

SAN FRANCISQUITO CREEK FLOOD REDUCTION, ECOSYSTEM RESTORATION, AND RECREATION PROJECT

San Francisco Bay to Highway 101

OPERATION & MAINTENANCE MANUAL

October 2014



ACKNOWLEDGEMENTS

This manual was prepared through a collaboration of the San Francisquito Creek Joint Powers Authority (JPA). Participating JPA members for this project segment include Santa Clara Valley Water District, the City of Palo Alto and the City of East Palo Alto, San Mateo County, and Santa Clara County.

LIST OF COMMON ACRONYMS AND ABBREVIATIONS

JPA	San Francisquito Creek Joint Powers Authority
LIS	Levee Inspection System
NAVD	North American Vertical Datum
O&M	Operation & Maintenance
RSP	Rock Slope Protection
SCVWD	Santa Clara Valley Water District
SFC	San Francisquito Creek
SMP	Stream Maintenance Program
US 101	U.S. Highway 101
USACE	U.S. Army Corps of Engineers
YR	Year

GLOSSARY

100-year flood	A flood that has a 1 percent probability of occurrence in a given year.
bank protection	Bank protection stabilizes a channel bank using rock, riprap, concrete, soft materials, vegetation, or a combination of materials or methods. Bank protection can also include preventative maintenance to ensure that banks do not erode in the future.
bed	The bottom of a body of water, such as a stream, channel, or river.
bench	An area cut into a terrace for riparian zone restoration or for strengthening the design of a water channel.
Best Management Practices	Schedules of activities, use of erosion control measures, operation and maintenance procedures, and other practices to prevent or reduce the pollution of water of the United States.
brush	See woody brush
channel	A natural or human-made feature that conveys water. Channel erosion includes the processes of stream bank erosion, streambed scour, and degradation. Channel geometry is the structure of a waterway, including the force of water currents, the height and content of banks, and other features.
culvert	Any covered structure not classified as a bridge which conveys a waterway under a road or other paved area.
degradation	The lowering of the streambed by erosive processes such as scouring by flowing water, removal of channel bed materials, or downcutting of natural stream channels. Such erosion may initiate degradation of tributary channels, causing damage similar to that due to gully erosion and valley trenching.
design capacity	An engineering term used to describe the amount of water that a modified channel was designed to convey. Generally, the design capacity for improved District facilities is to accommodate the 1 percent or 100-year flood.
design flood	The flood magnitude selected for use as a criterion in designing flood control works. The largest flood that a given

project is designed to pass safely. In this project, the design flood is the 100-year flood.

design flow	The magnitude of stream flow that is used in design of channel improvements and structures across the channels.
downcutting	The erosive effect of water against the river channel and their protective features; incision.
erosion	The wearing away of land surface by running water including rainfall, surface runoff, drainage, or wind.
excessive vegetation	Vegetation growth whose pervasive presence obscures visibility and inhibits access.
flood protection project	A project that affects the flood conveyance capacity or flood management behavior of the system, usually designed to reduce flooding hazards.
flood	The temporary inundation of lands normally dry; any waters escaping from a creek or river.
floodplain	Low-lying areas adjacent to stream or river channel that are flooded during high flows in a channel.
floodwall	A wall constructed adjoining channel to prevent flooding of the surroundings areas.
freeboard	Vertical distance between the top of an embankment adjoining a channel and the water level in the channel.
HEC-RAS	(Hydraulic Engineering Center's River Analysis System) is a software program used to model the water surface profile for this project.
In-channel maintenance	Also designated as in stream maintenance, maintenance that occurs within the areas delineated as "in stream" on Figures 1 & 2.
levee	An embankment constructed to prevent a river or stream from flooding adjacent lands.
low-flow channel	The natural stream that carries the more frequent, periodic streamflows.
mitigation	An action taken to moderate, reduce, alleviate the impacts of a proposed activity by (a) avoiding the impact by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its

implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; (e) compensating for the impact by replacing or providing substitute resources or environments.

reach	The smallest subdivision of a drainage system consisting of a uniform length of channel or a discrete portion of a channel.
revetment	A facing of stones, sandbags, etc., to protect a wall, embankment, or earthworks
riparian	Pertaining to the banks of a river, stream, waterway, or other, typically, flowing body of water, as well as to plant and animal communities along such bodies of water.
riprap	Loose rock or concrete of varying size, typically brought to a site. Used to protect channel banks and drainage outlets from scouring forces.
scour	The clearing and digging action of flowing water, especially the downward erosion caused by stream water in removing material (e.g., soil, rocks) from a channel bed or bank or around in-channel structures.
sediment removal	The act of removing sediment deposited within a stream, channel, or bypass culvert. Typically, sediment is removed when it reduces the carrying capacity.
sediment	Solid material, both mineral and organic, that is carried by the water and settles to the bottom of channels, bypass culverts, drain pipes, or behind dams.
sedimentation	The process by which rock and organic materials settle out of water.
spalling	To break into pieces, esp. concrete.
station	A station is a standard channel location system used by the SCVWD that gives the distance from the downstream limit of jurisdiction (usually San Francisco Bay), or, for a tributary creek, from where it branches off of the main channel. Distance is measured in feet, with each "station" representing 100 feet for the Lower San Francisquito Creek Project levees. For example, station 26+00 would be a point 2,600 feet

upstream from the mouth of the channel from San Francisco Bay along the left or right levee.

streambed

The part of a stream over which a column of water moves.

toe

The line of a natural or fill slope where it intersects the natural ground.

vegetation management

Removal or pruning of vegetation for any of a number of anthropomorphic purposes including maintenance of infrastructure, fuel management, ecosystem modification or improvement, aesthetic, or purposes that provide desirable benefits in and adjacent to water channels to maintain their ability to function as flood protection facilities. In addition, vegetation is removed to meet local fire code requirements and to reduce combustible weeds and grasses on property adjacent to the streams within the District's jurisdiction. The control of invasive non-native vegetation is another purpose for which the District undertakes vegetation control. Vegetation management is also required for maintaining visibility for inspection; ensuring access for maintenance work and flood fighting; and minimizing detrimental effects to levees, embankment, and bank protection. Vegetation management can be accomplished through mowing, discing, hand clearing, or herbicide applications (depending on the environmental conditions of the site).

vegetation-free zone

A requirement by the USACE for a 15-wide area adjacent to levee inboard and outboard toes to be kept free of woody vegetation which impairs visual inspection and flood fighting activities. Vegetation located outside of project ROW on private property is not currently subject to Corps jurisdiction or this requirement. Vegetation (mitigation) planted as part of the original project improvements may also be exempt from removal pending Corps review and/or acceptance of a variance.

velocity

Speed with which water should flow in a channel. It depends on several factors, such as slope, smoothness and uniformity of channel, area of flow and wetted perimeter.

watershed

The area of a landscape from which surface runoff flows to a given point; a drainage basin. A ridge or drainage divide separates a watershed from adjacent watersheds.

woody brush

Thick, scrubby vegetation typically 6 feet in height or less. Brush is composed of shrubs and woody perennials usually growing in dense, impenetrable masses that can affect hydraulic conveyance in a channel.

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Figure 2. Maintenance Exhibit *[to be included when developed]*

1 OVERVIEW AND ACCESS

1.1 Purpose of Manual

The manual provides a consolidation of data and requirements needed by the sponsor to perform operation and maintenance (O&M) activities at San Francisquito Creek. The San Francisquito Creek Joint Powers Authority (JPA) is responsible for project O&M.

The manual has been developed as a “Living Document”. It is expected that the sponsor will update it when changes to the project and O&M occur. Significant changes to the project or procedures that could potentially impact the operation of the project should be addressed by the JPA for review and approval (see Section 1.2).

1.2 Changes to the Project or the Manual

Proposed changes to the project/system and/or its O&M Manual should be addressed by the JPA.

The current name and address is:
San Francisquito Creek Joint Powers Authority
615B Menlo Avenue
Menlo Park, CA 94025

1.3 Project Vehicular Access

See Figures 1 and 2 for vehicular access locations to the San Francisquito Creek levees and floodwalls.

- For normal O&M, vehicular access points to the gravel and paved roads are located at East Bayshore Road, Verbena Drive, Daphine Way, Geng Road, and O'Connor Street.
- Ramps providing direct channel access are located downstream from the Palo Alto Pump Station (L-Line STA 70+75) and near the overhead utility tower in the channel (L-Line STA 48+00).
- All access gates and bollards will remain locked when not in use.
- Access is available to pedestrians, bicyclists, and authorized cars and trucks.
- Access across Friendship Bridge and the Boardwalk is limited to pedestrians, and cars and light trucks. Heavy equipment is not allowed.

2 NORMAL OPERATION, MAINTENANCE AND REPAIR

2.1 Introduction

In accordance with U.S. Army Corps of Engineers (USACE) technical guidance, this section covers routine operations and maintenance details required for the proper care and efficient operation of the various project elements, including levee embankments, floodwalls, channels, interior drainage system, and pump stations. An outline of operation records must be maintained and available for inspections. For additional project design information, see Appendix A - Design Documentation Report.

Some activities listed below require regulatory permits and/or authorization to perform the work. The work activities for specific locations will need to be analyzed for determination of possible significant impacts through the appropriate environmental review and adoption process. O&M activities will be performed in accordance with SCVWD Stream Maintenance Program guidelines (Appendix D, Maintenance Activities List); however, separate permits will be obtained when maintenance is required.

2.2 Removal of Excess Sediment and Vegetation

The following sections identify the trigger points for the removal of sediment and/or vegetation so that the project complies with the as-built conditions.

2.2.1 Sediment Removal Triggers for Channel

Excess sediment in the channels affects the conveyance capacity of the improvements and impairs the ability of the Project to function as designed.

From Highway 101 to the San Francisco Bay, sediment deposition accumulated to a continuous elevation 8.0' (NAVD88) will reduce the levee/floodwall freeboard by 50% (1.5 feet) which will require sediment removal.

No sediment deposition is anticipated during normal conditions. Upstream bank failure could provide an amount of sediment that the channel could not accommodate, requiring a maintenance need as a result of an unpredictable event. In the event that tidal deposition reaches an equilibrium at a different elevation than designed, a berm or other means of recapturing freeboard will be installed.

2.2.2 Vegetation Removal Triggers for Channel

Vegetation management refers to the removal of vegetation for the purposes of maintaining specific flood control objectives such as passage of flood flows and to maintain flood control access (project inspections, flood fighting, maintenance and repairs).

From Highway 101 to the San Francisco Bay, a maximum roughness coefficient of $n=0.055$ (similar to continuous thickets or rigid woody understory and brush) would

result in a reduction of levee/floodwall freeboard of 33% (1.0 foot). This condition is based on brush or excessive vegetation (n-value = 0.055) being present on the terraced benches and levee side slope.

The system has been designed to a maximum roughness coefficient of $n=0.038$ (similar to grasses).

Maintenance activities shall occur when woody understory or brush is encountered. Anticipated frequency of maintenance is between three and five years. Specific maintenance activities for the Project elements are identified in Sections 2.3 through 2.7.

2.3 Levee Embankments

Maintenance measures are necessary to ensure serviceability of the levees to withstand flow events up to the design flood event. A Vegetation-Free Zone is required to allow for visual inspection of the levee embankments. Vegetation other than shallow rooted grasses shall not be permitted on levee crowns, slopes, or within 15' of levee toes. This is necessary to prevent the development of deep roots within the body of the levee which can create seepage paths. A rodent abatement program shall be employed as soon as evidence of burrowing activity is found on the levee embankment or toe. Shallow scattered holes allow for runoff to infiltrate the levee and can result in seepage flow paths through the levee during flood events.

