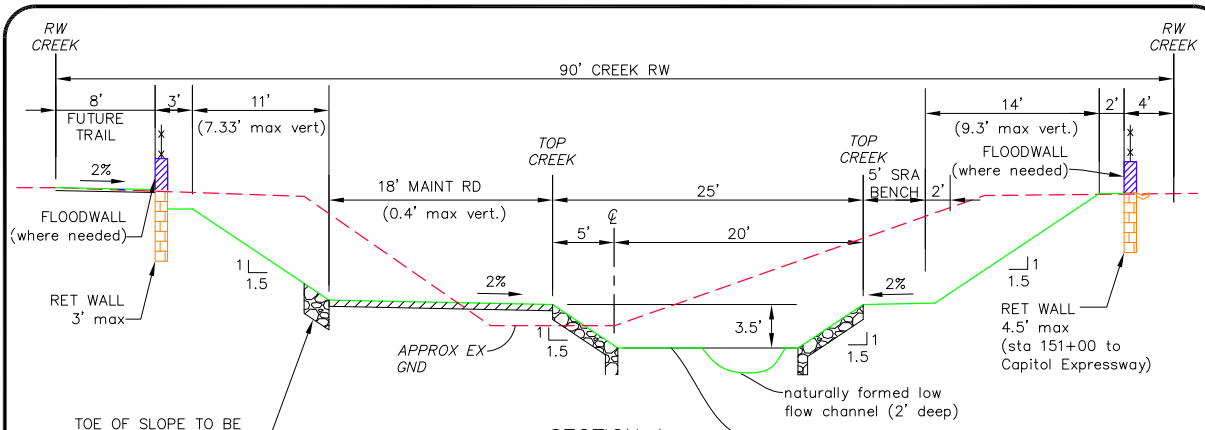
3. Vine Planting vs. Decorative Wall

The main impetus for incorporating vine planting up and along the flood wall is to prevent vandalism. Due to the difficulties described below, SSA is recommending installation of a decorative wall with a natural rock outcrop appearance in lieu of vine and shrub planting.

Vine/shrub planting would help deter wall defacement, but there are drawbacks with both types of planting that ultimately could become a greater hindrance than damages to the wall. Some difficulties with vine or shrub planting against/along the fall wall include:

- Shrub planting will add greatly to long-term maintenance costs: shrubs will need to be pruned regularly to keep width at around 3' (2 times/year min.). Vine planting will add to long-term maintenance costs as well.
- Limited choices on vine species: only nonnative vines species will effectively and efficiently attach and climb up/down the concrete wall. There isn't an acceptable native vine for this application.
- Additional costs: start up and irrigation will add to the overall cost of the project significantly.
- Inadequate wall coverage: shrub planting would need to have a sufficient amount of space (50' min.) between each plant so as not to affect the hydraulics on site. This spacing defeats the goal of limiting vandalism by exposing too much wall.
- Limitations of maintenance road: shrub/vine planting will reduce the width of the maintenance road from 18' to 16' approximately once plants are established. The maintenance road is already at the minimum width requirements.

As an alternative vandalism deterrent SSA suggests the use of a textured decorative wall to mimic a natural stone/rock outcropping (see sample images below). The wall is aesthetically pleasing and keeps with the width requirements for the maintenance road. Textured surfaces and darker colored surfaces are known to be less attractive to graffiti vandals. The surface of the wall should be textured in such a manner that the visibility of the surface from the surrounding community will have a natural appearance. In case of graffiti damage an anti graffiti sealer may be used in order to cut down on maintenance costs. The textured wall would occur on both sides of the channel for consistency in design. This option minimizes long-term maintenance costs and overall is a less expensive option. This option provides a functional and aesthetic floodwall (see section for location).



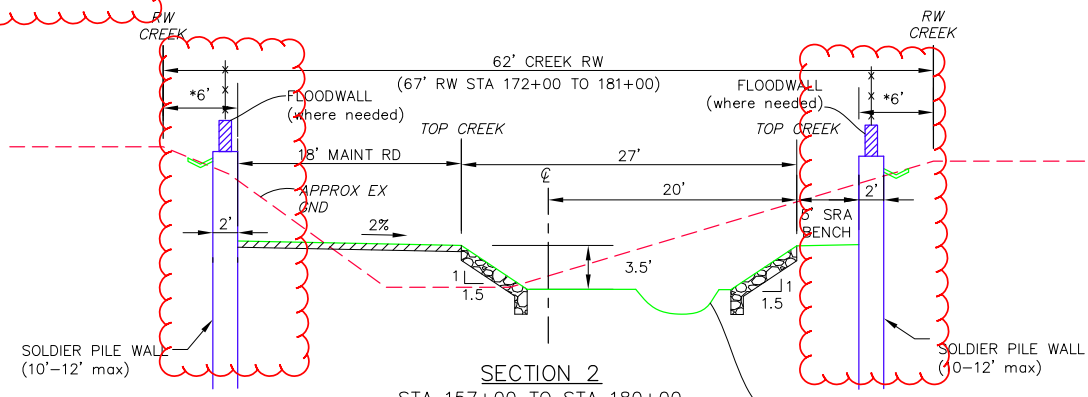
SECTION 1

STA 133+00 TO STA 154+00

(Between Jackson Ave & Capitol Expressway)

1"=10'

FLOOD WALLS TO BE DECORATIVE



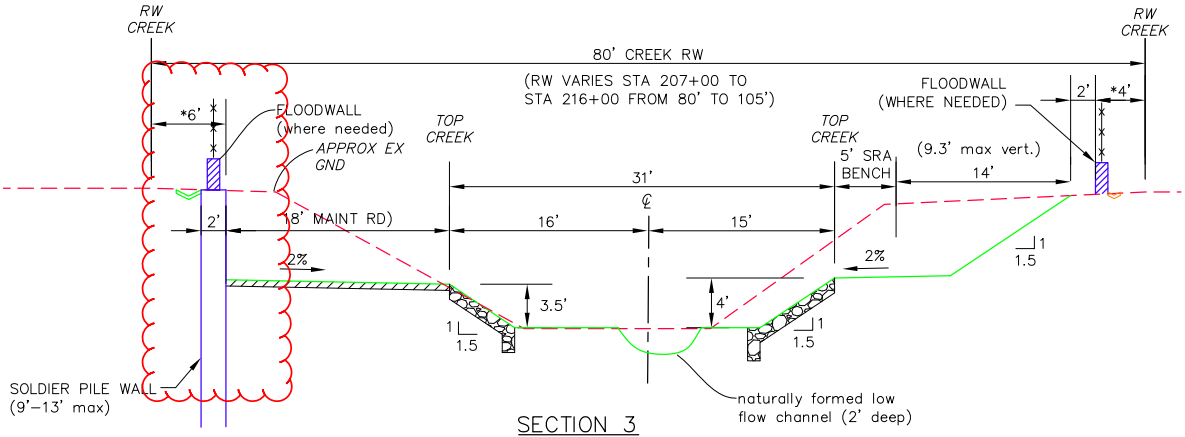
SECTION 2

STA 157+00 TO STA 180+00

(Between Capitol Expressway & Story Road)

1"=10'

NOTE:
*CREEK RW IS 67' FROM STA 172+00 TO 181+00. DISTANCE FROM FACE OF WALL TO PL IS 8.5' IN THIS AREA.



SECTION 3

STA 184+00 TO STA 216+00

(Between Story Road & Moss Point Drive)

1"=10'

NOTE:
*CREEK RW VARIES FROM 80' TO 105' STA 212+00 TO 216+00. DISTANCE FROM FACE OF WALL TO PL VARIES FROM 6'–18'.

LEGEND

- EX. GROUND
- PROP. GROUND
- PROP. SOLDIER PILE WALL
- PROP. FLOOD WALL
- PROP. RET WALL
- RIP RAP SLOPE PROTECTION
- MAINTENANCE RD ROCK WITH

CONCEPTUAL CREEK SECTIONS

LOWER SILVER CREEK

SAN JOSE, CALIFORNIA

JANUARY 7, 2010

RJA
RUGGERI-JENSEN-AZAR
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JOB NUMBER: 092051

SSA recommends incorporating all three items in the Silver Creek Stream Restoration project in order to best accomplish revegetation along Reaches 4, 5 and 6A. Following the response and approval of the three aforementioned items we will move forward with including each in our design development package.

Please call Alison Hobbs at 831-459-0455 with any questions or comments.

Regards,

Briana Cox

GEOTECHNICAL INVESTIGATION REPORT

LOWER SILVER CREEK, REACHES 4-6A
SANTA CLARA VALLEY WATER DISTRICT
SANTA CLARA COUNTY, CALIFORNIA

(DRAFT)

For

Ruggeri-Jensen-Azar & Associates
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DRAFT

January 2010

Job No. 200116.PSE

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Laboratory Test Results Extracted from Geotechnical Investigation Report (Lower Silver Creek, Reach 4) by PARIKH Consultants, Inc.

Laboratory Test Results Extracted from Geotechnical Investigation Report (Capitol Expressway Box Culvert, Dobern Avenue Pedestrian Bridge, Lyndale Avenue Pedestrian Bridge and Story Road Box Culvert) by PARIKH Consultants, Inc.

Laboratory Test Results Extracted from Geotechnical Design Report (Lower Silver Creek, Reaches 5 and 6) by Geotechnical Consultants, Inc.

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GEOTECHNICAL INVESTIGATION REPORT
LOWER SILVER CREEK, REACHES 4-6A
SANTA CLARA VALLEY WATER DISTRICT
SANTA CLARA COUNTY, CALIFORNIA

1. INTRODUCTION

This report presents the results of our geotechnical engineering investigation for the "Lower Silver Creek Reaches 4-6A" in Santa Clara County, California, hereinafter referred to as "PROJECT". The work was performed in general accordance with the scope of work outlined in our proposal to Ruggeri-Jensen Azar & Associates (hereinafter referred to as Designer). The general location of the project site is shown on the Project Location Map, Plate 1.

The geotechnical recommendations presented in this report are intended for design input and are not intended to be used as specifications. In addition, the data provided in this report including these geotechnical recommendations should not be used for bidding purposes or directly for construction cost estimates. If the report is provided as a reference document, any interpretation of the data and recommendations should be sole responsibility of the user and PARIKH Consultants, Inc. (PARIKH) shall not be liable for any consequences.

2. PURPOSE AND SCOPE

The scope of work performed for this investigation included a review of the readily available soils and geologic literature pertaining to the site, refer to previous geotechnical reports by PARIKH and Geotechnical Consultants, Inc. (GTC); site reconnaissance; obtaining representative soil samples and logging soil materials encountered in the supplemental exploratory borings and Cone Penetration Test (CPT); laboratory testing of the collected soil samples, performing engineering analyses based on the field and laboratory data, evaluating the general soil conditions at the site, evaluating their engineering properties, presenting recommendations for the above various elements of the creek improvement and preparation of this report for the "Lower Silver Creek Reaches 4-6A".

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the subsurface soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain a properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction. Our recommendations presented in this report are based on the above information; any major deviation should be reported to this office for consideration.

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3. PROPOSED CONSTRUCTION

Lower Silver Creek drains a watershed in the southeastern portion of the City of San Jose from Lake Cunningham to Coyote Creek. It is approximately five miles long, and empties into the Coyote Creek, which then drains into the San Francisco Bay. The Santa Clara Valley Water District (SCVWD) is implementing flood protection improvements on all segments of Lower Silver Creek from Coyote Creek confluence to Lake Cunningham. The flood protection improvements of Lower Silver Creek from Reach 1 to Reach 3 have been completed. This project is divided into following reaches and sub-reach.

a) Reach 4 is from Interstate-680 (Sta. 127+93.63) at one end to North Babb Creek (Approximate Sta. 170+07.79) at the other end with a distance of approximately 4,000 feet.
b) Reach 5a is from North Babb Creek to Lyndale Avenue.
c) Reach 5b is from Lyndale Avenue to Story Road.
d) Reach 5c is from Story Road to South Babb Creek.
e) Reach 6a is from South Babb Creek to Moss Point Drive.

The proposed flood protection is to be provided by increasing the flow capacity of the channel. The key elements in this project will include

a) Slope trimming with 1.5(H): 1(V) slope,
b) Floodwall/retaining wall
c) Floodwall/soldier pile wall and
d) Replacement of existing box culvert under Jackson Avenue, Capitol Expressway and Story Road.

Geotechnical recommendations for the foundation design of the replacement of existing reinforced box culvert under Jackson Avenue, Capitol Expressway and Story Road should be referred to the geotechnical reports prepared by PARIKH and other consultants (Ref. 3 and 4).

4. PERTINENT REPORTS AND INVESTIGATION

We have referred to the following available geotechnical investigation reports and boring information in our study:

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a) Geotechnical Investigation Report of Lower Silver Creek Reaches 4A and 4B, July 2003, by PARIKH Consultants, Inc (Geotechnical Report by PARIKH).

The project by PARIKH addresses Reach 4, which is divided into 4a, 4b and 4c for design purposes. These reaches extend from Route 680/Jackson Avenue to near the confluence of North Babb Creek and Lower Silver Creek.

b) Geotechnical Investigation Report of Lower Silver Creek Reaches 5 and 6, June 2002, by Geotechnical Consultants, Inc (Geotechnical Report by GTC).

The project by Geotechnical Consultants, Inc. (GTC) addresses Reaches 5a, 5b, 5c, 6a and 6b. These reaches extend from Cunningham Avenue to near the confluence of North Babb Creek and Lower Silver Creek.

c) Geotechnical Investigation Report (Draft) of Capitol Expressway Box Culvert at Lower Silver Creek, October 2002, by PARIKH (Capitol Expressway Report).

d) Geotechnical Investigation Report (Draft) of Story Road Box Culvert at Lower Silver Creek, October 2002, by PARIKH (Story Road Report).

e) Geotechnical Investigation Report of Dobern Avenue Pedestrian Bridge at Lower Silver Creek, April 2005, by PARIKH (Dobern Avenue Report).

f) Geotechnical Investigation Report (Draft) of Lyndale Avenue Pedestrian Bridge at Lower Silver Creek, November 2002, by PARIKH (Lyndale Avenue Report).

Copies of the as-built boring logs are included in Appendix A. The locations of the as-built borings and CPTs are shown on Plates 2A through 2D, Site Plan.

5. SITE CONDITIONS

The following are the descriptions of existing conditions at the project site.

- Except for the existing reinforced concrete box culvert under the Jackson Avenue, Capitol Expressway and Story Road, the creek banks are earth slopes.
- The elevation of the top of the bank is generally higher on the left bank than the right bank.
- The elevation of the top of the bank increases from the beginning of Reach 4 to the end of Reach 6a.

- The existing slope is generally steep on both sides of the creek with the slope on the left bank steeper than the slope on the right bank.
- The slope gradient of the existing slope is approximately 1(H):1(V) with steeper gradient at some locations within the project limits.
- The existing creek banks are typically on the order of 10 feet.
- The land adjacent to the SCVWD right-of-way (ROW) is primarily residential with some commercial properties and school yards at some locations. There are improvements along the property lines that include swimming pools, hot tubs and out buildings etc.
- The existing banks of the creek appear to be in fair condition. The creek ROW is covered with trees and brush.

6. FIELD EXPLORATION AND LABORATORY TESTING

Field Explorations Performed in 2000

The following table presents the summary of field explorations performed by PARIKH and GTC in 2000.

TABLE 1: SUMMARY OF FIELD EXPLORATIONS PERFROMED IN 2000

Boring No.	Date of Drilling	Boring Depth (feet)	Approximate Measured Groundwater Elev. (ft)	Location	Within Reach
By PARIKH Consultants, Inc.					
B-1	11/2000	24.5	88.5	West of Jackson Ave. – Left Bank	4
B-2	11/2000	29.5	96.0	East of Jackson Ave. – Right Bank	4
B-3	12/2000	30.5	94.5	East of Jackson Ave. – Left Bank	4
B-4	11/2000	29.5	94.5	East of Jackson Ave. – Right Bank	4
B-5	11/2000	29.5	-	East of Jackson Ave. – Right Bank	4
B-6	11/2000	31.5	99.0	East of Jackson Ave. – Left Bank	4
B-7	11/2000	24.5	93.5	West of PG&E Easement – Right Bank	4
B-8	11/2000	31.5	96.0	East of PG&E Easement – Left Bank	4
B-9	12/2000	30.0	97.5	East of PG&E Easement –Right Bank	4
B-10	11/2000	31.5	98.5	East of PG&E Easement – Left Bank	4
B-11	11/2000	24.5	98.5	West of Capitol Expressway – Right Bank	4
B-12	12/2000	30.5	101.5	West of Capitol Expressway – Left Bank	4
B-13	11/2000	29.5	102.0	West of Capitol Expressway – Right Bank	4

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B-14	12/2000	30.0	103.5	East of Capitol Expressway – Left Bank	4
B-15	11/2000	29.5	92.5	West of Jackson Ave. – Right Bank	4
B-16	11/2000	31.5	100.0	East of Capitol Expressway – Right Bank	4
B-17	11/2000	30.0	107.0	East of Capitol Expressway – Left Bank	4
By GTC					
B-1	10/2000	21.5	108.0	West of North Babb Creek – Left Bank	5a
B-2	10/2000	36.5	112.0	East of North Babb Creek – Right Bank	5b
B-3	10/2000	31.5	116.0	East of North Babb Creek – Left Bank	5b
CPT-1	10/2000	25.0	113.0	Between Story Rd. and North Babb Creek – Left Bank	5b
B-5	10/2000	26.5	115.0	East of North Babb Creek – Left Bank	5c
B-6	10/2000	21.5	117.0	West of Murtha Drive – Left Bank	5c
B-7	10/2000	41.5	109.0	East of Murtha Drive – Left Bank	5c
CPT-14	10/2000	40.0	116.0	East of Story Road – Right Bank	5c
CPT-2	10/2000	31.0	116.0	East of Story Road – Left Bank	5c
CPT-3	10/2000	31.0	117.0	Between Story Rd. and Murtha Dr. – Left Bank	5c
CPT-4	10/2000	41.0	120.0	West of Murtha Drive – Left Bank	5c
B-8	10/2000	21.5	118.0	East of South Babb Creek – Left Bank	6a
B-9	10/2000	31.5	117.0	West of Moss Point Drive – Right Bank	6a
CPT-5	10/2000	25.0	122.0	East of South Babb Creek – Right Bank	6a
CPT-6	10/2000	25.0	120.0	Left of Moss Point Drive – Left Bank	6a

Field Exploration Performed in 2009

Based on the plans provided, discussions with designer, and readily available geologic and existing boring information, fifteen borings were drilled and five CPT were performed in December 2009. The primary purpose of this exploration was to supplement the data for the proposed retaining walls. The following are the details of the field exploration:

a) Eight shallow borings (depth between 30 feet and 35 feet) were drilled on the right bank with portable rig because inaccessibility of the truck-mounted drill rig to the site.

b) Seven relatively deep borings (depth between 60 feet and 65 feet) were drilled and five CPT were performed on the left bank.

The approximate locations of the borings and CPTs are shown on Site Plan (Plates 2A through 2D). The boring/CPT locations, stations, and relevant information are summarized in Table 2 below.

TABLE 2: SUMMARY OF BORINGS

Boring/CPT No.	Station (ft)	Within Reach	Boring/CPT Depth (feet)	Approx. Ground Elev. (feet)	Approx. Groundwater Elev. (feet)
A-09-001	156+94	4 - Left Bank	60.0	117.5	104.5
A-09-002	163+69	4 - Left Bank	30.5	118.0	-
A-09-003	166+86	4 - Left Bank	35.5	119.5	108.5
A-09-004	169+24	4 - Right Bank	60.0	115.0	102.0
A-09-005	172+12	5b - Left Bank	30.0	122.0	112.0
A-09-006	174+67	5b - Left Bank	30.0	122.5	112.5
A-09-007	179+74	5b - Right Bank	60.0	122.0	112.0
A-09-008	184+33	5c - Left Bank	30.0	125.0	113.0
A-09-009	188+35	5c - Left Bank	30.0	124.0	112.5
A-09-010	197+44	5c - Right Bank	60.0	123.0	113.0
A-09-011	203+33	6a - Right Bank	60.0	123.0	113.0
A-09-012	215+22	6a - Right Bank	60.0	131.5	121.5
A-09-013	203+25	6a - Left Bank	30.5	128.5	117.5
A-09-014	207+08	6a - Left Bank	35.0	129.0	117.0
A-09-015	209+13	6a - Left Bank	35.0	129.5	117.5
A-09-016	212+39	6a - Right Bank	35.5	130.0	118.0

The details of the field exploration are included in Appendix A. The descriptions of the materials encountered in the field exploration are shown on the "Log of Borings".