2.3.1 Maintenance of grass and sod cover

- Annual mowing of grasses to no more than 4 inches high on levee embankments from top of levee to levee toe by the early summer for inspection and fire control purposes
- Clippings may be left on levee face to augment grasses and act as a seed bank
- Clippings may be removed to facilitate inspections for animal damage. Areas will be chosen prior to inspection
- Hydroseed bare spots on levee faces due to fire or slope repairs in fall or early winter months to facilitate germination
- Monitor hydroseeded areas for success
- Repeat hydroseed application, as needed if first attempt was not successful
- Control undesirable vegetation through use of herbicide, mechanical mowing, or other appropriate methods

2.3.2 Removal or trimming of woody and non-woody vegetation within project right-of-way for inspections at base of levee toes

- Cut and remove native and non-native understory and brush from levee slopes
- Cut and remove woody growth (trees, saplings, and volunteers) within 15-feet of levee toes

2.3.3 Removal or pruning of all vegetation encroaching within project right-of-way

- Limb up tree branches to 8 feet (14 feet above maintenance roads) above grade and remove ground cover that obscures visual inspections and flood fighting activities

- Cut, trim, and or remove landscape ground covers, brush, and ornamentals from adjacent private property which encroaches onto the right-of-way within 15 feet of levee toe in accordance with current USACE requirements

2.3.4 Animal Control Program (baiting, trapping, and barriers)

- Control of burrowing animals (gophers, ground squirrels, and rodents) with bait stations, fumigants, smoke bombs, pesticides, and live trapping to prevent damage or colonization of levee embankments
- Displace or exclude animals constructing and using dens (burrows) in the levee embankments by mechanical means

2.3.5 Repair animal damage on levee slopes and at levee toe

- Excavate burrow locations and reconstruct levee embankment
- Pressure-fill burrows with bentonite clay, cement grout slurry. Slurry to consist of two parts bentonite clay, one part cement grout and water
- Mud packing method may be used to backfill burrows
- For information on the repair of animal burrows refer to FEMA Publication 473, Technical Manual for Dam Owners, Impacts of Animals on Earthen Dams as a reference for repair of animal burrows

2.3.6 Levee embankment and slope repairs

- Excavate, repair, and reconstruct levee embankments due to seepage, slumps, cracks (longitudinal or transverse), loss of grade, sloughs, slides, rodent burrows, scour, or erosion in order to maintain full levee section
- Reconstruct/raise levee crown due to sags, depressions, or groundwater subsidence
- The levee is to be repaired to original design specifications (See Appendix B –Project As-Built Drawings)

2.3.7 Repair and maintenance of levee access roadways

- Fill potholes or ruts with compacted Class 2 aggregate base per Caltrans Specifications
- Apply herbicide on levee crown surfaces to prevent unwanted vegetation
- Remove woody vegetation and overhanging growth which impairs or obstructs maintenance access along the base of levee roads and along the top of levees

2.3.8 Repair of levee damage caused by flood events (scour, slumps, and sags)

- Inspect and document cause of levee damage
- Plans for repairs will be prepared by the JPA
- Schedule and complete construction

- Levee fill material shall be placed in maximum uncompacted lifts of 8-inches and moisture conditioned to between 0 and +3% of the optimum moisture content. The fill shall be compacted to a minimum dry density of 92% of the maximum laboratory dry density determined by ASTM Method D1557. The upper 12 inches of levee embankment shall be compacted to a minimum dry density of 95% of the maximum laboratory dry density determined by ASTM Method D1557. Monitor repair site for performance

2.4 Floodwall

Maintenance measures are necessary to ensure serviceability of the floodwalls to withstand flood events up to the design flood event. A Vegetation-Free Zone is required to allow for visual inspection of the floodwall. Vegetation other than shallow rooted grasses shall not be permitted within 15 feet from the floodwall. This is necessary to prevent the development of deep roots near or through the floodwall which can create seepage paths and to prevent obstructions to maintenance vehicles and activities. A rodent abatement program shall be employed as soon as evidence of burrowing activity is found near a floodwall. See Figures 1 and 2 for maintenance activity locations.

2.4.1 Removal or trimming of non-woody vegetation within project right-of-way

- Cut, trim, and remove native and non-native ground covers, understory, vines, herbaceous vegetation, and volunteers from inboard side of floodwalls to facilitate visual inspection

2.4.2 Removal of all woody vegetation within 15 feet of floodwalls

- Cut and remove woody growth (trees, saplings, and volunteers) within 15 feet of floodwalls

2.4.3 Removal or pruning of all vegetation encroaching within project right-of-way

- Limb up tree branches to 8 feet (14 feet above maintenance roads) above grade and remove ground cover that obscures visual inspections and flood fighting activities
- Partner with offsite property owners on a voluntary basis to cut, trim, and or remove landscape ground covers, brush, and ornamentals from adjacent private property which encroaches within 15 feet of all floodwalls

2.4.4 Repair and maintenance of floodwall access roadways/ramps

- Fill potholes or ruts with compacted Class 2 aggregate base per Caltrans Specifications
- Apply herbicide on roadway surfaces to exclude unwanted vegetation
- Remove woody vegetation and overhanging growth which impairs or obstructs maintenance access.

2.4.5 Repair of floodwall coating

- The sheet pile floodwall has been protected from rust by a 15-millimeter thick phenalkamine coating on the floodwall surface
- This coating should be visually inspected at least bi-monthly to insure a complete coverage
- Any nicks or scrapes in the coating surface should be repaired immediately

2.4.6 Repair of floodwall damage caused by flood events

- Inspect and document cause of floodwall damage
- Plans for repairs will be prepared by the JPA
- Schedule and complete construction
- Monitor repair site for performance

2.5 Interior Drainage System

Outfalls which penetrate the floodwall must be maintained and repaired as necessary to ensure that they continue to operate as intended and at full design capacity. Outfalls which have failed, including flap gates that are not operating properly, culverts that are operating below full capacity or positive closure valves that are inoperable, may create flooding.

2.5.1 Culvert flap gate service and repairs (annually)

- Check for damage
- Check for rust
- Confirm proper seating and sealing of flap gate on culvert
- Service frame and lubricate pivots

2.5.2 Pipe culvert inspection, repairs, and sediment removal

- Evaluate culvert for sediment and/or blockages
- Check pipe interior
- Periodic video inspection of culvert joints and lining for buckling, spalling, corrosion, damage, or separation
- Remove sediment in culvert
- Replace damaged or degraded pipes and culvert sections

2.5.3 Removal of sediment and woody vegetation at culverts and outfalls

- Cut and remove vegetation that could affect flap gate or discharge
- Remove sediment that could affect flap gate or discharge

2.5.4 Repair and maintenance of outfall slope protection

- Remove any woody vegetation (brush or trees) in riprap
- Repair or replace riprap slope protection
- Repair foundation or apron of outfalls to prevent undermining, scour, and/or slope failures

2.5.5 Positive Closure Valve

- Positive closure valves located at the outboard side of the flood walls shall be tested to insure proper sealing
- Positive closure valves that do not seal properly shall be repaired or replaced to ensure protection from flooding backflow

2.6 San Francisquito Creek Channel

Maintenance measures shall be performed to ensure serviceability of the creek to safely pass all flows up to the design flood event. Maintenance of the low flow creek channel and terraced benches shall consist of the removal of sediment deposition, debris accumulation and vegetative growth. The JPA will periodically re-assess facilities to evaluate conveyance to verify maintenance practices (see Section 3).

The channel shall be thoroughly inspected annually and immediately following each major high water period after water levels are reduced to the low flow.

2.6.1 Removal of woody vegetation in channel

- Cut and remove woody saplings, trees, volunteers, understory, and brush
- Follow up with appropriate herbicide treatment as necessary to prevent regrowth

2.6.2 Trimming, modifying, and removal of downed trees in creek channels

- Cut and remove downed trees within creek channel

2.6.3 Sediment removal in low flow channel

- Sediment removal in channels is necessary if sediment bar and vegetation blocks flow and reduces conveyance

2.6.4 Fill and repair scour holes in channel

- Scour hole repairs are required if conveyance, slope stability, or a utility is affected
- Drain ponded water and reconstruct channel embankment and/or invert
- Fill placed in 8-inch lifts, minimum 90% compaction. Sand Cone method to test relative compaction may be used

2.6.5 Control of unwanted vegetation and brush on benches to maintain conveyance

- Mowing/trimming of herbaceous growth when it is 4 feet or higher
- Cut, remove, and treat brush or trees in channels to control woody growth and maintain conveyance per section 2.6.1

2.6.6 Maintenance and repair of hydraulic gates and control structures

- Inspect and verify operation, identify and document any damage annually
- Grease, lubricate, and exercise mechanical appurtenances as needed based on inspection. Gates are opened and closed once or twice per year.
- Determine if the condition is undesirable, or affects operations
- Prepare plans and complete repairs if necessary
- Monitor for performance

2.6.7 Repair of revetment and riprap

- Inspect condition of riprap after flood events
- Replace, repair, and restore rock riprap to as-constructed conditions

- Remove woody vegetation (brush or trees) growing in riprap. Cut trees or woody vegetation and treat stumps with appropriate herbicide

2.6.8 Trash and debris removal in channels and at bridge piers/columns

- Remove debris that creates blockages or reduces conveyance, as determined by engineering staff

2.6.9 Homeless encampment clean-up

- Remove homeless encampments with assistance from local authorities
- Monitor, evaluate, and repair impacts from homeless encampments (brush clearance, tree trimming, creation of trails and paths) as needed

2.7 Miscellaneous Maintenance Activities

Maintenance on the following project elements is required to provide security in areas where access is not intended, and to ensure access at the proper locations for maintenance staff as needed, and to the general public for recreational use. Encroachments into the project ROW must be maintained when authorized, and removed when not authorized.

2.7.1 Miscellaneous Repairs and Maintenance

- Repair fence sections and replaced damaged gates
- Replace and install public signage for Project as necessary
- Paint defaced structures located in the channel (floodwalls, drop structures, etc.) as part of the neighborhood clean-up work

2.7.2 Remove unauthorized encroachments on Project (stairs, landscaping, utilities, fences, irrigation, etc)

- Coordinate removal of unauthorized private encroachments with local jurisdictions (parks, police, public works, building departments)
- Notify adjacent property owners to remove unauthorized encroachments if they are the responsible party
- Provide neighborhood notice if work is necessary to remove encroachments
- Coordinate removal of unauthorized encroachments or utility encroachments with owners

2.7.3 Maintenance of authorized encroachments on Project (Vehicular and pedestrian trails, utilities, etc.)

- Encroachment owner identifies needed repairs or modifications
- Repairs are identified and project is defined
- Owner applies for a permit from the appropriate governing entity to perform work
- Coordinate with local jurisdictions (city, parks, or private party)
- Owner sends neighborhood notices to the surrounding property owners/community
- Complete repairs

- Monitor for performance

2.7.4 Faber Tract levee stability slope maintenance

- Target unwanted vegetation and control non-natives (hand methods) as needed.
- Removal of diseased vegetation as needed
- Implement additional maintenance measures, as needed, to ensure that long term success criteria are met
- Note that this element is within California clapper rail and salt marsh harvest mouse habitat and any maintenance requires specific conditions to be included in natural resource agency permits (see Appendix E)

2.8 Storm Water Pump Stations

There are two municipal storm water pump stations located within the project limits: the O'Connor Street Pump Station located near R-Line Station 30+00 and the Palo Alto Pump Station located near L-Line Station 71+00. Neither of the pump stations was constructed as part of the flood control works. The pump stations were operational prior to the construction of the levees and floodwalls. Contact the Cities of East Palo Alto and Palo Alto for their operations and maintenance protocols.

2.9 Friendship Bridge and Boardwalk

2.9.1 Removal of woody vegetation at piers

- Cut and remove vegetation or debris that may accumulate at bridge piers
- Inspect for scour and erosion at bridge piers and abutments
- Reconstruct channel sags, depressions, or groundwater subsidence to original design specifications (See Appendix B – Project As-Constructed Drawings)

3 INSPECTION AND REPORTS

3.1 Introduction

This section details the inspection required for proper care and efficient operation of the various project elements. Completed projects must be adequately maintained if they are to function as intended. The JPA is responsible for preserving maintenance and inspection records for its area of responsibility and making them available for government inspection. Government inspections will be performed in consultation with JPA. The inspection requirements included herein apply to all items constructed by and necessary for the operation of the Federal Project.

3.2 Inspection and Reporting Frequency

Semiannual inspections performed by JPA shall occur by May 1 and November 1.

In addition to the semiannual inspection and reporting cycle, the following events require immediate inspection.

- Immediately following each major flood
- Immediately following each earthquake based upon the following criteria:
 - Earthquakes measuring less than 5.0 on the Richter scale, inspection shall be performed when the epicenter is within 3 miles of the project
 - Earthquakes measuring 5.0 to 6.0 on the Richter scale, inspections shall be performed when the epicenter is less than 30 miles from the project
 - For earthquakes measuring 6.0 or higher on the Richter scale, inspections shall be performed when the epicenter is less than 50 miles from the project
 - Inspections shall also be performed after any earthquakes in which specific reports of damage to the project are received

3.3 JPA Inspections of Project Elements

- Channels checked for scour, fallen trees, debris and other blockages
- Levee embankments
- Interior drainage (culverts, flap gates, isolation gates, valves)
- Levee penetrations are visually inspected annually, and by video or walkthrough every 5 years. Frequency will be increased if deficiencies are noted.
- Biannual reports documenting project conditions
- Levee elevations on both sides will be inspected by survey two years after completion of construction and four years after completion of construction to verify forecast elevations following settlement. If settlement exceeds predictions, repair options will be evaluated and implemented.

3.4 Check Lists and Instructions

The SCVWD check lists and instructions shown in Appendix C are to be explicitly followed in each inspection to ensure that no features of the protective system are overlooked. A copy of the inspector's original field notes as recorded on the check list shall be transmitted to the District Engineer as an enclosure to the annual report. Completed inspection check lists are located at the direction of the JPA. The following documents are included in "Appendix C - SCVWD Inspection Rating Guides and Checklists":

- SCVWD WW 75161 Field Operations Levee Inspection Guidelines
- SCVWD WF 75161 Levee Field Inspection Rating Guide
- SCVWD WW 75165 Field Operations Inspection Guidelines
- SCVWD WF 75166 Facilities Inspection Rating Guide
- SCVWD WF 75165 Field Inspection Checklist

3.5 JPA Project Inspections

The JPA completes semiannual inspections of the Project by May and November of each year. Every six months the Project elements (levees, channels, maintenance roads, culverts, revetment, etc.) are evaluated and rated following the SCVWD guidelines for inspections. Evaluations will identify and document any deficiency (e.g., erosion, scour, sediment, rodent control problems, animal damage, in-stream vegetation, levee maintenance, trash build up, homeless encampments, large woody debris blockages, etc.) on the Project.

3.5.1 JPA Evaluation of Project Elements

The SCVWD has developed specific Inspection Guidelines for watershed facilities and levees throughout the county. These Guidelines identify the inspection category (routine or event driven) and frequency of inspection (annual, event, or semiannual) for each project and system. The Guidelines contain information on the inspection and work flow so that deficiencies identified during the inspections are corrected. Appendix D contains the SCVWD detailed description of the facility and levee maintenance activities.

3.5.2 JPA Rating of Project Elements and Deficiencies

During inspections, project elements are assigned a rating (A=New, B=Good, C=Monitor, D=Corrective Action, E=Immediate Action). Deficiencies or items of concern found during the inspections are documented by the JPA.

Based on the severity of the deficiency, available budget, right-of-way, and existing permits, the JPA then schedules corrective maintenance to remedy the problem. If it is determined that maintenance is required, a project plan is prepared, the repairs are scheduled, and funds are budgeted as necessary.

APPENDIX A

Design Documentation Report

**San Francisquito Creek Flood Reduction,
Ecosystem Restoration, and Recreation Project
San Francisco Bay to Highway 101**

Design Documentation Report

Draft 100% Design Submittal

SAN FRANCISQUITO CREEK
JOINT POWERS AUTHORITY

July 2014



Prepared by:



HDR Engineering, Inc.
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Folsom, CA 95630

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1.0 Background

The HDR Project team is under contract with the San Francisquito Creek Joint Powers Authority (JPA) to provide consulting services in support of plans, specifications and estimates (PS&E) preparation for flood protection improvements along San Francisquito Creek between the San Francisco Bay (SF Bay) and Highway 101. Scoped tasks include: project management; public outreach assistance; design concept, model, and base map/survey review; utility mapping; design criteria development; geotechnical investigations and associated reporting and recommendations; PS&E at the 30%, 90%, 95% Draft 100%, and 100% levels. Optional services include bid and construction support.

This Technical Memorandum (TM) details the design analysis to this Draft 100% stage. This TM is a living document and will be continuously updated with new design calculations and criteria as the design progresses.

The following sections describe the Draft 100% submittal design elements, the status of the current design, significant changes, and specific considerations that have shaped the progress of the design. Figure 1 depicts the project design features as they are currently planned.

2.0 Alternatives Analysis

In July 2009, Philip Williams & Associates (PWA) completed the San Francisquito Creek Flood Reduction Alternatives Analysis. PWA divided the project into three reaches; the upper reach extends from East Bayshore Road / Highway 101 Bridge to the Palo Alto Municipal Golf Course, the middle reach extends from the golf course to Friendship Bridge and the lower reach extends from Friendship Bridge to the San Francisco Bay. The JPA selected PWA's Alternative 2 model for the design of the downstream portion of San Francisquito Creek. Alternative 2 consisted of setback floodwalls in the upper reach, levee setbacks in the middle reach, an overflow terrace near Friendship Bridge, and the removal of the levee between the Baylands Preserve (also known as the Faber Tract) and the north side of the creek. PWA's Alternative 2 diagram is shown in Figure 2.

HDR has worked within the design constraints laid out by the JPA to minimize impacts to existing features and structures, minimize increases to the design water surface elevation at Highway 101 / East Bayshore Road, and preserve opportunities for habitat within the creek as much as possible. The levee and floodwall layout proposed in the PWA Model has been reconfigured to fit within existing structures, utilities, and recreational facilities in coordination with the JPA right of way acquisition efforts.

3.0 Flood Protection Design Elements

3.1 Floodwalls

A geotechnical evaluation was performed by GEI Consultants and are summarized in a memorandum titled, “San Francisquito Creek Flood Protection Project, Geotechnical Evaluation Report” dated May 2012.

Both interlocking steel sheet pile cantilever walls and T-type concrete walls were considered for flood wall design. During the subsurface exploration program, shallow, pervious soil units and soft Bay deposits were encountered below relatively thin blankets of low permeability soils along the proposed floodwall alignments. The results of seepage analyses indicate that flood walls should include a cut off to intercept the pervious foundation soils in order to meet the minimum acceptance criteria for underseepage gradients. In addition, flood wall cut offs should fully penetrate into the soft bay deposits and terminate in competent material.

Shallow supported concrete T-type walls would likely have a wide foundation embedded 3 to 5 feet below the ground surface, and include a cutoff at the heel. Construction of this type of floodwall would require significant excavation, and a large construction footprint.

Sheet pile walls are constructed in a more limited construction zone with fewer disturbances to adjacent areas and can intercept the pervious foundation soils present within the project footprint. Based on these considerations, a floodwall consisting of interlocking sheet piles that fully penetrate soft bay deposits and terminate in competent material is recommend for flood control within the upper reach of this project.

3.1.1 Floodwall Depth

GEI’s evaluation of sheet pile depth required that the floodwall be embedded to the maximum tip elevations shown in Table 1 (i.e. no shallower than the elevations shown).

Table 1. GEI Floodwall Depths

FLOODWALL DEPTHS	
LEVEE – STATION	ELEVATION
R-LINE 54+00 TO 67+50	-15
L-LINE – 67+00 TO 76+00	-10
L-LINE – 49+00 TO 67+00	-15

These maximum tip evaluations are based on providing cutoff for seepage and a minimum embedment of 8 feet below the estimated bottom of young Bay Mud.

The floodwall materials were identified and embedment depths were refined during the structural design of these walls. This design is in conformance with USACE EM 1110-2-2504. A summary of the structural calculations for this project are located in Appendix A. The final sheet pile floodwall depths are summarized in Table 2 and can be found within the construction documents on Sheet S-1.

Table 2. Final Floodwall Depths and Types

FLOODWALL DEPTHS AND TYPES		
LEVEE – STATION	SHEET PILE TYPE	ELEVATION
R-LINE 29+53.75 TO 31+57.64	AZ 24-700	-15.0
R-LINE 54+00 TO 61+00	AZ 19-700	-15.0
R-LINE 61+00 TO 70+00	AZ 24-700	-15.0
R-LINE 70+00 TO 75+00	AZ 36-700	-17.0
R-LINE 75+00 TO 75+54.13	AZ 50	-22.0
L-LINE 49+00 TO 62+00	AZ 19-700	-15.0
L-LINE 62+00 TO 71+05	AZ 24-700	-15.0
L-LINE 71+80 TO 75+00	AZ 24-700	-15.0
L-LINE 75+00 TO 76+29.42	AZ 36-700	-17.0

3.1.2 Floodwall – Levee Transition

To mitigate for the potential for differential settlement at the transition between the floodwall and the new levee fill, the floodwall section should be extended into the new levee fill section with an overlap of at least 150 feet. This overlap will provide additional protection against levee through seepage if differential settlement and cracking of the levee fill should occur. There are four transitions that occur between floodwall and levee. The transitions occur at R-Line 28+03.00 to 29+53.73, R-Line 31+57.64 to 33+07.00, R-Line 52+50.00 to 54+00.00, and L-Line 47+50.00 to 49+00.00.

3.2 Levees

Levees are the preferred flood protection element downstream of the project floodwalls. For conformance with USACE EM 1110-2-1913, the levee geometry includes:

- ◆ A 16 foot crown width.
- ◆ A 3 horizontal to 1 vertical (3H:1V) water side levee slope.
- ◆ A 2H:1V landside levee slope.

- ◆ Top of Levee elevation includes three feet of freeboard above the 100 year design water surface elevation.
- ◆ Top of Levee elevation includes four feet of freeboard above the 100 year design water surface elevation 100 feet upstream and downstream of bridge structures (Highway 101 and Friendship Bridge).

See **Figure 3** for the typical levee section layout.

Geotechnical stability analyses indicate that this geometry will provide factors of safety as required by USACE guidelines. Seepage analyses indicate that no seepage berms or cutoff walls are required for the levee portion of this project.

3.3 Access Road

To provide the appropriate level of flood protection, the proposed flood wall will be significantly higher than the existing ground, on the order of 10 feet in some sections. In order to maintain visibility of the creek for pedestrians and bicyclists, the access roadway located behind the flood wall will be raised when necessary (see **Figure 4**). The access roadway will typically be 16 ft. wide and will slope away from the flood wall at a 2% slope.

In the area of the International School of the Peninsula (ISTP), the creek is particularly narrow, and maximizing the width of the floodway is hydraulically beneficial. However, it is also beneficial to mitigate for any encroachment that this floodway widening will impose on the school playground. In order to minimize encroachment within the playground area behind the ISTP, the access roadway will be reduced to a width of 12 ft. and a retaining wall will be constructed on the outboard side of the access road in order to eliminate the 2H:1V landside slope that typically occurs at the raised access way (see **Figure 5**).

3.4 Appurtenant Structures and Tie-Ins

Several details were produced with the Draft 100% plan set; these include but are not limited to: the sheet pile wall connection to concrete structures, sheet pile wall utility penetrations, concrete cap, and flood wall details.

3.5 Friendship Bridge

Per direction of the JPA, its member agencies and stakeholders, the existing friendship bridge will not be removed from its current location. Because of significant floodway widening that will occur at this bridge, the existing left bank levee will be transformed to an in-creek island at the Friendship Bridge north abutment. A new boardwalk will also be constructed from the new in-creek island to the new setback levee (see **Figure 6**).

4.0 Alignment and Layout Considerations

4.1 Project Extent

For the left levee, the downstream project extent will occur at the tie-in point between the new and existing levees downstream of Friendship Bridge. The extent of the project along the right levee alignment will occur at the eastern end of the bay levee degrade near the San Francisco Bay. These extents are shown on the attached **Figure 1**. HDR understands that subsequent local or Shoreline Study project(s) will address levee inadequacies in the creek upstream of Highway 101. It is expected that such future projects will tie in to the flood protection elements of this project, to create a comprehensive flood protection system that protects from riverine and tidal flooding.

4.2 Hydraulics

Due to the complexity of the hydraulic design required for this project, a separate TM was prepared by HDR to address the hydraulic design features. This TM is titled Hydraulic Review Technical Memorandum, San Francisquito Creek Flood Protection Capital Project, Floodwater Conveyance Improvements from East Bayshore Road to San Francisco Bay, dated July 2014.

4.3 Geotechnical Design

A geotechnical report was completed by GEI Consultants and is titled, “San Francisquito Creek Flood Protection Project, Geotechnical Evaluations Report” and dated May 2012. Topics within this report include:

- ◆ Field exploration and laboratory testing.
- ◆ Subsurface conditions.
- ◆ Engineering analyses for proposed levees and floodwalls including seepage, stability, and settlement evaluations.
- ◆ Geotechnical recommendations and design criteria.

Results of this report were used to develop the floodwall and levee design criteria listed previously in this report.

4.4 Utilities

There are several utility structures that cross the proposed levee/flood wall alignment. A summary of these encroachments is listed within **Table 3** and are shown in **Figure 7**:

Table 3. Utility Encroachments

UTILITY ENCROACHMENTS			
LEVEE – STATION	TYPE OF UTILITY	SIZE	MATERIAL
L-Line – 14+20 TO 26+50	SANITARY SEWER	24"	Concrete
L-Line – 27+00	STORM DRAIN	6"	Plastic
L-Line – 28+50	JOINT TRENCH	Unknown	Unknown
L-Line – 30+50	WATER	Unknown	Unknown
R-Line – 31+50 TO 32+50	SANITARY SEWER	24"	Concrete
R-Line – 30+20	PUMP STATION	NA	Concrete
R-Line – 31+00	WATER	2"	Copper
R-Line – 31+00 TO 34+40	SANITARY SEWER	14"	RCP
R-Line 34+50	SANITARY SEWER	12"	Wooden (Abandoned)
R-Line - 44+50 TO 50+55	GAS	20"	Steel
R-Line – 68+90	STORM DRAIN	10"	CMP
R-Line – 73+50	STORM DRAIN	30"	CMP
L-Line - 68+00 TO 70+00	WATER	2.5"	Unknown
L-Line 67+00 TO 70+00	GAS	2"	Unknown
L-Line - 67+60	STORM DRAIN	12"	NA
R-Line - 72+50 TO 74+50	WATER	6"	Unknown
L-Line - 75+20	STORM DRAIN	96"	
R-Line - 42+80	ELECTRICAL TOWER	Unknown	Steel Lattice
L-Line - 46+80	ELECTRICAL TOWER	Unknown	Steel Lattice
L-Line - 52+50	ELECTRICAL POLE	Unknown	Unknown

4.4.1 USACE

HDR conducted a meeting on January 20, 2012 with Paul Schimelfenyg and Brian Hubel of the USACE to discuss the existing utility encroachments and proposed utility relocations. The following is a list of proposed actions agreed upon for each utility:

- A. Sanitary Sewer – There is an existing Sanitary Sewer line that crosses under San Francisquito Creek. HDR recommended protecting the existing line in place during construction. Paul expressed interest in determining the condition of the existing pipe. HDR indicated that the interior of the existing pipe will be lined by the East Palo Alto Sanitary District to improve function.
- B. Brian expressed concern with settlement that would occur if a new levee were built over the existing sewer line. The existing soil consists of Bay Mud which can experience significant consolidation.
- C. After discussion it was agreed that HDR should consider re-routing the existing sewer line to cross the levee at a point where the existing levee is not being relocated. This will eliminate settling because the soil underneath the existing levee is already consolidated. The manhole at the Friendship Bridge abutment will be raised and fitted with a watertight cover. The design will address erosion protection around the manhole.
- D. Gas - There is an existing 20” gas line that crosses the levee twice. HDR should work with PG&E to insure that the gas line is relocated over the levee per EM 1110-2-1913. Settlement should be considered. If possible, the gas line should be installed after settlement of the levee is complete due to the bay mud which is prevalent within the project footprint.
- E. Storm Drain – There is an existing storm drain inlet behind the International School of the Peninsula (ISTP) that drains the water from the blacktop area behind the school. Another drain inlet that currently discharges to the creek is located behind the adjacent storage facility and drains runoff from the roofs and blacktop area. These storm drain inlets release to 12-inch diameter pipes that discharge to the creek. Paul did not see a concern with protecting these lines in place. However, the 12-inch diameter pipes will be replaced with 30-inch diameter pipes fitted with flap gate outlets and landside positive closure valves to prevent the backflow of water into the pipe.
- F. Private Water Line – There is an existing 6” private water line near US 101. The line does not cross the proposed flood wall but does lie beneath the proposed access way. Paul suggested relocating the line if possible; however the line occurs in a densely populated area. Paul was okay with leaving the line if relocation is not feasible.
- G. Abandoned Utilities – Abandoned utilities will be removed and backfilled where possible. Abandoned pipes left in place under the creek will be grouted.
- H. Electrical Towers – The design needs to include 15 feet of easement around the towers to provide for inspection. PG&E will need to consider seepage and stability issues at

their towers, including settlement and lateral loads. The design will address the impact to the WSEL of leaving these towers in the floodway.