Laboratory tests including moisture content, dry density, Atterberg Limits, particle size distribution analyses, corrosion analysis, unconfined compression tests, unconsolidated undrained tests, consolidated undrained tests and corrosion tests were performed on selected soil samples collected during field exploration to evaluate the physical and engineering properties of the subsurface soils. The laboratory test methods and test results are presented on plates in Appendix B.

It should be noted that the descriptions of the soils encountered and relevant boring information presented on the Log of Borings depict subsurface conditions only at the locations

indicated on the plan and on the particular date noted on the Log of Borings. Because of the variability from place to place within soil/rock in general, subsurface conditions at other locations may differ from conditions occurring at the boring locations explored. The abrupt stratum changes shown on the logs may be gradational and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. Also, the passage of time may result in a change in the soil conditions at these locations due to environmental changes.

7. SUBSURFACE SOIL CONDITIONS

Previous Field Exploration

The following are the subsurface soils conditions according to the geotechnical reports (Ref. 1 and Ref. 2) prepared by PARIKH and GTC.

Reach 4 (Between Route 680 and North Babb Creek)

- Soft to very stiff lean clays, with pockets/lenses of loose to medium dense clayey sand, underlain by stiff to very stiff fat clays. A relatively thick layer of clayey sand with gravel was encountered from the borings upstream of Capitol Expressway.
- Groundwater was encountered in the borings at the depths between 6 feet and 23 feet during drilling.

Reach 5a (North Babb Creek)

- Creek bank materials consist of dark brown lean clay.
- Firm to stiff lean clay with inter-fingered layers of silt/clayey sand below the creek bed.
- Groundwater was encountered in Boring B-1 at the depth of 6 feet during drilling.

Reach 5b (Between North Babb Creek and Story Road)

- Creek bank materials consist of stiff to very stiff, black to red brown lean clay.
- A 2-foot layer of silty sand was encountered at the top of the creek bed at approximate Elev. +112.0 feet.
- Stiff, dark gray sandy lean clay to lean clay with occasional pockets of silt underlies the creek bed to approximate Elev. +100.0 feet.
- Layers of clayey sand to clean sand between Elev. + 90 feet and Elev. +100.0 feet.

- Stiff, orange-brown lean clay underlies the sand layer to approximate Elev. +86.0 feet.
- Groundwater was encountered in Borings B-2 and B-3 at the depths of 2 feet and 11 feet during drilling.

Reach 5c (Between Story Road and Murtha Drive)

- Creek bank materials consist of stiff, dark gray lean clay to the creek bed level at approximate Elev. +117.0 feet. A pocket of dark brown fat clay was encountered between Elev. +112 feet and Elev. + 118.0 feet in CPT-3 and B-5.
- Subsurface soil materials below the creek bed consists of stiff clays of moderate to high plasticity with pocket of clean sand and silty sand to approximate Elev. +105.0 feet.
- Layers of poorly graded sand between Elev. + 105 feet and Elev. +95.0 feet.
- Stiff, orange-brown lean clay from Elev. +95.0 feet to approximate Elev. +86.0 feet.
- Groundwater was encountered in the borings at the depths between 3 feet and 9 feet during drilling.

Reach 6a (Between Murtha Drive and Moss Point Drive)

- Creek bank materials consist of very stiff lean clay/fat clay.
- Subsurface soil materials below the creek bed consist of stiff lean clays.
- Groundwater was encountered in Borings B-8 and B-9 at the depths of 5 feet and 13 feet during drilling.

Field Exploration in 2009

The following are the additional information on subsurface soil conditions based on the field exploration performed by PARIKH in 2009.

Reach 4 (Between Capitol Expressway and North Babb Creek)

- Firm to stiff lean clays, underlain by a thin layer of very stiff to hard lean clays, underlain by firm to very stiff lean clays. Pockets/lenses of soft lean clays and medium dense to dense clayey sands were encountered at various depths.

Reach 5 (Between North Babb Creek and Murtha Drive)

- Firm to hard lean/fat clays, underlain by loose to very dense clayey sand/poorly graded sand on the right bank.

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- Firm to stiff lean clays with pockets/lenses of soft clays and loose to medium dense clayey sand/poorly graded sand on the left bank.

Reach 6a (Between Murtha Drive and Moss Point Drive)

- Soft to very stiff lean/fat clays, underlain by layers of loose to medium dense silty/clayey sand/poorly graded sand, underlain by firm to very stiff lean clays.

Plasticity indices obtained from the laboratory test results range from 14 to 25 for the lean clays. Percentages of fines for the clayey sand/silty sand range from 15% to 40%.

The D_{10} of the clayey/silty sand is likely to be less than 0.05 mm and the coefficient of permeability is considered as smaller than 50×10^{-6} m/sec (or 5.17×10^{2} feet/year) according to Figure 3-5 of Army Corp of Engineer's Manual EM1110-2-1913 "Design and Construction of Levees".

Groundwater was encountered at the depths between 10 feet and 13 feet during drilling in 2009.

The groundwater level is anticipated to vary with the passage of time due to seasonal groundwater fluctuations, fluctuation of water level in Lower Silver Creek, surface and subsurface flows, ground surface run-off, and other environmental factors, which may not be present at the time of the investigation.

8. GEOLOGY

The project site is in the southeastern portion of the San Francisco Bay area in the Coast Range geomorphic province of California. The Coast Range forms a nearly continuous topographic barrier between the California coastline and the San Joaquin Valley. The Coast Range in this region is a double chain of mountain running north-northwest. Three prominent geologic blocks dominate the San Francisco Bay Area: the Santa Cruz Mountains (western block), the San Francisco Bay (central block), and the East Bay Hills/Diablo range (eastern block).

General geologic features pertaining to the site and its vicinity were evaluated with reference to the Geologic Map titled "Quaternary Geology of Santa Clara Valley, Santa Clara,

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Alameda, and San Mateo Counties, California", a digital database, compiled by E.J. Helley, R.W. Graymer, G.A. Phelps, P.K. Showalter, and C.M. Wentworth, May 1994. Based on the map, the site is primarily underlain by Natural Levee Deposits (Qhl) (Holocene) and First Alluvial Terrace Deposits (Qhfp1) (Holocene). The general geology of the project area is shown on the Geologic Map, Plate 3. Descriptions of the main geologic units are as follows:

Qhl - Natural Levee Deposits (Holocene): loose, moderately- to well-sorted sand with some silt and clay deposited by streams that overtop their banks during flooding.

Qhfp1 - First Alluvial Terrace Deposits (Holocene): Generally less than 3 feet thick and consist of rounded gravel and historic artifacts in a clayey silt matrix.

9. SEISMIC CONSIDERATIONS

9.1 Seismic Source

The project is located in a seismically active part of Northern California. Many faults exist in the regional area. These faults are capable of producing earthquakes and may cause strong ground shaking at the site. Faults in the vicinity of the site with a moderate to high potential for surface rupture include the Hayward Fault, Monte Vista/East Fault, Calaveras-Pacines-San Benito and San Andreas Fault Zone. The attached Fault Map (Plate 4) presents the locations of the fault systems relative to the project site.

Maximum credible earthquake magnitudes for some of the major faults in the area determined by Mualchin (California Seismic Hazard Map 1996) are summarized in Table 1 below. These maximum credible earthquake magnitudes represent the largest earthquakes that could occur on the given fault based on the current understanding of the regional tectonic structure.

TABLE 3: EARTHQUAKE DATA

Fault	Estimated Distance from Project Site (km)	Maximum Credible Earthquake Magnitude
Hayward (strike-slip)	4	7.5
Monte Vista/East (unknown/not published)	13	6.5
Calaveras-Pacines-San Benito (strike-slip)	8	7.5
San Andreas/North (strike-slip)	25	8.0

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Based on the seismic hazard map prepared by Mualchin (1996) the controlling fault is the Hayward Fault (Mw = 7.5). According to the Attenuation Relationship by Sadigh et Al. (1997), the Peak Bedrock Acceleration (PBA) at the site should be in the order of 0.6 g.

Based on the available boring information, the subsurface soil conditions at the project site consist of dense to very dense silty sand with gravel and silty gravel with sand. These types of soil generally match the criteria for Soil Type D, as per Caltrans Seismic Design Criteria (Version 1.4, June 2006). The seismic design criteria for the project are as follows:

1. Governing Fault = Hayward Fault
2. Soil Profile = Type D
3. Closest Distance to Fault = 2.5 mile
4. Peak Bedrock Acceleration = 0.6 g
5. ARS Design Curve = Caltrans Seismic Design Criteria June 2006 Version Figure B.8 (Soil Profile Type D) with the no modification. The reverse fault effect has been accounted for in the Peak Bedrock Acceleration.

An "ARS Design Curve" (Plate No. 5), which is based on Caltrans Seismic Design Criteria, (Version 1.4) is attached.

9.2 Seismic Hazards/Liquefaction Potential

Potential seismic hazards at a site may arise from three sources: surface fault rupture, strong ground shaking and liquefaction. Since no known active or potential faults pass through the site, therefore, in our opinion, the potential for ground surface fault rupture due to faulting at the project site is considered relatively low. Based on available geological and seismic data, the possibility of the site to experience strong ground shaking may be considered moderate to high.

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged cohesionless sands and silts of low relative density are the type of soils, which usually are susceptible to

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liquefaction. Clays are generally not susceptible to liquefaction.

Based on the field boring logs and available data, the majority of the soils encountered during our investigation are mainly firm to very stiff lean/fat clay. Pockets/lenses/layers of loose to medium dense clayey/silty sand were encountered at various depths in some of the borings.

In our opinion, the liquefaction potential within the project site is relatively low to moderate. Localized post-liquefaction settlement may occur to the pocket/lenses of loose to medium dense sands within the clays. The impact of the post-liquefaction settlement on the project should be relatively small because:

- The potentially liquefiable soil layers are generally covered by predominantly cohesive soils, which tend to serve as a "soil mat" and should reduce the potential impact of liquefaction.
- The post-liquefaction settlement probably would be random and localized and could spread out over some distance/area.

10. FINDINGS AND RECOMMENDATIONS

10.1 General

This report was prepared specifically for the proposed project according to the plans provided to us. Normal construction procedures were assumed throughout our analyses and represent one of the bases of recommendations presented herein. Our design criteria have been based upon the materials and conditions encountered in the soil borings at the project site. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations.

10.2 Earthwork and Grading

The proposed project includes mainly trimming back of the existing slopes of the creek bank. No major embankment fill is proposed. However, minor earthwork and grading

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work is anticipated for the backfill of the floodwall/retaining wall and for the over-excavation of loose sand pockets/lenses exposed during construction.

The grading within the creek should be performed in accordance with Santa Clara Valley Water District's specifications for levee reconstruction. Based on the SCVWD specifications, the fill to be placed on top of the bank should contain

- At least 40 percent of clay (by weight) passing US Standard Sieve No. 200;
- Plasticity Index (PI) in the range of 10 to 20 and Liquid Limit of the fill material should also not exceed 40;
- The fill should not contain rocks or lumps over 3 inches in greatest dimension and should not contain more than 10 percent greater than 1 ½ inch.

The fill material should be placed and mechanically compacted in horizontal layers to a relative compaction not less than 95 percent in accordance with ASTM 1557. The loose thickness of each layer of fill before compaction shall not exceed 8 inches. The compaction moisture content of the fill should be within a range of -2 percent to +3 percent of optimum moisture content.

At the time of our investigation, the crests and side slopes of the existing creek were covered with light to moderate growth of vegetation. Prior to the commencement of grading operations, the existing creek and the adjacent natural ground on which fill is to be placed should be stripped to a minimum depth of 6 inches, or to a greater depth as determined necessary by the regulatory agency or Geotechnical Engineer at the time of construction. Fills to be placed on slopes of existing creek should be keyed and benched into the creek bank. The height of the key should not be less than 3 feet or more than 5 feet. The frequency and location of the benches may be adjusted and modified in the field as necessary. We also recommend that the fill to be placed on the slopes should be over-built and cut back to the proposed grade. Grading within the creek should be performed under the observation of the regulatory agency or Geotechnical Engineer in accordance with the project specifications.

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Areas to receive engineered fill should be excavated to remove any loose/soft soil materials. The resulting surface upon which fill is to be placed should be observed by the Geotechnical Engineer. Areas receiving fill should be scarified, moisture conditioned and compacted in accordance with Caltrans standard specifications.

10.3 Evaluation of Creek with Modified Geometry and Creek with Floodwall

The analyses were carried out as per guidelines outlined in US Army Corps of Engineer's Levee Design and Construction Manual EM 1110-2-1913. Case No. I was not analyzed since it is believed to be not critical to the slope stability. Case IV was found to be not relevant to this project since there is no placement of fill above the existing bank and no landside creek. The results of these analyses are included in Appendix C of the report and discussed in the following subsections.

Settlement of the bank has also not been considered because no significant additional surcharge is anticipated in considering the configuration of the proposed floodwall. The loading from the floodwall will be acting as a point load and its settlement impact is minimal.

10.3.1 Slope Stability Analyses

Slope stability analyses were performed on the proposed trimmed slope [1.5 (H): 1(V)] sections using SLOPE/W program. Critical sections used for the slope stability analyses were developed based on the proposed slope geometries, geology, boring logs and laboratory test results.

Critical sections were analyzed for Cases II, III and V on the creekside slope outlined in the US Army Corps of Engineer's Manual EM 1110-2-1913. These critical conditions and the corresponding minimum strength and factors of safety requirements are presented on Table 4.

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TABLE 4

CASE NO.	DESIGN CONDITION	SLOPE ANALYZED	SHEAR STRENGTH*	MINIMUM FACTOR OF SAFETY
II	Sudden Drawdown	Creekside	S where < R R where < S	1.0
III	Intermediate River Stage	Creekside	S where < R (R+S)/2 where R < S	1.4
V	Earthquake: Case III with seismic loading	Creekside	Seismic Coefficient 0.2g	1.1

* Q Strength: Unconsolidated Undrained Strength

R Strength: Consolidated Undrained Strength

S Strength: Consolidated Drained Strength

a) The effective and total strength parameters were based on field test data and laboratory test results, including standard penetration tests, pocket penetration tests, CPTs, unconfined compressive strength test, consolidated undrained triaxial tests with pore pressure measurement, unconsolidated undrained triaxial tests, empirical correlation and reference to the assumed strength parameters from previous studies on Reaches 4 through 6 and engineering judgment. For the effective strength parameters of cohesive soil, apparent cohesion c' is usually between 100 psf and 500 psf according to Lamb and Whitman. Ø' was estimated by correlation with the plasticity index. $Ø_T$ is usually less than Ø'.

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TABLE 5: SUMMARY OF SHEAR STRENGTH PARAMETERS

Soil	Unit Weight (pcf)	Q-Strength (psf)	R-Strength (psf)	S-Strength (psf)	(R+S)/2 Strength (psf)
Lower Silver Creek Reach 4 by PARIKH					
Lean Clay CL)	110 130	-	C=750 psf Ø=18°	C=300 psf Ø=28°	C=525 psf Ø=23°
Lower Silver Creek Reaches 5 and 6 by GTC					
Lean Clay CL)	Moist=115 Sat=125	C=2,000 psf Ø=0°	C=250 psf Ø=20°	C=200 psf Ø=28°	C=225 psf Ø=24°
Fat Clay (CH)	Moist=110 Sat=120	C=1,500 psf Ø=0°	C=350 psf Ø=18°	C=250 psf Ø=25°	C=300 psf Ø=21.5°
Silt (ML)	Moist=110 Sat=125	C=700 psf Ø=0°	C=150 psf Ø=25°	C=100 psf Ø=30°	C=125 psf Ø=27.5°
Silty/Clayey Sand (SM/SC)	Moist=120 Sat=130	NA	NA	C=300 psf Ø=32°	NA
Sand (SP)	Moist=120 Sat=130	NA	NA	C=0 psf Ø=35°	NA
Lower Silver Creek Reaches 4-6A by PARIKH (Laboratory Test Results)					
Lean Clay CL) Reach 4 (19')	-	-	C=130 psf Ø=22°	C=110 psf Ø=31°	C=120 psf Ø=27°
Lean Clay CL) Reach 5 (24.5')	-	-	C=120 psf Ø=25°	C=120 psf Ø=34°	C=120 psf Ø=30°
Lean Clay CL) Reach 6a (5')	-	-	C=350 psf Ø=18°	C=280 psf Ø=28°	C=315 psf Ø=23°
Lower Silver Creek Reaches 4-6A by PARIKH (assumed for stability analyses)					
Lean Clay CL) (Reach 4)	Moist=105 Sat=115	-	C=350 psf Ø=18°	C=350 psf Ø=18°	C=350 psf Ø=18°
Lean Clay CL) (Reaches 5c&6a)	Moist=105 Sat=115		C=350 psf Ø=18°	C=350 psf Ø=18°	C=350 psf Ø=18°
Fat Clay (CH)	Moist=110 Sat=120	-	C=350 psf Ø=18°	C=250 psf Ø=25°	C=300 psf Ø=21.5°
Silty/Clayey Sand (SM/SC)	Moist=120 Sat=130	NA	NA	C=300 psf Ø=32°	NA

b) Stability analyses were carried out based on the typical section prepared by

Ruggeri-Jensen-Azar & Associates. Section 1A-1A is for the right bank cut slope between Jackson Avenue. Section 1B-1B is for the left bank cut slope between Jackson Avenue and Capitol Expressway. Section 2-2 is for the right bank cut slope between Story Road and Murtha Drive. Section 3-3 is for the right bank cut slope between Murtha Drive and Moss Point Drive.

c) A surcharge load of 250 psf was assumed for the maintenance vehicle and construction equipments and/or construction materials.

d) Earthquake loading conditions were modeled by using a seismic loading coefficient of 0.2g for pseudo-static analysis.

e) Based on the available boring information, the subsurface soil conditions at the levees consists of stiff lean clays, underlain by firm lean clays, underlain by stiff fat clays between Jackson Avenue and Capitol Expressway. The subsurface soil conditions at the levees consist of stiff lean clays, underlain by a thin layer of clayey sand, underlain by stiff lean clays between Story Road and Moss Point Drive.

f) The mean-low water level was assumed to be at the bottom of the creek and the 100-year flood water level was assumed to be at the top of the bank for the "Rapid Draw-Down" Case (Case II). For the Intermediate River Stage Case (Case III) and Seismic Case (Case V), the minimum factor of safety was obtained by assuming mean-low water level and anticipated maximum groundwater level within the levee. The average groundwater level was measured at approximately 10 feet below ground in the field exploration. An additional two feet was allowed for the rise of groundwater table during the rainy season. A groundwater at the depth of five feet was assumed in the slope stability analyses.

The factors of safety obtained from the slope stability analyses are summarized in Table 6.

TABLE 6: SLOPE STABILITY ANALYSES SUMAMARY OF FACTOR OF SAFETY

Location (Creek-side)	Minimum Factor of Safety of Proposed Trimmed [1.5(H): 1(V)] Slope Sections		
	Case No. II (Rapid Drawdown)	Case No. III (Intermediate River Stage)	Case No. V (Seismic for Case I and Case III)
	1.0*	1.4*	1.0*
Section 1A-1A	1.2	1.5	1.2
Section 1B-1B	1.2	1.4	1.2
Section 2-2	1.3	1.5	1.1
Section 3-3	1.4	1.6	1.2

* Required minimum factor of safety

The shear strengths, unit weights, geometry, phreatic surfaces used in the analyses, the factors of safety and possible critical sliding surfaces obtained from slope stability analyses are presented on the plates in Appendix C.

Based on the above results, it is concluded that the modified geometry of the bank of the creek with the proposed 1.5(H): 1(V) cut slope has the adequate global stability under static and seismic (pseudo-static) loading conditions.

The stability analysis evaluates the overall global slope stability of the creek bank. After bank excavation, strength softening is expected for the bare (before the application of surface protection) surficial cohesive soil materials submerged under water. Stiff clays tend to be fissured to some degree. The unconfined clays at the face of the cut may be cyclically dried and wetted and the fissures will tend to open. The fissures will be filled with water as the water level rises and local sloughing and cracking etc. may occur after the water recedes. Exposed pockets of cohesionless sand or silt on the face of the excavated bank slope could also experience minor slough during construction. Therefore, the construction for the slope trimming should be planned in the dry season with the minimum water level in the channel. Adequate surface protection should be provided to the slope surface after its exposure during

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construction. Regular routine maintenance should be carried out in the future to ensure proper surface protection to the slope.

10.3.2 Floodwall

Based on the "Conceptual Creek Sections, Lower Silver Creek" prepared by Ruggeri-Jensen-Azar" dated December 8, 2009, flood walls/retaining walls are proposed on both the left bank and right bank from Station 133+00 to Station 154+00 (between Jackson Avenue and Capitol Expressway) and on the right bank from Station 184+00 to Station 216+00 (between Story Road and Moss Point Drive). The proposed floodwall is planned to be on top of the existing bank and behind the 1.5(H): 1(V) cut slope. The retaining walls are to support the floodwalls. The heights of the flood walls range from ±2 (?) feet to ±4 (?) feet. The retaining walls are to be supported on spread footing.