- I. Power Poles – There is an existing power pole that is located within the proposed floodway. HDR will work with PG&E to relocate this pole outside the proposed levees and O&M corridors. The new pole will be constructed at sufficient height to provide vertical clearance required by USACE guidelines.

4.4.2 EPASD

HDR conducted a meeting with East Palo Alto Sanitary District (EPASD) on February 21, 2012. At this meeting, options for the existing 24 inch diameter sanitary sewer creek crossing were discussed. EPASD has not finalized a design for this crossing but are considering replacing the existing 24 inch diameter sanitary sewer siphon with a new 24 or 30 inch diameter siphon that would span the new, wider, creek width.

Previously HDR had proposed to keep the existing siphon and raise the existing manhole that was located within the new floodway to an elevation above the 100-yr flood elevation. EPASD did not approve of this design approach because it limited access to the manhole within the floodway.

HDR will coordinate with EPASD to ensure that the proposed crossing meets the required USACE guidelines for utilities crossing a levee.

4.4.3 PG&E

HDR met with PG&E on March 28, 2012 to discuss the electrical and gas crossings. PG&E said that they had plans to raise the height of the electrical towers located along the north levee by 15 feet.

After some discussion and coordination with PG&E, HDR determined that it would be in the project's best interest to require that the contractor cut the sheet piles that will occur beneath the electrical crossings and install them one half at a time to eliminate the need for an excessively tall electrical line at the levee. A weld will join the two halves of sheet pile wall to obstruct any seepage through the wall.

Heights required for the electrical crossing were sent by HDR to PG&E in an email on March 29, 2012. A copy of this email and its attachment can be found within Appendix B.

During the March 28th meeting, PG&E also agreed to relocate the existing Gas line that is located beneath the existing levee. The new relocated line will be of sufficient depth to comply with USACE guidelines.

4.5 Caltrans Design Coordination

Caltrans has provided preliminary drawings for the proposed bridge/culvert replacement under Highway 101 that is planned to occur before this project goes to construction. The proposed

bridge will consist of a box culvert consisting of 3 cells that are 30.9 ft. wide and one cell that is 27.3 ft. wide for a total width of 120 ft. The current project floodwall alignment is aligned to match the outer cell wall of the proposed Caltrans bridge structure.

At the July 21, 2010 Caltrans coordination meeting, Caltrans disclosed that they will design no permanent wing walls, only temporary sheet pile wing walls aligned to conform to existing contours. The wing walls on the south side of the creek will close off the 4th bridge cell until the upstream and downstream projects are complete in this area.

There is currently a 96-inch diameter storm drain outfall that is located approximately 50 feet downstream of the Highway 101 Bridge. Caltrans will coordinate the relocation of the existing 96-inch diameter storm drain outfall so that the future outfall will be located beneath Highway 101. This will be of benefit because the exiting 96-inch diameter outfall conflicts with the location of the new floodwall.

During review of the Caltrans drawings, HDR determined that the concrete barrier located at the downstream face of the bridge is lower than the proposed adjacent flood wall. As such, the Caltrans Barrier does not provide the 4 ft of freeboard required by FEMA guidelines. On May 28, 2014 SCVWD met with Caltrans to discuss the Highway Bridge Replacement. HDR joined the conference via teleconference. The barrier was discussed and HDR requested that Caltrans consider raising the barrier to provide the typical 4 ft freeboard required by FEMA. Caltrans replied that the barrier was standard for the approach speed and that a substitution was not feasible.

4.6 Right-of-Way

The layout has been purposely set such that a minimal property take is required, specifically in the residential area of East Palo Alto. It is advisable to avoid property takes for public relations and cost impact purposes; in addition, the minimal backyard takes that are possible in East Palo Alto would provide little hydraulic benefit to offset the resulting impacts. The majority of the ROW infringements and changes in use will be considered on the Santa Clara County side of the creek.

The current right-of-way limit provides a 15' Operations and Maintenance (O&M) easement at the waterside and landside toe of each levee for inspection and flood fighting purposes. This easement is narrowed to 10 ft easements within areas that have limited access due to existing structures.

The levee right-of-way line adjacent to the Right Bank Floodwall from station 57+00 to 69+00 is located along the existing fence line of the subdivision within that area.

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Figure 1. Project Design Features



LEGEND

-  FLOODWALL
-  LEVEE
-  LEVEE REMOVAL

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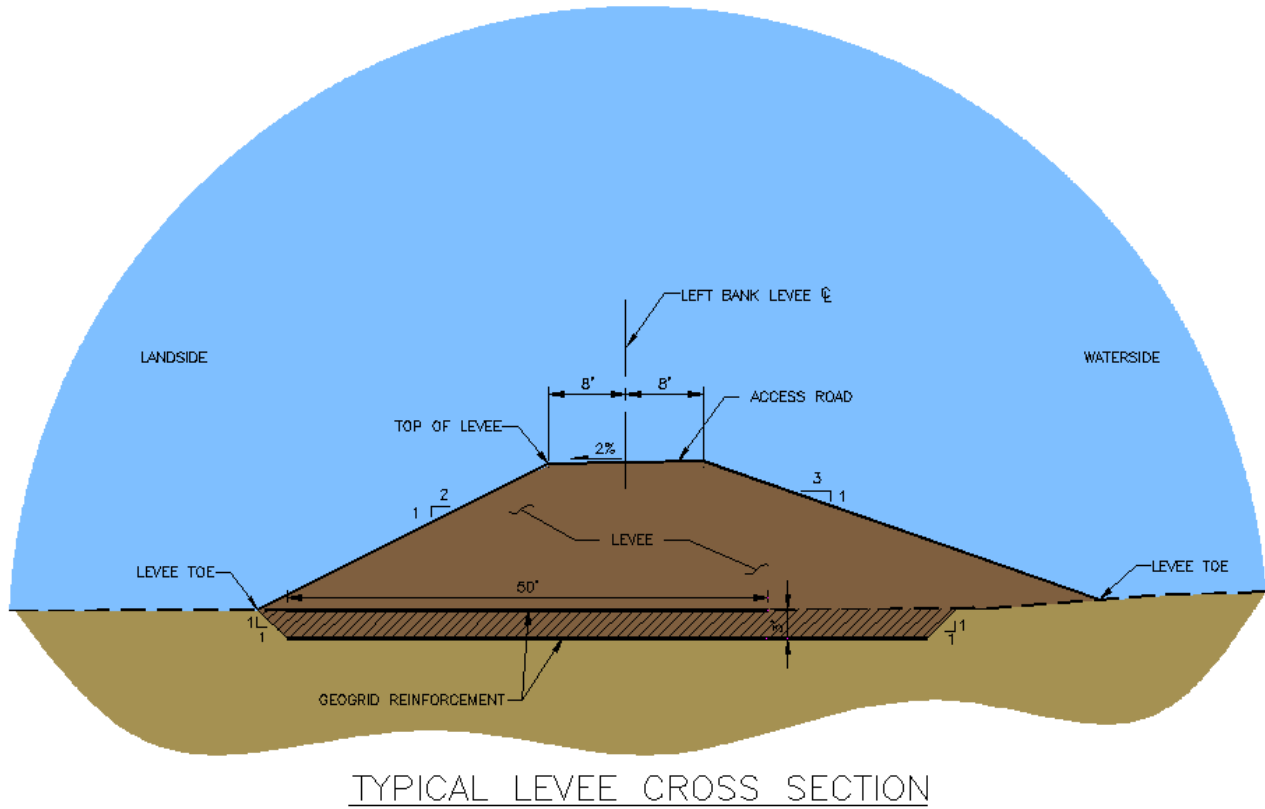
Figure 2. PWA Alternative 2 Conceptual Layout



Figure reproduced from PWA's July 2009 San Francisquito Creek Flood Reduction Alternatives Analysis.

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Figure 3. Typical Levee Cross Section



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Figure 4. Typical Raised Access Way

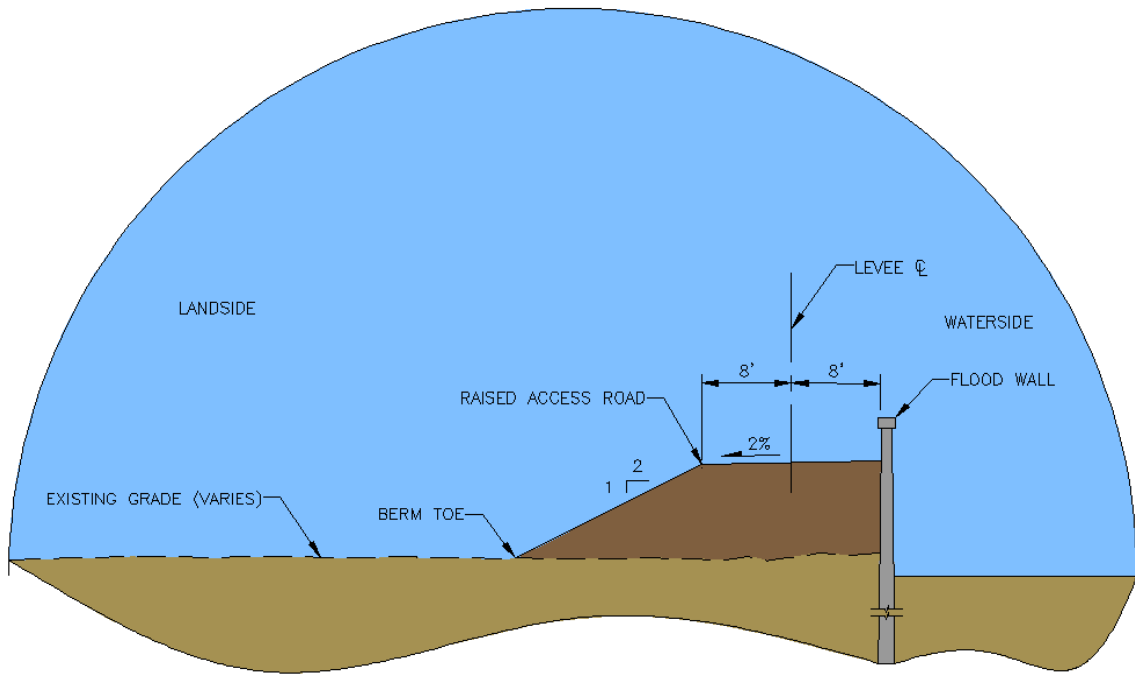
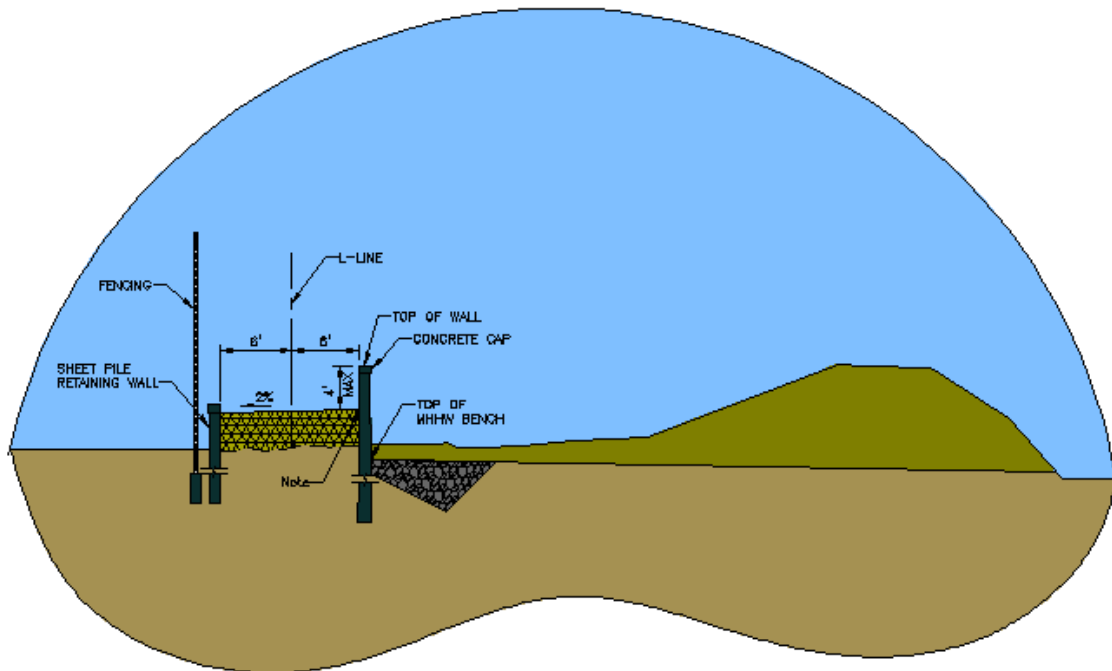
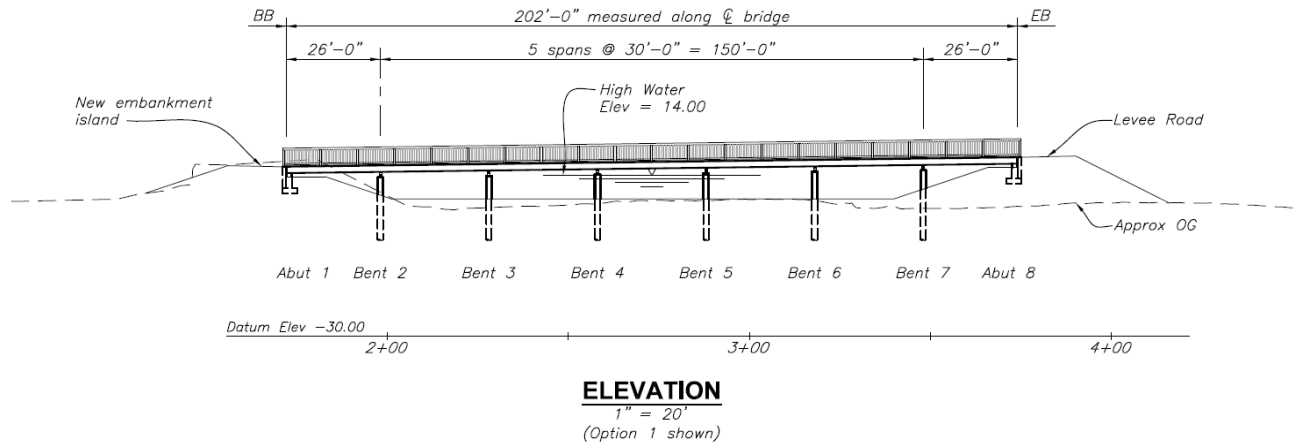


Figure 5. Raised Access way Behind ISTP



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Figure 6. New Boardwalk Structure



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Figure 7. Existing Utilities



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APPENDIX A - Flood Wall Calculations

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HDR

SFCJPA

**San Francisquito Creek
Flood Wall
Supplemental Structure
Design Calcs**

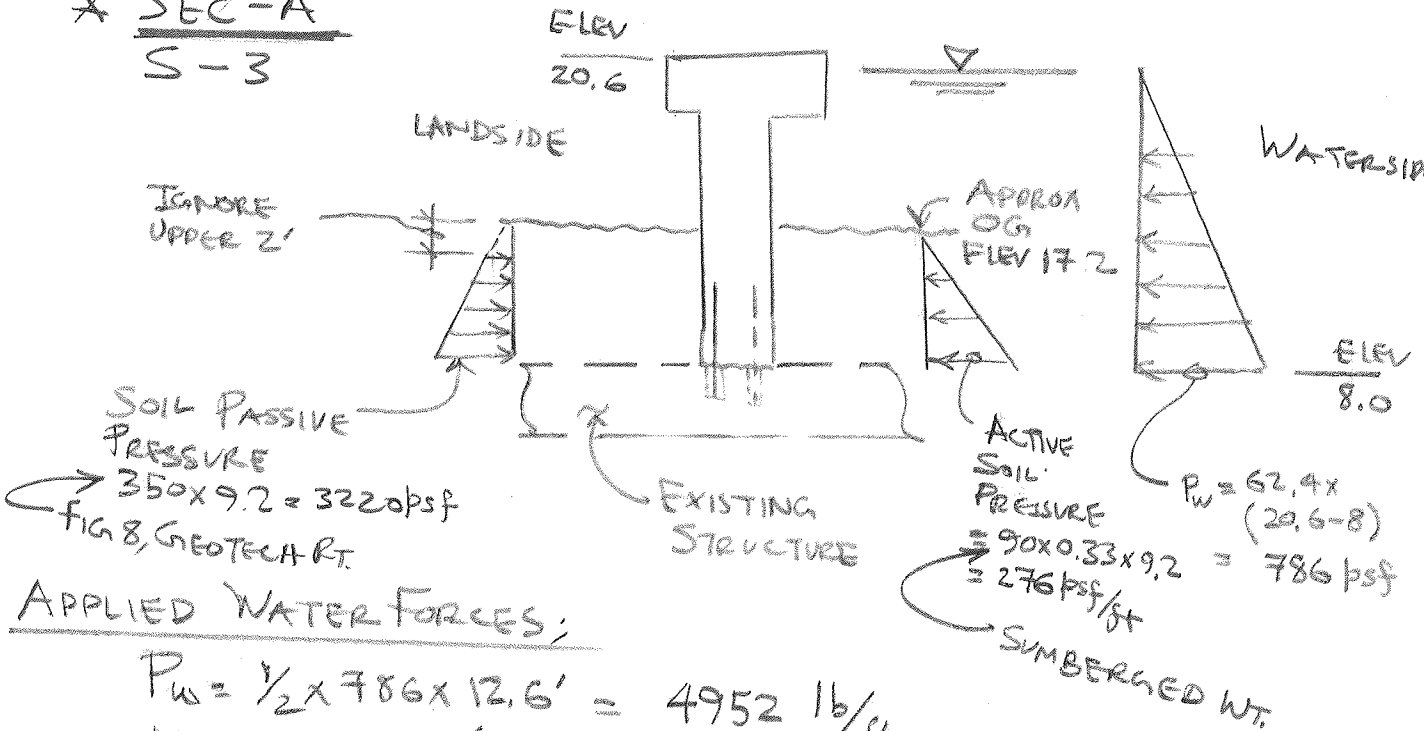


**Prepared For
San Francisquito Creek
Joint Powers Authority**

**February 2013
HDR # 130806**

⇒ NEW WALL CONNECTION DETAIL TO EXISTING CONC. STRUCTURE

* SEC-A
S-3



- APPLIED WATER FORCES:

$$P_w = \frac{1}{2} \times 786 \times 12.6' = 4952 \text{ lb/ft}$$

$$M_w = \frac{1}{3} \times 12.6 \times 4952 \times \frac{1}{1000} = \underline{20.8 \text{ k-ft}}$$

- ACTIVE SOIL PRESSURE; $P_s = \frac{1}{2} \times 276 \times 9.2 = 1268\#$; $M_s = \frac{1268 \times 9.2}{1500 \times 3} = \underline{3.9 \text{ k-ft}}$

- SOIL PASSIVE RESISTANCE:

$$P_p = \frac{1}{2} \times (2 \times 350 + 3220) \times 7.2'$$

$$= 14,112 \#/ft$$

$H_c = 17.2 - 8 - 2 = 7.2'$
IGNORE COVER SOIL

$$M_p = 14112 \times 2.68' \times \frac{1}{1000} = \underline{37.7 \text{ k-ft/ft}}$$

- NET MOMENT TO BE RESISTED BY DRILL & BOND DOWELS;

$$M_u = 1.5 \times (20.8 + 3.9) - 37.7 = -0.7 \text{ k-ft}'$$

CONCLUSION: - DOWELS WILL SEE NONE TO NEGLIGIBLE FORCES
 * PROVIDE #4 @ 12 IN 6' DEEP HOLES

PARAPET WALL CONNECTION TO EXIST STRUCTURE

$$P_w = \frac{1}{2} \times 219 \times 3.5$$

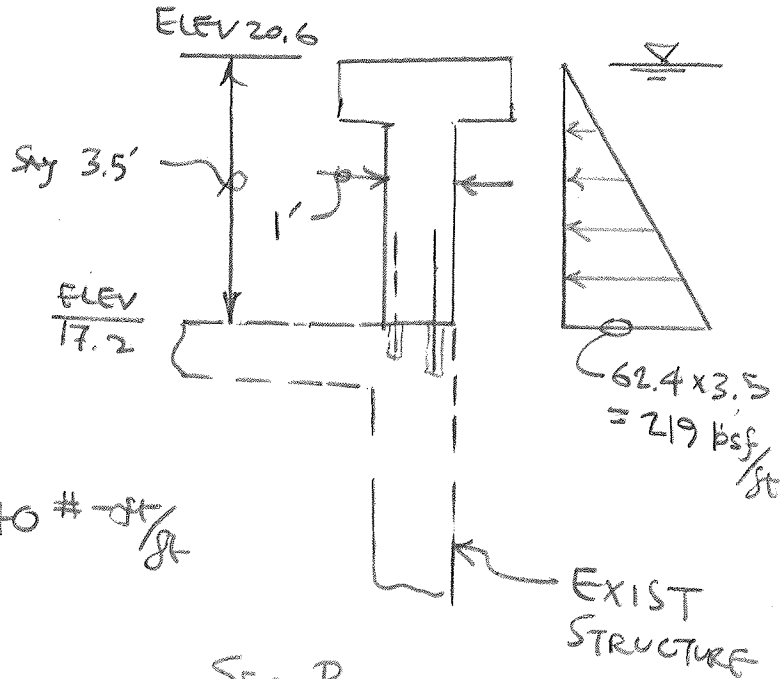
$$= \underline{383 \text{ lb/ft}}$$

$$M_w = 383 \times \frac{3.5^2}{3}$$

$$= 447 \# \cdot \text{ft/ft}$$

$$M_u = 1.5 \times 447 = 670 \# \cdot \text{ft/ft}$$

PER AASHTO LRFD



CAPACITY OF #4 DOWELS @ 12"

* ASSUME SHEAR RESISTED BY COMPRESSION SIDE DOWEL.

$$\Rightarrow T = 8.4" \text{ (SEE NEXT PG)}$$

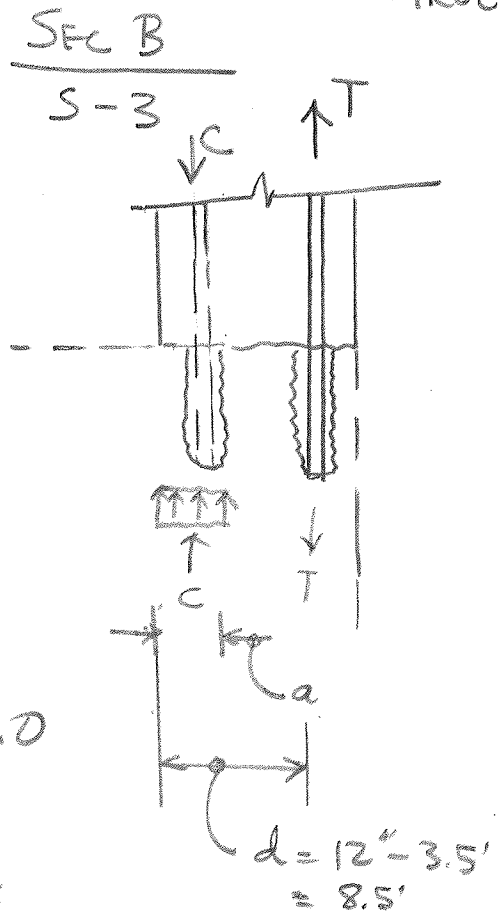
$$\Rightarrow a = \frac{8.4}{0.85 \times 12 \times 3 \text{ ksi}} = 0.28"$$

$$M_R = 0.9 \times 8.4 \left(\frac{8.5 - 0.28}{2} \right) \times \frac{1000}{12}$$

$$M_R = 5267 \text{ lb} \cdot \text{ft/ft}$$

$$\Rightarrow \frac{D}{C} = \frac{670}{5267} \times 0.13 \ll 1.0$$

OK





- For drill and bond dowels, when the edge distance is less than $10d_b$:

$$V = 1.4\pi\sqrt{f'_c}d_e^2 \leq [\phi * (0.55 * \text{yield strength of anchor})]$$

$$\phi = 0.8$$

For drill and grout dowels, V is calculated using the same equation above, but the value of d_e cannot exceed $8d_b$. Tables 3.2.2-1 and 3.2.2-2 have been developed for $f'_c = 4000$ psi.

In the shear strength equation based on edge distance shown above, V is in pounds (lb), the edge distance d_e is in inches (in.) and the concrete strength f'_c is in psi. A factor of 0.7 is incorporated into this equation.