10.3.2.1 Seepage Analyses under the Floodwall

Based on the boring data, the creek bank materials consist of mainly firm to stiff clays with pockets/lenses of soft clays. Seepage through the levee is unlikely. However, seepage analysis was performed using the "Flow Net" method. The seepage analysis result of a typical cross section of the levee with the floodwall is included in Appendix C.

10.3.2.2 Foundation Design of Floodwall

The following were assumed in the calculations of allowable bearing capacity and uplift pressures on the wall footing.

- The width of the strip footing is 3 feet.
- The bottom of the strip footing is 3 feet below the finish ground surface.

For the foundation design, an allowable bearing capacity of 2500 psf may be used. The allowable bearing capacity is based on a factor of safety of 3. Uplift pressure due to the seepage at full flood level is presented on the seepage analysis in Appendix C.

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10.3.3 Lateral Design

For the lateral design of the retaining wall and floodwall, the following lateral earth pressures (Equivalent Fluid Pressures) and design parameters should be used:

(a) 42 pcf Equivalent Fluid Pressure for the active lateral earth pressures.

(b) The recommended passive pressure against the side of the footing is 370 pcf Equivalent Fluid Pressure.

(c) A coefficient of friction of 0.3 may be used to estimate the frictional resistance along the bottom of the footing. Only the dead loads should be used to estimate the frictional resistance at the bottom of footings.

(d) No more than 50% of the available passive lateral earth pressures and 100% friction between the footing and the foundation soil shall be considered in determining the factor of safety against sliding.

10.3.4 Soldier Pile Wall/Flood Wall

Based on the "Conceptual Creek Sections, Lower Silver Creek" prepared by Ruggeri-Jensen-Azar" dated December 8, 2009, soldier pile walls/flood walls are proposed on both the north bank and south bank from Station 157+00 to Station 180+00 (between Capitol Expressway and Story Road) and on the north bank from Station 184+00 to Station 216+00 (between Story Road and Moss Point Drive). These soldier pile walls are to retain the vertical cut resulted from the excavation for the flood control improvement. The retained heights of the soldier pile walls/flood walls range from ±9 feet to ±15 feet. The anticipated total wall length is approximately 2,300 feet between Capitol Expressway and Story Road and approximately 3,000 feet between Story Road and Moss Point Drive.

It is recommended that the soldier pile consist of minimum 2 feet diameter cast-

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in-drilled-hole (CIDH) piles. The pile spacing may be on the order of 4 feet to 6 feet on centers. Based on the available boring data in the vicinity of the proposed soldier pile walls/flood walls, the subsurface soil material behind the proposed CIDH pile may consist of mainly firm to stiff lean/fat clays with pockets/lenses of soft lean clays.

- Design Wall Height = Anticipated Exposed Wall Height.
- Unit Weight (moist) = 105 lb/ft^3, Unit Weight (saturated) = 115 lb/ft^3
- Traffic Surcharge = Extra 2 feet of soil with unit weight of 125 lb/ft^3.
- Active Earth Pressure: Ka = 0.4 (ϕ =27° for native soil)
- Passive Earth Pressure: Kp = 3.9 (per Log-Spiral, ϕ = 27° for native soil)
- Arching capability = 2.0
- f(arching factor per Caltrans Trenching & Shoring Manual) = 0.67 assuming 2-foot CIDH piles with pile spacing of 6 feet on centers.

Self-compacting material is recommended for the wall backfill. Geo-synthetic filter fabric (section 88-1.03, Caltrans standard specifications) should be placed between the lagging and the shotcrete facing.

10.4 Corrosion

Chemical tests were performed on soil samples from Borings A-09-004, A-09-009 and A-09-012 to evaluate the corrosion potential of the subsoil. The test results are as follows:

TABLE 5: SUMMARY OF CORROSION TEST RESULT

Boring	Sample Depth (ft)	Minimum Resistivity (ohms-cm)	pH	Water-soluble Chloride (ppm)	Water-soluble Sulfate (ppm)
A-09-004	9.5	1100	7.28	57.1	65.6
A-09-009	14.5	1020	7.45	45.4	46.9
A-09-012	19.5	1610	7.15	43.6	39.5

Based on the corrosion test results, the native subsurface soils in Boring A-09-004, A-

09-009 and A-09-012 are considered non-corrosive per Caltrans corrosion design guidelines. Standard Type II modified or Type I-P (MS) modified cement may be used for the concrete substructure. The minimum cement factor and cover thickness should be per Section 8.22 of Caltrans Bridge Design Specifications – September 2003.

11. CONSTRUCTION CONSIDERATIONS (In Progress)

The recommendations for "construction considerations" are in progress and to be submitted later.

12. PLAN REVIEW

We recommend that final foundation plans for the proposed project be reviewed by PARIKH prior to construction so that the intent of our recommendations is included in the project plans and specifications and to further see that no misunderstandings or misinterpretations have occurred.

13. CONSTRUCTION OBSERVATION

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, geotechnical observation of foundation excavation, and pile installations should be carried out by regulating agencies. If the subsurface conditions different from those forming the basis of our recommendations are encountered, this office should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

14. INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface soil conditions do not deviate from observed conditions. All work done is in accordance with generally accepted

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geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project plans and specifications and necessary steps are also taken to see that the recommendations are carried out in the field.

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The findings in this report are valid as of the present date. However, changes in the subsurface conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

Alston Lam, P.E., G.E. 2605
Project Engineer

Gary Parikh, P.E., G.E. 666
Project Manager

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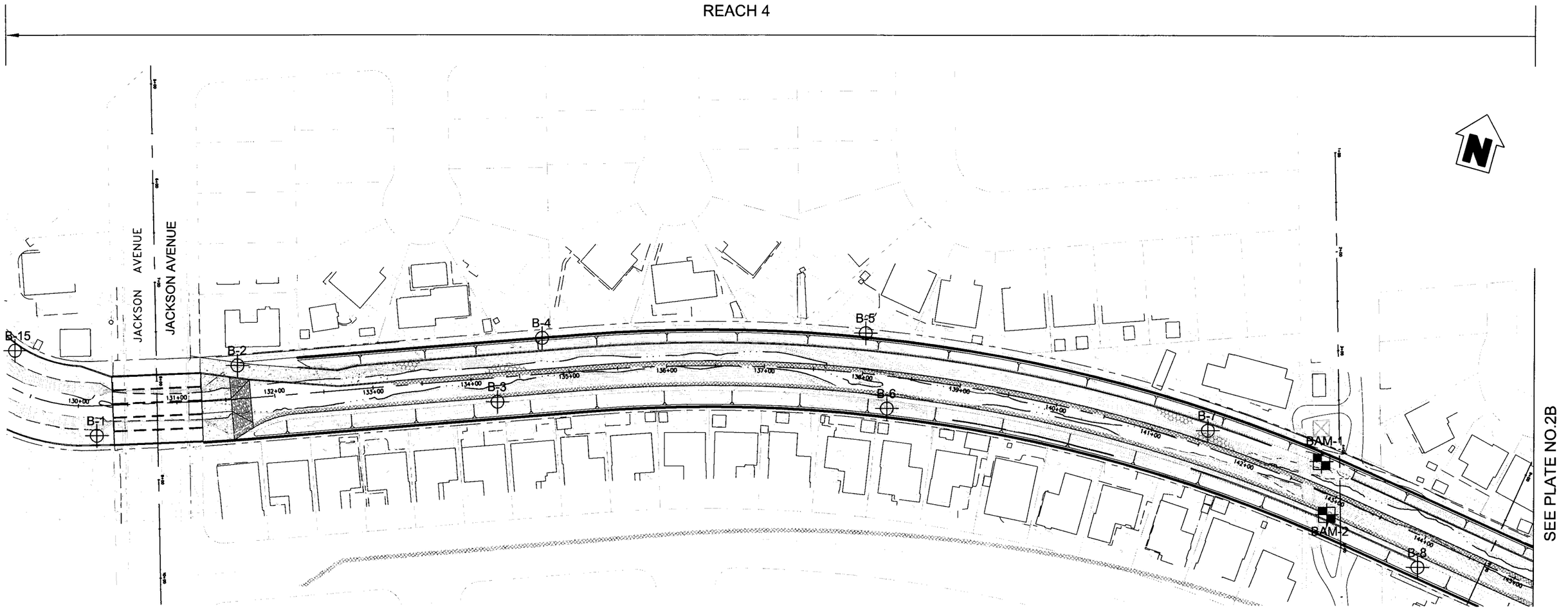
PROJECT LOCATION MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

LOWER SILVER CREEK REACHES 4-6A
SANTA CLARA COUNTY, CALIFORNIA

JOB NO.: 200116.PSE	**PLATE NO.: 1**



LEGEND

A-09-001 — Approximate boring location drilled in 2009 by Parikh.

B-2 — Approximate boring location drilled in 2000 by Parikh.

CPT-09-001 — Approximate Cone Penetration Test location perfomed in 2009 by Parikh.

CPT-1 — Approximate Cone Penetration Test location perfomed in 2000 by GTC.

BAM-2 — Approximate boring location drilled in 2002 by Parikh.