- c) Edge distance that is smaller than the minimum edge distance shown in Tables 3.2.2-1 and 3.2.2-2 is not permitted.
- d) When an anchor is subjected to combined tension and shear loading, the following equation should be satisfied:

$$\frac{\text{Factored shear load}}{\text{Factored shear resistance}} + \frac{\text{Factored tensile load}}{\text{Factored tensile resistance}} \leq 1$$

Table 3.2.2-1 Factored Resistance (Design Strength) for ASTM A 706 Rebars (Grade 60)




Rebar Size	Minimum Edge Distance- d_e (inches)	Minimum Embedment Depth- l_e (inches)	Hole Diameter (inches)		Design Strength for Minimum d_e and l_e (kips)			Design Shear Strength (kips) ($d_e \geq 10 d_b$)
			Grout	Bond	Tension		Grout and Bond	
					Grout	Bond		Grout and Bond
#5	3	5	7/8	1 1/8	3.1	10.5	2.5	8.2
#6	4	6	1	1 1/4	4.4	14.8	4.5	11.6
#7	4	7	1 1/8	1 3/8	6.0	20.3	4.5	15.8
#8	5	8	1 1/4	1 1/2	7.9	26.7	7.0	20.9

TENSION FOR #4 = $10.5 \times \frac{4}{5} = 8.4k < 0.75 \times 0.2 \times 60 = 9$

USE TENSION STRENGTH OF 8.4k

CALCULATION COVERSHEET

Client: SFJCPA
Project Name / Number: San Francisquito Creek Flood Improvement / Project # 241-130806
Deliverable Name / Number: Floodgate Foundation
Deliverable Type: Structural Calculations
Office: Sacramento – Gateway Oaks

Prepared by & Date	Reviewed by & Date	Approved by & Date	Rev No.	Pages Revised & Description (attach additional page if necessary)
Casey Nickols, S.E.  6/11/14	Keith De Lapp, P.E.  6/12/14	Casey Nickols, S.E.  6/12/14		

HDR Engineering, Inc.
 Hydropower Services

Seal:





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Project: SAN FRANCISQUITO CREEK	Computed: CRN	Date: 5/1/14
Subject: FLOOD GATE FOUNDATION	Checked: KDL	Date: 6/12/14
Task:	Page: 1	of: 16
Job #: 241-130806	No:	

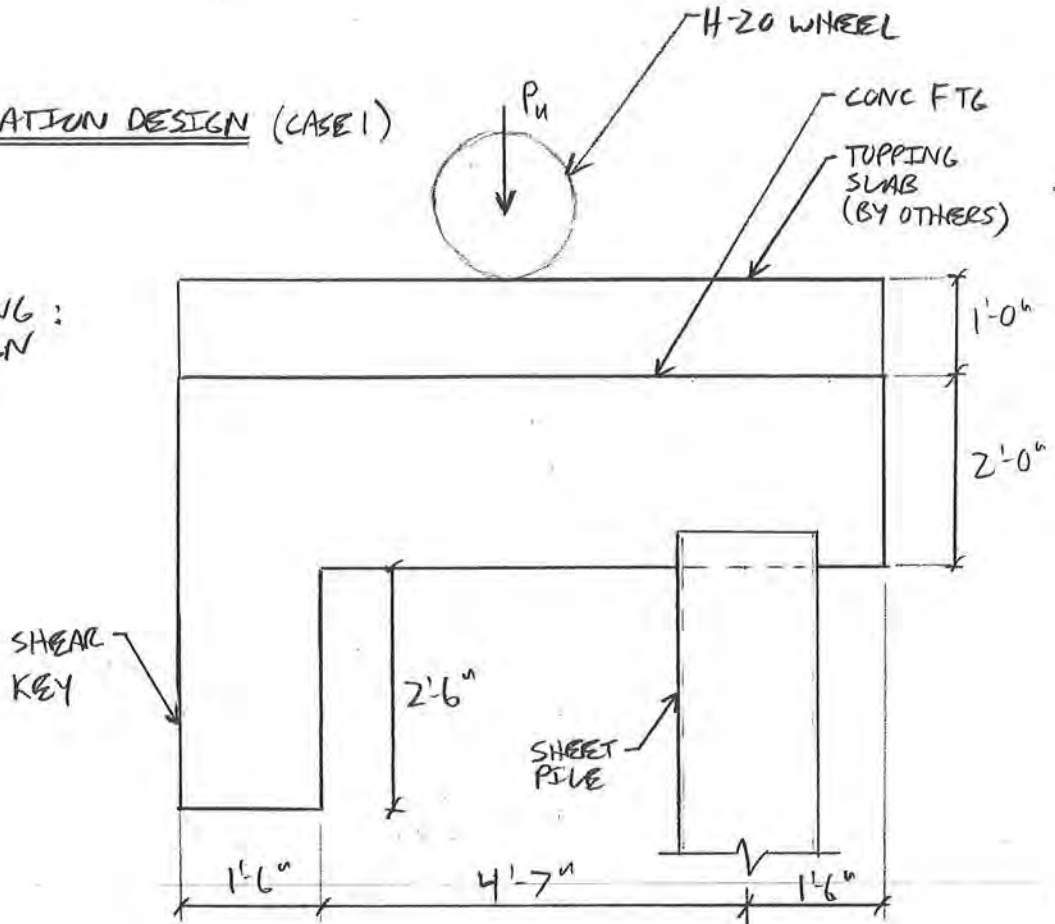
NARRATIVE

HDR HAS BEEN AUTHORIZED TO PROCEED ON THE DESIGN OF THE FOUNDATION FOR A (N) FLOOD GATE TO BE INSTALLED NEAR SAN FRANCISQUITO CREEK. THE FLOOD GATE IS A PROPRIETARY SYSTEM DESIGNED BY OTHERS. A BORING SAMPLE HAS BEEN PREVIOUSLY TAKEN NEAR THE FLOODGATE LOCATION. A GEOTECHNICAL EVALUATION REPORT HAS BEEN PROVIDED BY GEI CONSULTANTS, INC, DATED MAY 2012. RELEVANT GEOTECHNICAL PARAMETERS WERE PROVIDED FOR SHEET PILE DESIGN, HOWEVER SHALLOW FOUNDATION RECOMMENDATIONS WERE NOT PROVIDED IN THIS REPORT. THE FOUNDATION IS TO BE DESIGNED FOR THE FOLLOWING TWO CASES: 1. FLOOD GATE DOWN W/ H-2O WHEEL LOADING, 2. FLOOD GATE UP W/ MAX WATER LOADING



FOUNDATION DESIGN (CASE 1)

FOOTING :
DESIGN



H-20 LOAD

$$P = \left(\frac{32k}{\text{AXLE}} \right) \left(\frac{1 \text{ AXLE}}{2 \text{ WHEELS}} \right) = 16k / \text{WHEEL}$$

$$P_u = \underbrace{(1.3)}_{\text{IMPACT}} (1.7) (16k) = 35.4k$$

⇒ ASSUME A WHEEL CONTACT AREA OF $10'' \times 20''$ & ∴ 4' FTG WIDTH IS EFFECTIVE
TIRE LENGTH TIRE WIDTH

- ⇒ ASSUME ALL BEARING HANDLED BY SOIL BELOW (i.e. SHEET PILE NEGLECTED)
- ⇒ ASSUME 3000 psf ALLOWABLE BEARING PRESSURE
- ∴ PER FOLLOWING ENERGY OUTPUT, FOUNDATION OK FOR H-20 DEMANDS



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General Footing

File = C:\Users\cnickols\Desktop\SANFRA~1\Calcs\Enercalc\SANFRA~1.EC6
ENERCALC, INC. 1983-2013, Build:6.13.8.20, Ver:6.13.8.20

Lic. #: KW-06000410

Licensee: hdr engineering inc

Description: Case 1: Footing Check for Wheel Load @ Midspan

Code References

Calculations per ACI 318-05, IBC 2006, CBC 2007, ASCE 7-05

Load Combinations Used: ASCE 7-10

General Information

Material Properties

f_c : Concrete 28 day strength	=	3.0 ksi
f_y : Rebar Yield	=	60.0 ksi
E_c : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
ϕ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	3.0 ksf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Increases based on footing Depth

Footing base depth below soil surface	=	ft
Allowable pressure increase per foot of dept= when footing base is below	=	ft

Increases based on footing plan dimension

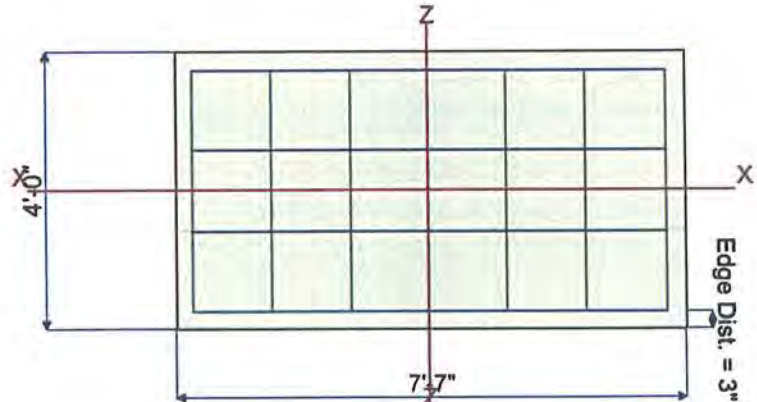
Allowable pressure increase per foot of dept = when maximum length or width is greater than	=	ksf ft
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Dimensions

Width parallel to X-X Axis	=	7.583 ft
Length parallel to Z-Z Axis	=	4.0 ft
Footing Thickness	=	24.0 in

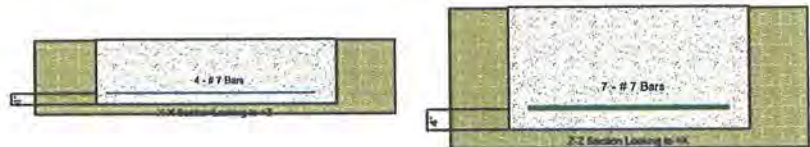
Pedestal dimensions...

p_x : parallel to X-X Axis	=	in
p_z : parallel to Z-Z Axis	=	in
Height	=	in
Rebar Centerline to Edge of Concrete.. at Bottom of footing	=	4.0 in



Reinforcing

Bars parallel to X-X Axis	=	
Number of Bars	=	4.0
Reinforcing Bar Size	=	# 7
Bars parallel to Z-Z Axis	=	
Number of Bars	=	7.0
Reinforcing Bar Size	=	# 7



Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation: Z-Z Axis

# Bars required within zone	=	69.1 %
# Bars required on each side of zone	=	30.9 %

Applied Loads

	D	L _r	L	S	W	E	H
P: Column Load	=		16.0				k
OB: Overburden	=	0.150					ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k

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General Footing

File = C:\Users\cnickols\Desktop\SANFRA~1\Cals\Enercalc\SANFRA~1.EC6
ENERCALC, INC. 1983-2013, Build:6.13.8.20, Ver:6.13.8.20

Lic. #: KW-06000410

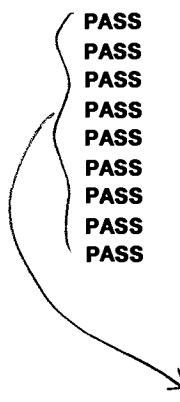
Licensee: hdr engineering inc

Description: Case 1: Footing Check for Wheel Load @ Midspan

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.3225	Soil Bearing	0.9675 ksf	3.0 ksf	+D+L+H about Z-Z axis
PASS	n/a	Overturing - X-X	0.0 k-ft	0.0 k-ft	No Overturing
PASS	n/a	Overturing - Z-Z	0.0 k-ft	0.0 k-ft	No Overturing
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.1635	Z Flexure (+X)	8.568 k-ft	52.412 k-ft	+1.20D+0.50Lr+1.60L+1.60H
PASS	0.1635	Z Flexure (-X)	8.568 k-ft	52.412 k-ft	+1.20D+0.50Lr+1.60L+1.60H
PASS	0.04916	X Flexure (+Z)	2.384 k-ft	48.495 k-ft	+1.20D+0.50Lr+1.60L+1.60H
PASS	0.04916	X Flexure (-Z)	2.384 k-ft	48.495 k-ft	+1.20D+0.50Lr+1.60L+1.60H
PASS	0.1299	1-way Shear (+X)	10.671 psi	82.158 psi	+1.20D+0.50Lr+1.60L+1.60H
PASS	0.1299	1-way Shear (-X)	10.671 psi	82.158 psi	+1.20D+0.50Lr+1.60L+1.60H
PASS	0.02015	1-way Shear (+Z)	1.656 psi	82.158 psi	+1.20D+0.50Lr+1.60L+1.60H
PASS	0.02015	1-way Shear (-Z)	1.656 psi	82.158 psi	+1.20D+0.50Lr+1.60L+1.60H
PASS	0.1242	2-way Punching	20.40 psi	164.317 psi	+1.20D+0.50Lr+1.60L+1.60H



IMPACT FACTOR

$$DCR_{MAX} = (0.1635)(1.3)(1.7/1.6)$$

CONVERT TO
1.7 LL FACTOR

$$DCR_{MAX} = 0.23 < 1.0$$

OK

General Footing

File = C:\Users\knickols\Desktop\SANFRA-1\Calcs\Enercal\SANFRA-1.EC6
ENERCALC, INC. 1983-2013, Build:6.13.8.20, Ver:6.13.8.20

Lic. #: KW-06000410

Licensee : hdr engineering inc

Description : Case 1: Footing Check for Wheel Load @ End

Code References

Calculations per ACI 318-05, IBC 2006, CBC 2007, ASCE 7-05
Load Combinations Used : ASCE 7-10

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0	ksi
fy : Rebar Yield	=	60.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

Soil Design Values

Allowable Soil Bearing	=	3.0	ksf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

Analysis Settings

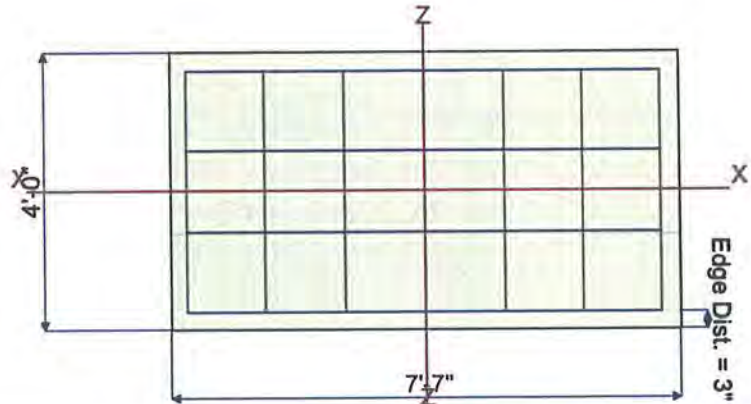
Min Steel % Bending Reinf.	=		
Min Allow % Temp Reinf.	=	0.00180	
Min. Overturning Safety Factor	=	1.0	:1
Min. Sliding Safety Factor	=	1.0	:1
Add Ftg Wt for Soil Pressure	:	Yes	
Use ftg wt for stability, moments & shears	:	Yes	
Add Pedestal Wt for Soil Pressure	:	No	
Use Pedestal wt for stability, mom & shear	:	No	