SCALE 1 inch = 100 feet

Reference Map was provided by RJA.
Note: All units are in feet unless otherwise specified

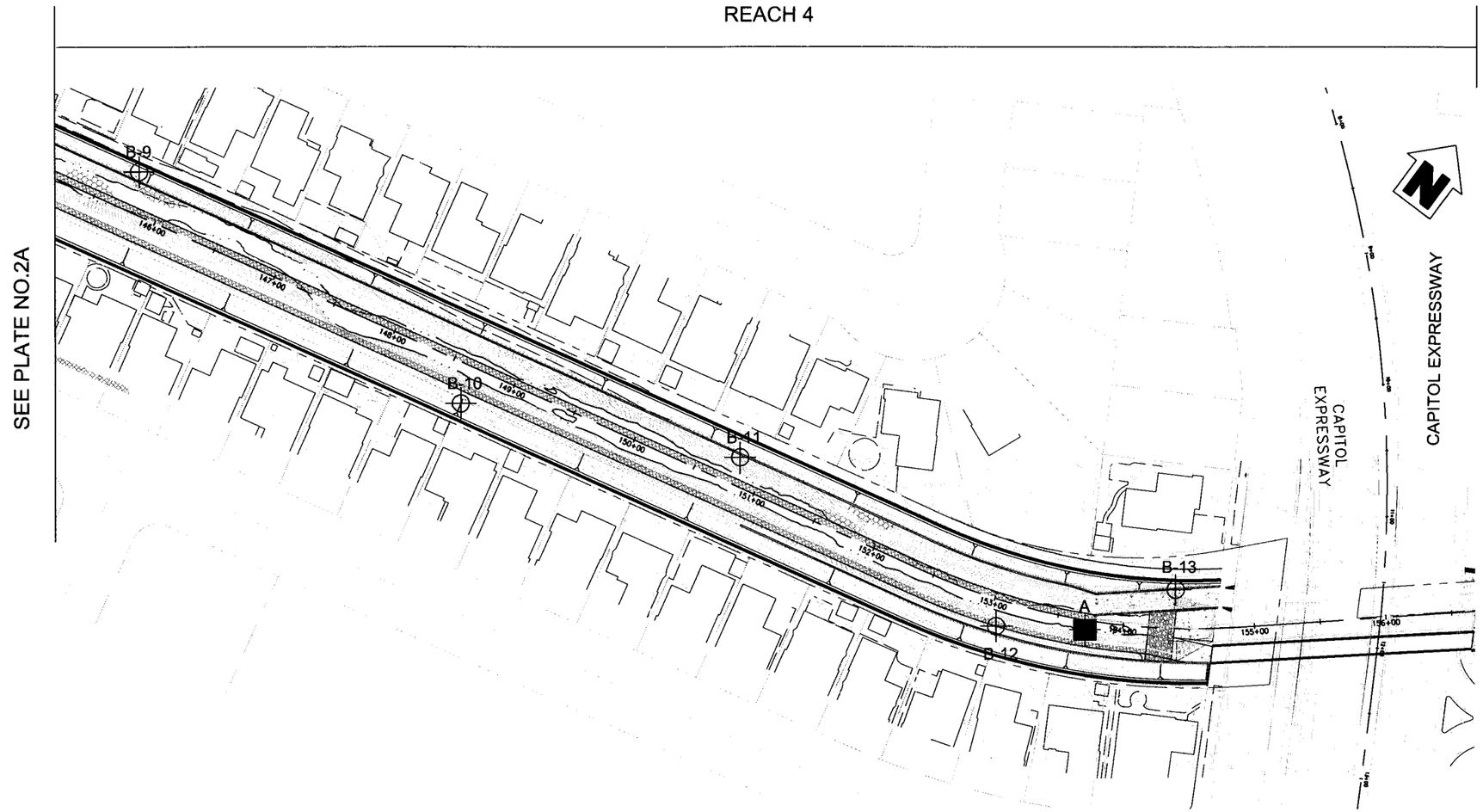
SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

LOWER SILVER CREEK REACHES 4-6A
SANTA CLARA COUNTY, CALIFORNIA

JOB NO.:200116.PSE

PLATE NO: 2A



LEGEND

A-09-001
Approximate boring location drilled in 2009 by Parikh.

B-11
Approximate boring location drilled in 2000 by Parikh.

CPT-09-001
Approximate Cone Penetration Test location perfomed in 2009 by Parikh.

CPT-1
Approximate Cone Penetration Test location perfomed in 2000 by GTC.

A
Approximate Bulk Sample location perfomed in 2010 by Parikh.

SCALE 1 inch = 100 feet

Reference Map was provided by RJA.
Note: All units are in feet unless otherwise specified

SITE PLAN

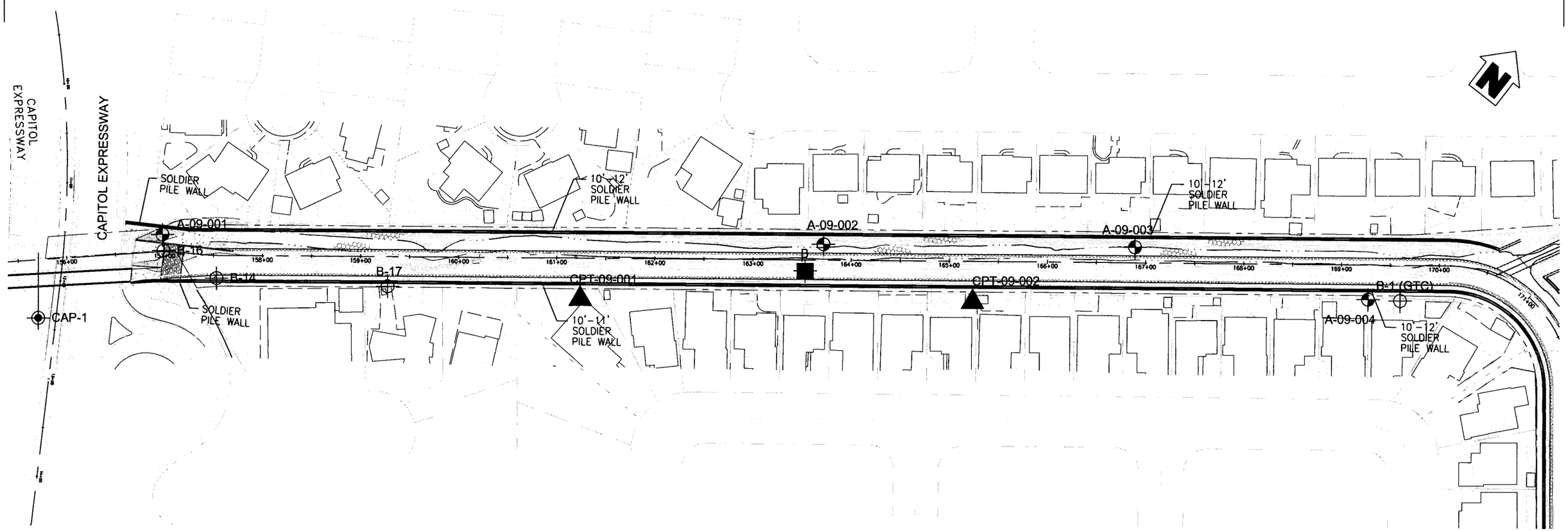
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

LOWER SILVER CREEK REACHES 4-6A
SANTA CLARA COUNTY, CALIFORNIA

JOB NO.:200116.PSE

PLATE NO: 2B

REACH 4



LEGEND

A-09-001
Approximate boring location drilled in 2009 by Parikh.

B-14
Approximate boring location drilled in 2000 by Parikh.

B-1 (GTC)
Approximate boring location drilled in 2000 by GTC.

CPT-09-001
Approximate Cone Penetration Test location perfomed in 2009 by Parikh.

CPT-1
Approximate Cone Penetration Test location perfomed in 2000 by GTC.

B
Approximate Bulk Sample location perfomed in 2010 by Parikh.

Approximate boring location drilled in 2002 by Parikh.
CAP-1

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by RJA.

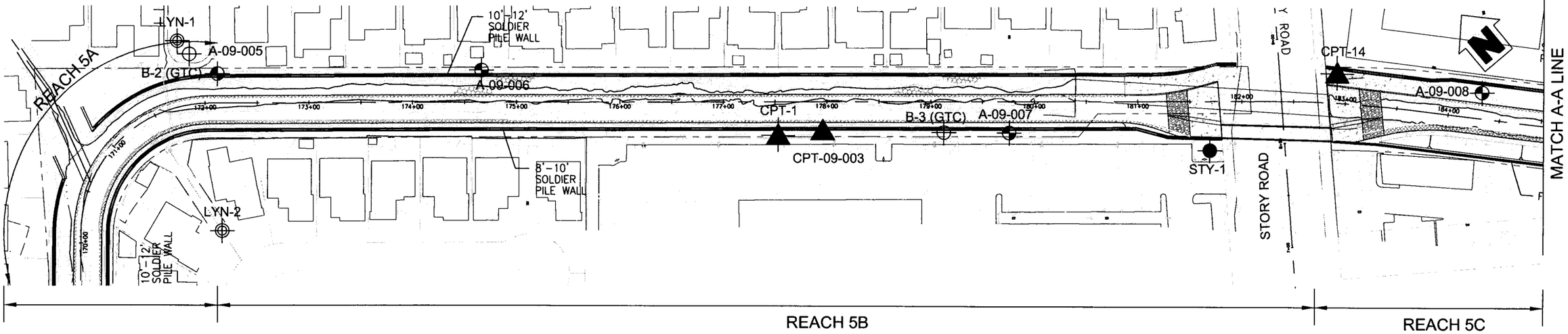
SITE PLAN

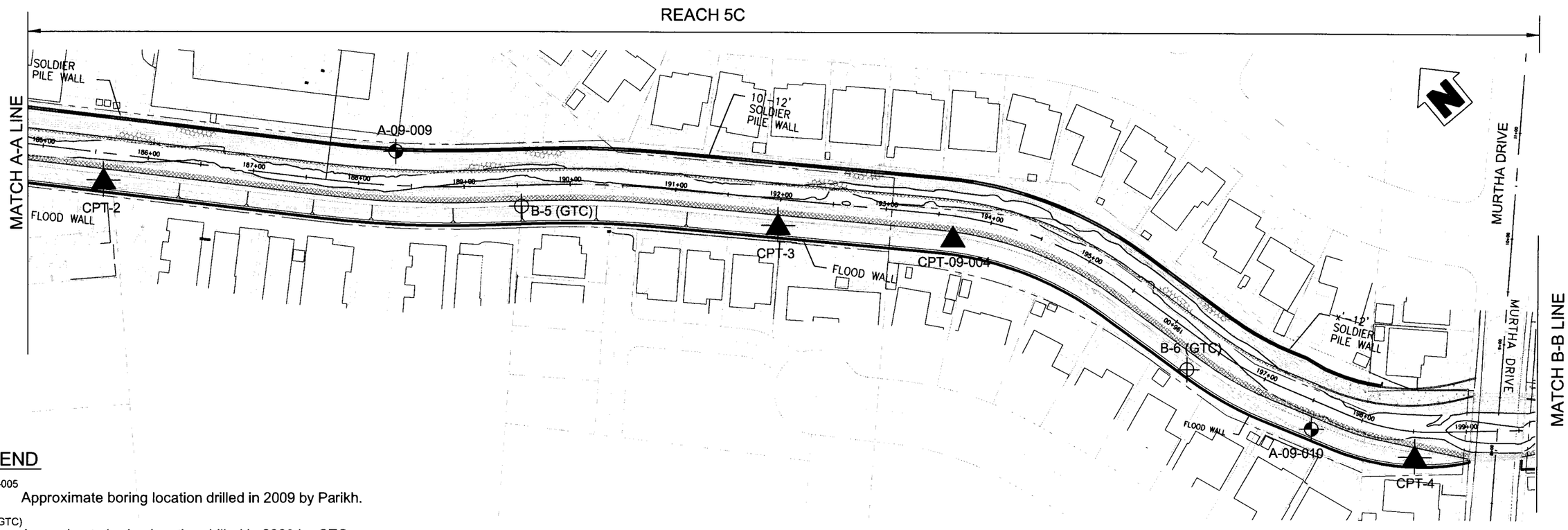
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

LOWER SILVER CREEK REACHES 4-6A
SANTA CLARA COUNTY, CALIFORNIA

JOB NO.:200116.PSE

PLATE NO: 2C





LEGEND

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B-2 (GTC) — Approximate boring location drilled in 2000 by GTC.