Increases based on footing Depth			
Footing base depth below soil surface	=		ft
Allowable pressure increase per foot of dept	=		ksf
when footing base is below	=		ft

Increases based on footing plan dimension			
Allowable pressure increase per foot of dept	=		ksf
when maximum length or width is greater than	=		ft

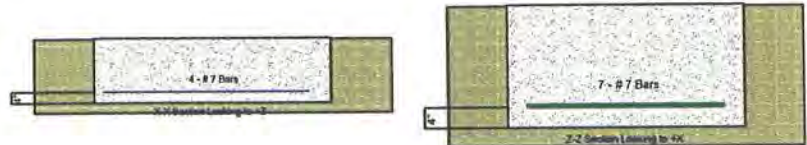
Dimensions

Width parallel to X-X Axis	=	7.583	ft
Length parallel to Z-Z Axis	=	4.0	ft
Footing Thicknes	=	24.0	in
Load location offset from footing center...			
ex : Prll to X-X Axis	=	45	in
Pedestal dimensions...			
px : parallel to X-X Axis	=		in
pz : parallel to Z-Z Axis	=		in
Height	=		in
Rebar Centerline to Edge of Concrete..	=	4.0	in
at Bottom of footing			



Reinforcing

Bars parallel to X-X Axis			
Number of Bars	=	4.0	
Reinforcing Bar Size	=	# 7	
Bars parallel to Z-Z Axis			
Number of Bars	=	7.0	
Reinforcing Bar Size	=	# 7	



Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation	g Z-Z Axis
# Bars required within zone	69.1 %
# Bars required on each side of zone	30.9 %

Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=		16.0				k
OB : Overburden	=	0.150					ksf
M-xx	=						k-ft
M-zz	=						k-ft
V-x	=						k
V-z	=						k

KDL 6/12/14
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General Footing

File = C:\Users\cniccols\Desktop\SANFRA~1\Calcs\Enercalc\SANFRA~1.EC6
ENERCALC, INC. 1983-2013, Build:6.13.8.20, Ver:6.13.8.20

Lic. #: KW-06000410

Licensee: hdr engineering inc

Description: Case 1: Footing Check for Wheel Load @ End

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.9220	Soil Bearing	2.766 ksf	3.0 ksf	+D+L+H about Z-Z axis
PASS	n/a	Overturing - X-X	0.0 k-ft	0.0 k-ft	No Overturing
PASS	n/a	Overturing - Z-Z	0.0 k-ft	0.0 k-ft	No Overturing
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.0	Z Flexure (+X)	0.0 k-ft	0.0 k-ft	No Moment
PASS	0.2203	Z Flexure (-X)	11.545 k-ft	52.412 k-ft	+1.40D+1.60H
PASS	0.04916	X Flexure (+Z)	2.384 k-ft	48.495 k-ft	+1.20D+0.50Lr+1.60L+1.60H
PASS	0.04916	X Flexure (-Z)	2.384 k-ft	48.495 k-ft	+1.20D+0.50Lr+1.60L+1.60H
PASS	n/a	1-way Shear (+X)	0.0 psi	82.158 psi	n/a
PASS	0.3514	1-way Shear (-X)	28.873 psi	82.158 psi	+1.20D+0.50Lr+1.60L+1.60H
PASS	0.02015	1-way Shear (+Z)	1.656 psi	82.158 psi	+1.20D+0.50Lr+1.60L+1.60H
PASS	0.02015	1-way Shear (-Z)	1.656 psi	82.158 psi	+1.20D+0.50Lr+1.60L+1.60H
PASS	0.1341	2-way Punching	22.036 psi	164.317 psi	+1.20D+0.50Lr+1.60L+1.60H

IMPACT FACTOR

$$DCR_{MAX} = (.3514) \overbrace{(1.3)}^{IMPACT FACTOR} \overbrace{(1.7/1.6)}^{CONVERT TO 1.7 LL FACTOR}$$

$$DCR_{MAX} = .49 < 1.0 \quad \underline{OK}$$

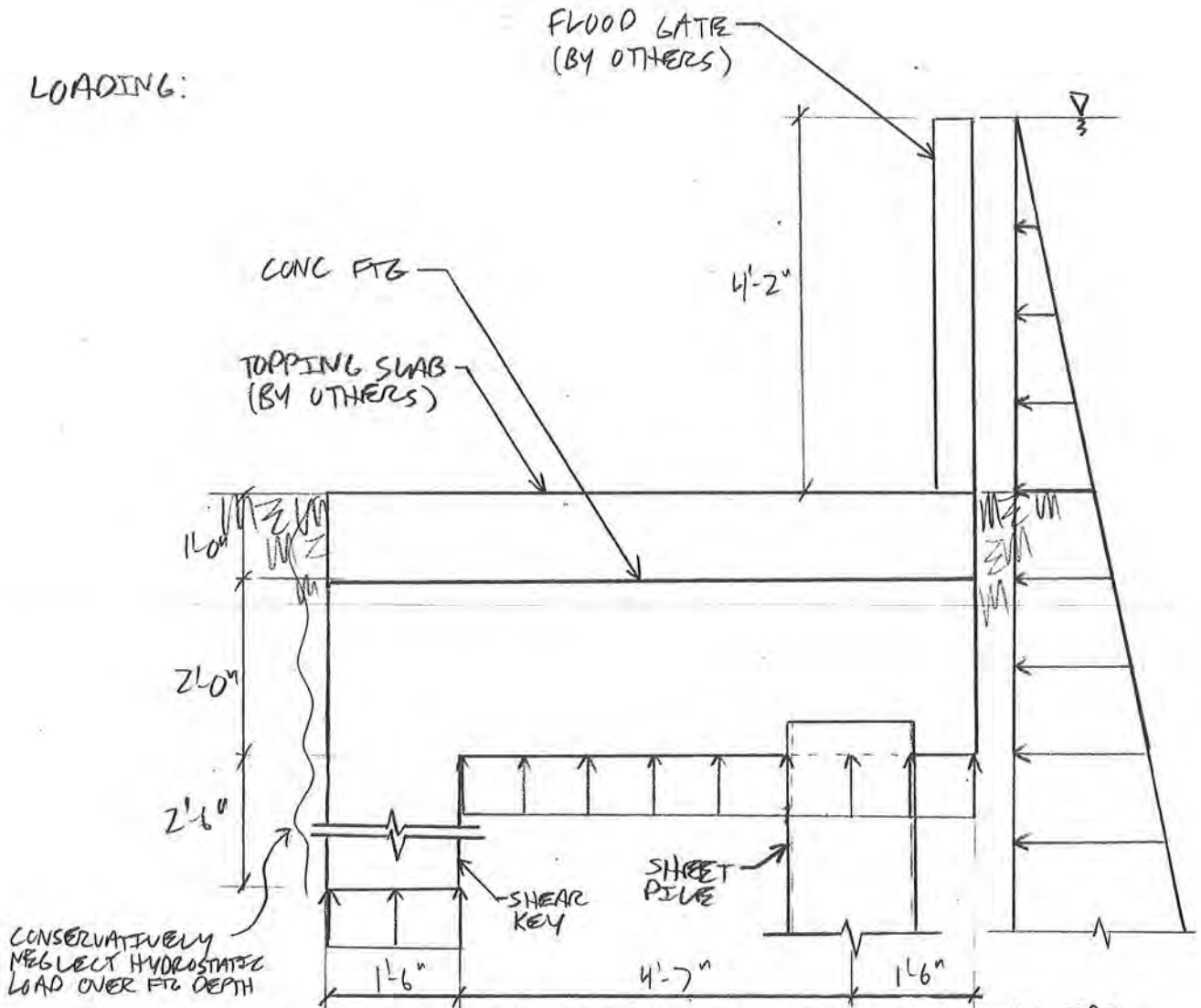


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Project: SAN FRANCISQUITO CREEK Computed: CRN Date: 5/2/14
 Subject: FLOOD GATE FOUNDATION Checked: KDL Date: 6/12/14
 Task: Page: 7 of: 16
 Job #: 241-130806 No:

FOUNDATION DESIGN (CASE 2)

LOADING:

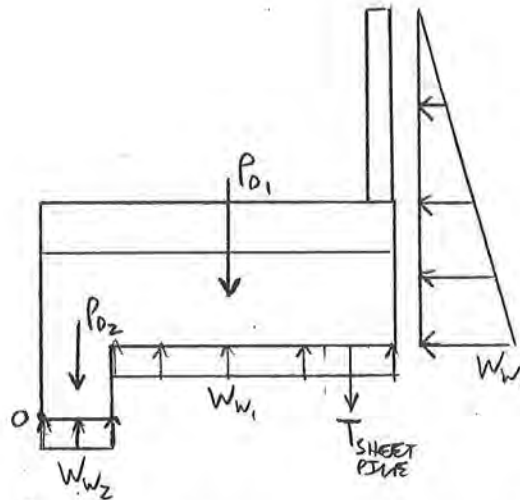


- ⇒ ASSUME WATER SURFACE c.t.o. WALL & CREEK SIDE
- ⇒ ASSUME BUOYANT DEMANDS DUE TO HEAD FROM WSE
- ⇒ ASSUME SOIL LOADING ON BOTH SIDES OF FTG BALANCES EACH OTHER OUT



FOUNDATION DESIGN (CASE 2)

SHEET PILE DESIGN



$$P_{01} = (150 \text{ pcf})(1' + 2')(7.58') = 3411 \text{ \#/},$$

$$P_{02} = (150 \text{ pcf})(1.5')(2.5') = 563 \text{ \#/},$$

$$W_{w2} = (62.4 \text{ pcf})(7.17') = 448 \text{ plf},$$

$$W_{w1} = (62.4 \text{ pcf})(8.67') = 541 \text{ plf},$$

⇒ ASSUME F.S. = 1.5 FOR OVERTURNING

$$\sum M_o = \sum M_r / F.S. \geq \sum M_{OT}$$

$$\begin{aligned} & ((3411 \text{ \#/})(7.58' / 2) + (563 \text{ \#/})(1.5' / 2) + T_{\text{SHEET PILE}}(7.58' - 1.5')) / 1.5 \\ & = \frac{1}{2} (448 \text{ plf})(7.17') (7.17' / 3 + 1.5') \\ & \quad + (448 \text{ plf})(7.58' - 1.5')(1.5' + (7.58' - 1.5') / 2) \\ & \quad + (541 \text{ plf})(1.5')^2 / 2 \end{aligned}$$

$$T_{\text{SHEET PILE}} = 2547 \text{ \#/}, \quad \sum M_{OT} = 19223 \text{ \#}\cdot\text{ft},$$



FOUNDATION DESIGN (CASE 2)

SHEET PILE DESIGN (CONT.) ⇒ TRY AZ 19-700 HOT ROLLED SHEET PILE

$$f_a = 1.5 f_y \quad (\text{EM 2504, SECTION 6-3})$$

$$f_y = 39 \text{ ksi} \quad (\text{ASSUME A328})$$

$$A = 6.88 \text{ in}^2/\text{ft} \quad (\text{SEE FOLLOWING PRODUCT INFO SHEETS})$$

$$T_{\text{allow}} = 1.5 f_y A = 1.5 (39000 \text{ psi}) (6.88 \text{ in}^2/\text{ft})$$

$$T_{\text{allow}} = 134160 \text{ #/ft} > T_{\text{SHEET PILE}} = 2547 \text{ #/ft}$$