CPT-09-003 — Approximate Cone Penetration Test location perfomed in 2009 by Parikh.

CPT-1 — Approximate Cone Penetration Test location perfomed in 2000 by GTC.

STY-1 — Approximate boring location drilled in 2002 by Parikh.

LYN-2 — Approximate boring location drilled in 2002 by Parikh.

SCALE 1 inch = 100 feet

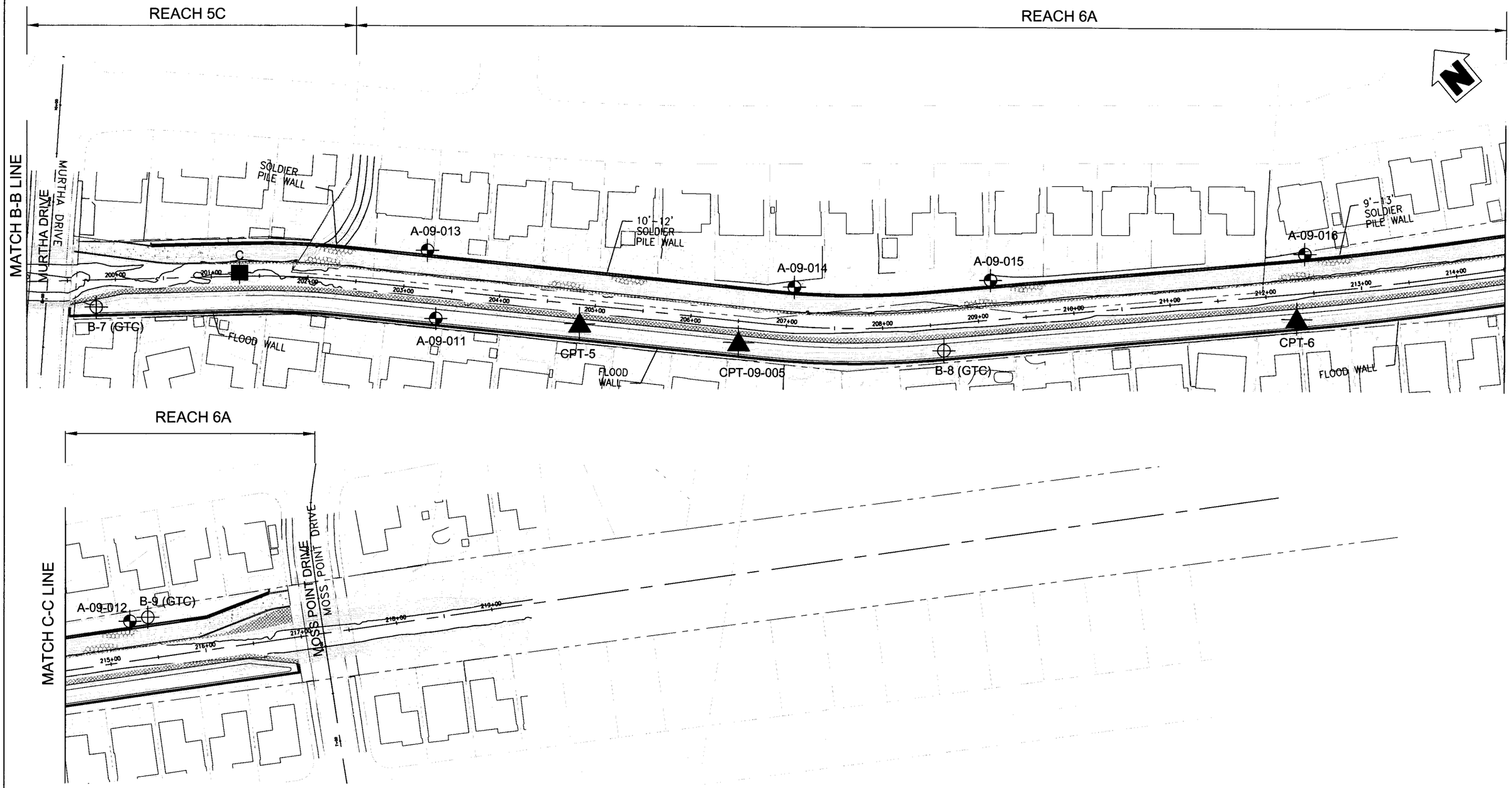
Note: All units are in feet unless otherwise specified
Reference Map was provided by RJA.

SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

LOWER SILVER CREEK REACHES 4-6A
SANTA CLARA COUNTY, CALIFORNIA

JOB NO.:200116.PSE | PLATE NO: 2D



LEGEND

A-09-005
Approximate boring location drilled in 2009 by Parikh.

B-9 (GTC)
Approximate boring location drilled in 2000 by GTC.

CPT-09-003
Approximate Cone Penetration Test location perfomed in 2009 by Parikh.

CPT-1
Approximate Cone Penetration Test location perfomed in 2000 by GTC.

C
Approximate Bulk Sample location perfomed in 2010 by Parikh.

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by RJA.

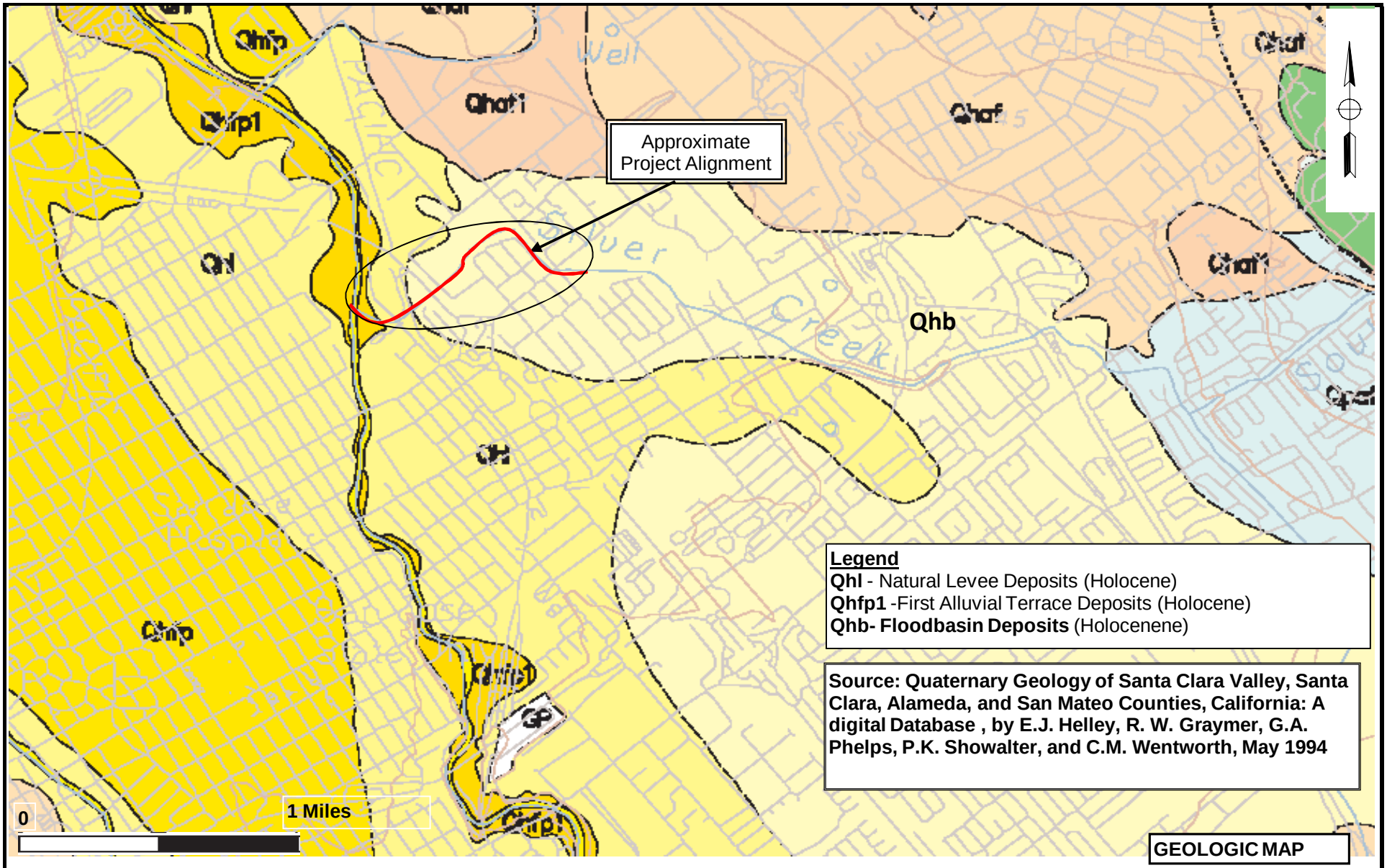
SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

LOWER SILVER CREEK REACHES 4-6A
SANTA CLARA COUNTY, CALIFORNIA

JOB NO.:200116.PSE

PLATE NO: 2E



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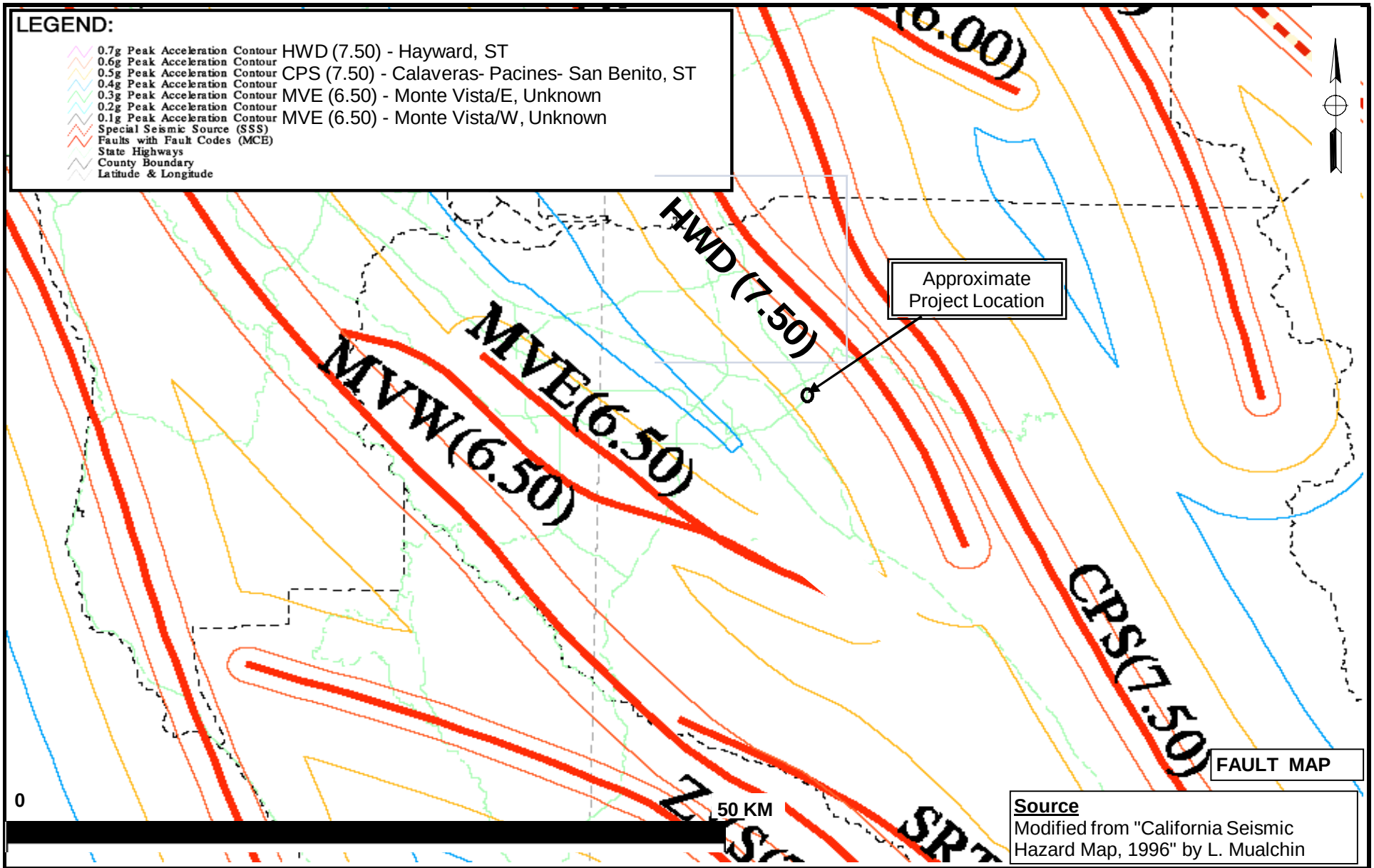
DRAFT

JOB NO.: 200116.PSE

PLATE NO.:3



FAULT MAP

Source
Modified from "California Seismic Hazard Map, 1996" by L. Mualchin

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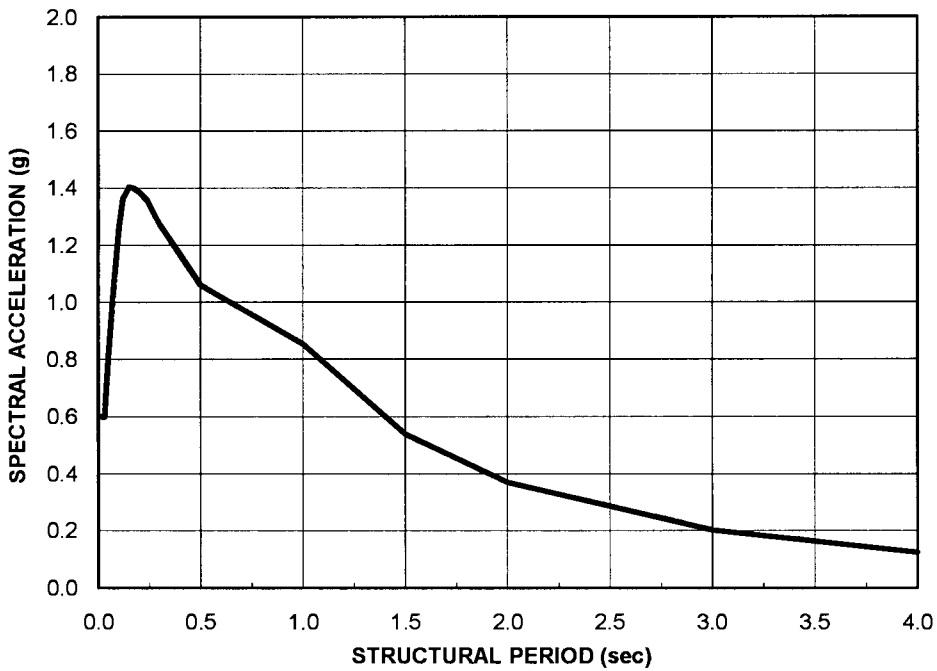
PLATE NO.: 4

ARS DESIGN CURVE
LOWER SILVER CREEK REACHES 4-6A



Spectral Data

Period (sec)	152 (7.1) Spectral Accel. (g)
0.010	0.600
0.020	0.598
0.030	0.596
0.050	0.817
0.075	1.053
0.100	1.260
0.120	1.362
0.150	1.403
0.170	1.400
0.200	1.386
0.240	1.355
0.300	1.273
0.400	1.166
0.500	1.060
0.750	0.957
1.000	0.853
1.500	0.539
2.000	0.369
3.000	0.203
4.000	0.125

1. Caltrans SDC (v 1.4, June 2006), Figure B.8,
   Governing Fault: Silver Creek Fault
   (Mw = 7.1, Soil Profile Type D, PBA = 0.6g)
   with the following modifications:
   (1) No change of Sa for structural periods < 0.5 sec
   (2) 20% increase of Sa for structural periods ≥ 1 sec
   (3) Linear interpolation for structural periods between 0.5 and 1 sec

REDUCTION FACTOR (R) OF K_p FOR VARIOUS RATIOS OF $-\delta/\phi$								
ϕ \ δ/ϕ	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	-0.0
10	.978	.962	.946	.929	.912	.898	.881	.864
15	.961	.934	.907	.881	.854	.830	.803	.775
20	.939	.901	.862	.824	.787	.752	.716	.678
25	.912	.860	.808	.759	.711	.666	.620	.574
30	.878	.811	.746	.686	.627	.574	.520	.467
35	.836	.752	.674	.603	.536	.475	.417	.362
40	.783	.682	.592	.512	.439	.375	.316	.262
45	.718	.600	.500	.414	.339	.276	.221	.174

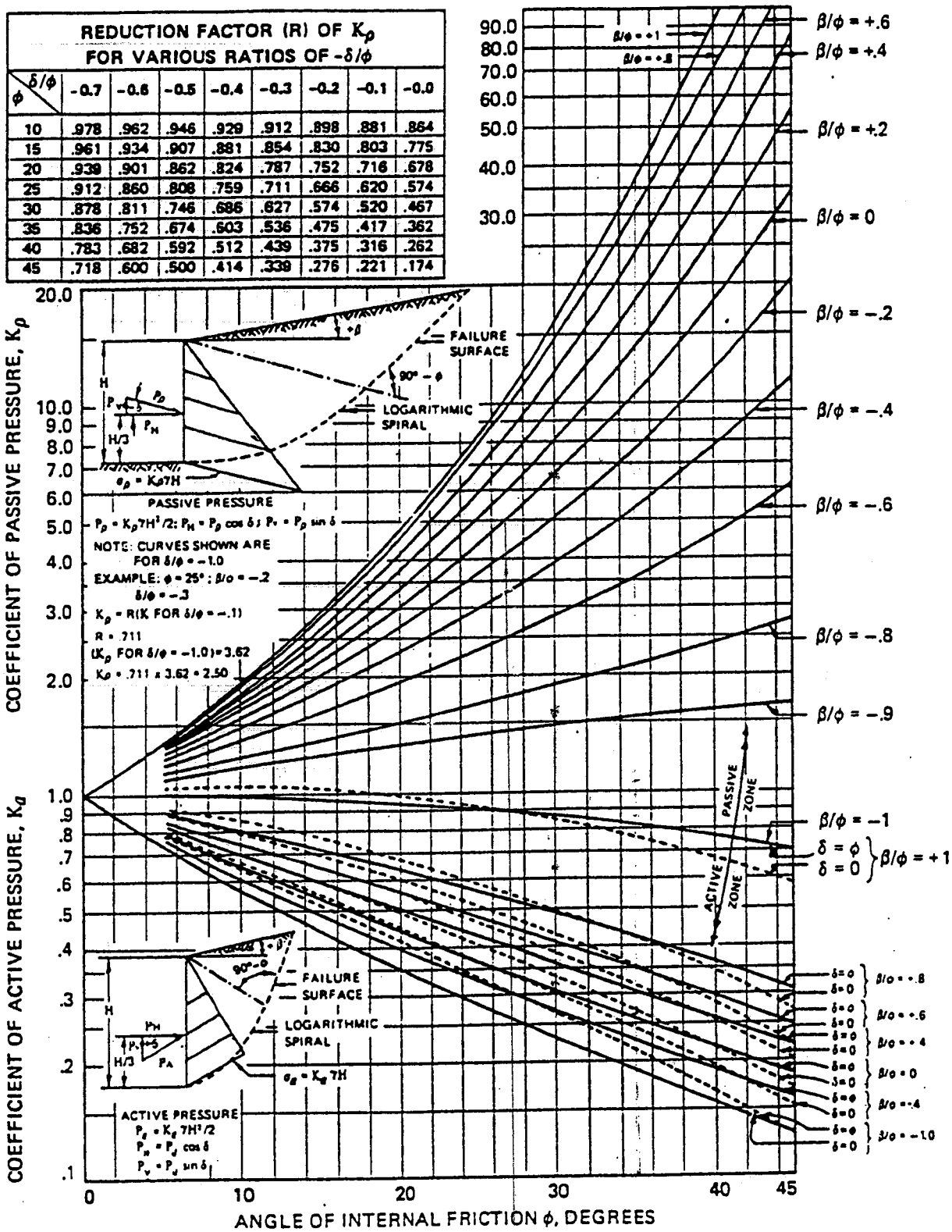


Figure 1

Active and passive coefficients with wall friction (sloping backfill) (after Caquot and Kerisel)