∴ AZ 19-700 SHEET PILE OK

SHEET PILE EMBEDMENT ⇒ DETERMINE MIN. EMBEDMENT OF SHEET PILE SUCH THAT TENSION DEMAND RESISTED THROUGH SOIL/STEEL INTERFACE VIA FRICTION. USACE EM 1110-2-2503 PROCEDURE OUTLINED IN SECTION 4-14 TO BE USED

$$FS = Q_u / Q_p, \quad Q_p = 2547 \text{ #/ft}, \quad \text{e F.S.} = 1.5$$

$$Q_u = \frac{1}{2} K_a \gamma_e D^2 \tan \delta \quad (2) \quad \text{2 SIDES OF SHEET PILE}$$

$$\text{FOR: } \alpha = 0^\circ, \beta = 0^\circ, \quad \delta = 30^\circ, \delta_w = 14^\circ \quad : K_a = \frac{\cos^2 \theta}{\cos \delta_w [1 + \frac{\sin(\theta + \delta_w) \sin \theta}{\cos \delta_w}]} = \frac{\cos^2(30^\circ)}{\cos(14^\circ) [1 + \frac{\sin(30+14) \sin(30)}{\cos(14^\circ)}]} = 1.303$$

$$\gamma_e = 120 \text{ pcf} - 62.4 \text{ pcf} = 57.6 \text{ pcf}$$

δ_s ASSUMED δ_w

$$\tan \delta = 0.25 \quad (\text{ASSUMED PER TABLE 4-3})$$

$$\frac{1}{2} (1.303) (57.6 \text{ pcf}) D_{\text{MIN}}^2 (0.25) (2) = 2547 \text{ #/ft}$$

$$D_{\text{MIN}} = 24.2'$$

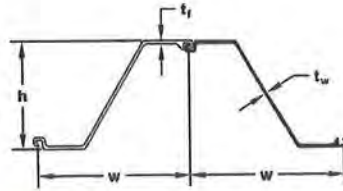
∴ PROVIDE 25' MIN OF SHEET PILE EMBED



AZ

AZ Hot Rolled Steel Sheet Pile

KDL 6/12/14



SECTION	Width (w) in (mm)	Height (h) in (mm)	THICKNESS		Cross Sectional Area in ² /ft (cm ² /m)	WEIGHT		SECTION MODULUS		Moment of Inertia in ⁴ /ft (cm ⁴ /m)	COATING AREA	
			Flange (t _f) in (mm)	Web (t _w) in (mm)		Pile lb/ft (kg/m)	Wall lb/ft ² (kg/m ³)	Elastic in ³ /ft (cm ³ /m)	Plastic in ³ /ft (cm ³ /m)		Both Sides ft ² /ft of single (m ² /m)	Wall Surface ft ² /ft ² (m ² /m ²)
AZ 12-700	27.56 700	12.36 314	0.335 8.5	0.335 8.5	5.82 123.2	45.49 67.7	19.81 96.7	22.4 1205	26.3 1315	138.3 18880	5.61 1.71	1.22 1.22
AZ 13-700	27.56 700	12.40 315	0.375 9.5	0.375 9.5	6.36 134.7	49.72 74.0	21.65 105.7	24.3 1305	28.6 1540	150.4 20540	5.61 1.71	1.22 1.22
AZ 13-700-10/10	27.56 700	12.42 316	0.394 10.0	0.394 10.0	6.63 140.4	51.85 77.2	22.58 110.2	25.2 1355	29.8 1600	156.5 21370	5.61 1.71	1.22 1.22
AZ 14-700	27.56 700	12.44 316	0.413 10.5	0.413 10.5	6.90 146.1	53.96 80.3	23.50 114.7	26.1 1405	31.0 1665	162.5 22190	5.61 1.71	1.22 1.22
AZ 12-770	30.31 770	13.52 343.5	0.335 8.50	0.335 8.50	5.67 120.1	48.78 72.60	19.31 94.30	23.2 1245	27.5 1480	156.9 21430	6.10 1.86	1.20 1.20
AZ 13-770	30.31 770	13.54 344.0	0.354 9.00	0.354 9.00	5.94 125.8	51.14 76.10	20.24 98.80	24.2 1300	28.8 1546	163.7 22360	6.10 1.86	1.20 1.20
AZ 14-770	30.31 770	13.56 344.5	0.375 9.50	0.375 9.50	6.21 131.5	53.42 79.50	21.14 103.20	25.2 1355	30.0 1611	170.6 23300	6.10 1.86	1.20 1.20
AZ 14-770-10/10	30.31 770	13.58 345	0.394 10.0	0.394 10.0	6.48 137.2	55.71 82.9	22.06 107.7	26.1 1405	31.2 1677	177.5 24240	6.07 1.85	1.20 1.20
AZ 18	24.80 630	14.96 380.0	0.375 9.50	0.375 9.50	7.11 150.4	49.99 74.40	24.19 118.10	33.5 1800	39.1 2104	250.4 34200	5.64 1.72	1.35 1.35
AZ 17-700	27.56 700	16.52 419.5	0.335 8.50	0.335 8.50	6.28 133.0	49.12 75.10	21.38 104.40	32.2 1730	37.7 2027	265.3 36230	6.10 1.86	1.33 1.33
AZ 18-700	27.56 700	16.54 420.0	0.354 9.00	0.354 9.00	6.58 139.2	51.41 76.50	22.39 109.30	33.5 1800	39.4 2116	276.8 37800	6.10 1.86	1.33 1.33
AZ 19-700	27.56 700	16.56 420.5	0.375 9.50	0.375 9.50	6.88 145.6	53.76 80.60	23.41 114.30	34.8 1870	41.0 2205	288.4 39550	6.10 1.86	1.33 1.33
AZ 20-700	27.56 700	16.58 421	0.394 10.0	0.394 10.0	7.18 152.0	56.11 83.5	24.43 119.3	36.2 1945	42.7 2296	299.9 40960	6.10 1.86	1.33 1.33
AZ 26	24.80 630	16.81 427.0	0.512 13.00	0.480 12.20	9.35 198.0	65.72 97.80	31.79 155.20	48.4 2600	56.9 3059	406.5 55510	5.91 1.80	1.41 1.41
AZ 24-700	27.56 700	18.07 459.0	0.441 11.20	0.441 11.20	8.23 174.1	64.30 95.70	28.00 136.70	45.2 2430	53.5 2867	408.8 55820	6.33 1.93	1.38 1.38
AZ 26-700	27.56 700	18.11 460.0	0.480 12.20	0.480 12.20	8.84 187.2	69.12 102.90	30.10 146.90	48.4 2600	57.1 3070	437.3 59720	6.33 1.93	1.38 1.38
AZ 28-700	27.56 700	18.15 461.0	0.520 13.20	0.520 13.20	9.46 200.2	73.93 110.00	32.19 157.20	51.3 2760	60.9 3273	465.9 63620	6.33 1.93	1.38 1.38
AZ 24-700N	27.56 700	18.07 459.0	0.492 12.5	0.354 9.0	7.71 163.3	60.28 89.7	26.26 128.2	45.3 2435	52.3 2810	409.3 55890	6.30 1.92	1.37 1.37
AZ 26-700N	27.56 700	18.11 460	0.531 13.5	0.394 10.0	8.33 176.4	65.11 96.9	28.37 138.5	48.4 2600	56.1 3015	437.8 59790	6.30 1.92	1.37 1.37
AZ 28-700N	27.56 700	18.15 461	0.571 14.5	0.433 11.0	8.95 189.5	69.95 104.1	30.46 148.7	51.4 2765	59.9 3220	466.5 63700	6.30 1.92	1.37 1.37
AZ 36-700N	27.56 700	19.65 499.0	0.591 15.00	0.441 11.20	10.20 216.0	79.70 118.60	34.61 169.00	66.8 3590	76.5 4110	656.2 89610	6.76 2.06	1.47 1.47
AZ 38-700N	27.56 700	19.69 500.0	0.630 16.00	0.480 12.20	10.87 230.0	84.94 126.40	37.07 181.00	70.6 3795	81.1 4360	694.5 94840	6.76 2.06	1.47 1.47
AZ 40-700N	27.56 700	19.72 501.0	0.669 17.00	0.520 13.20	11.53 244.0	90.18 134.20	39.32 192.00	74.3 3995	85.7 4605	732.9 100080	6.76 2.06	1.47 1.47
AZ 42-700N	27.56 700	19.65 499.0	0.709 18.00	0.551 14.00	12.22 259.0	95.49 142.1	41.57 203.00	78.2 4205	90.3 4855	766.0 104930	6.76 2.06	1.47 1.47
AZ 44-700N	27.56 700	19.69 500.0	0.748 19.00	0.591 15.00	12.89 273.0	100.73 149.9	43.83 214.00	81.9 4405	94.9 5105	804.1 110150	6.76 2.06	1.47 1.47
AZ 46-700N	27.56 700	19.72 501.0	0.787 20.00	0.630 16.00	13.55 287.0	105.97 157.7	46.08 225.00	85.7 4605	99.5 5350	842.2 115370	6.76 2.06	1.47 1.47
AZ 46	22.83 580	18.94 481.0	0.709 18.00	0.551 14.00	13.76 291.2	89.10 132.60	46.82 228.60	85.5 4595	98.5 5295	808.8 110450	6.23 1.90	1.63 1.63
AZ 48	22.83 580	18.98 482.0	0.748 19.00	0.591 15.00	14.48 306.5	93.81 139.60	49.28 240.60	89.3 4800	103.3 5553	847.1 115670	6.23 1.90	1.63 1.63
AZ 50	22.83 580	19.02 483.0	0.787 20.00	0.630 16.00	15.22 322.2	98.58 146.70	51.80 252.9	93.3 5015	108.2 5915	886.5 121060	6.23 1.90	1.63 1.63

AZ

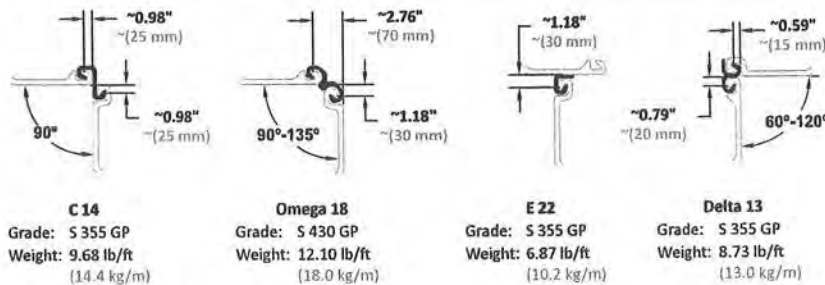
AZ Hot Rolled Steel Sheet Pile

KDL 6/12/14

Available Steel Grades											
AMERICAN			CANADIAN			EUROPEAN			AMLoCor***		
ASTM	YIELD STRENGTH		CSA G40.21	YIELD STRENGTH		EN 10248	YIELD STRENGTH			YIELD STRENGTH	
	(ksi)	(MPa)		(ksi)	(MPa)		(ksi)	(MPa)		(ksi)	(MPa)
A 328	39	270	Grade 260 W	38	260	S 240 GP	35	240	Blue 320	46	320
A 572 Gr. 42	42	290	Grade 300 W	43	300	S 270 GP	39	270	Blue 355	51	355
A 572 Gr. 50	50	345	Grade 350 W	51	355	S 320 GP	46	320	Blue 390	57	390
A 572 Gr. 55	55	380	Grade 400 W	58	400	S 355 GP	51	355			
A 572 Gr. 60	60	415				S 390 GP	57	390			
A 572 Gr. 65	65	450				S 430 GP	62	430			
A 690	50	345				S 460 AP	67	460			
A 690*	57	390									

*Not available for AZ 36-700N and larger. ** Corrosion resistant steel, check for availability

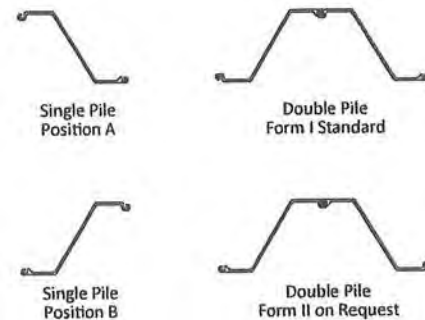
Corner Piles



Delivery Conditions & Tolerances

	ASTM A 6	EN 10248
Mass	± 2.5%	± 5%
Length	+ 5 inches - 0 inches	± 200 mm
Height		± 7 mm
Thickness		≤ 8.5 mm ± 0.5 mm > 8.5 mm ± 6%
Width		± 2%
Double Pile Width		± 3%
Straightness		0.2% of the length
Ends out of Square		2% of the width

Delivery Forms



Maximum Rolled Lengths*

AZ	101.7 feet	(31.0 m)
E 22	59.1 feet	(18.0 m)
C 14	59.1 feet	(18.0 m)
Delta 13	55.8 feet	(17.0 m)
Omega 18	52.0 feet	(16.0 m)

* Longer lengths may be possible upon request.

FOUNDATION DESIGN (CASE 2)

SHEET PILE : ⇒ USE .9D + (1.3)1.7H COMBO
 CAP R DESIGN

$$\begin{aligned}
 &.9 \left((3411 \#7_1) (7.58' / 2) + T_{\text{SHEET PILE}} (7.58' - 1.5') \right) \\
 &= (1.3)(1.7) \left[\frac{1}{2} (448 \rho f_{c1}) (2.17') (7.17' / 3 + 1.5') \right. \\
 &\quad \left. + (448 \rho f_{c1}) (7.58' - 1.5') (1.5' + (7.58' - 1.5') / 2) \right. \\
 &\quad \left. + (541 \rho f_{c1}) (1.5')^2 / 2 \right]
 \end{aligned}$$

$$T_{\text{SHEET PILE}} = 5638 \#7_1$$

⇒ ASSUME R SPANS 14"

$$M_{uR} = (5.638 \text{ k}_1) (1 \frac{1}{2} \text{ in}) (14 \text{ in})^2 / 8$$

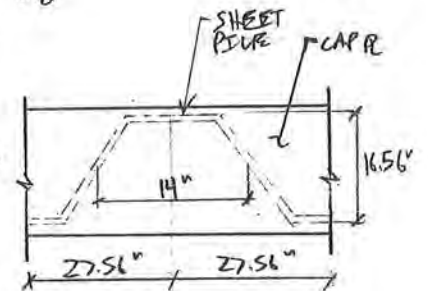
$$M_{uR} = 12 \text{ k-in}$$

$$\phi M_n \geq M_{uR}$$

$$(1.9)(36 \text{ ksi})(16.56 \text{ in})^2 \rho R^2 / 4 = 12 \text{ k-in}$$

$$\rho R^2 = .3 \text{ in}$$

∴ USE 1/2" CAP R



PLAN VIEW

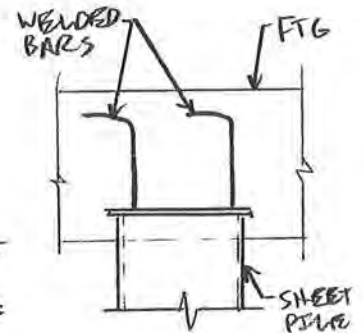
WELDED BAR DESIGN : ⇒ TRY 2-#7 @ 24" OC

$$T_u = (5638 \#7_1) (2') = 11.3 \text{ k}$$

$$\phi T_n = (1.9)(60 \text{ ksi})(2 \times 6 \text{ in}^2)$$

$$\phi T_n = 64.8 \text{ k} > T_u = 11.3 \text{ k} \quad \text{OK}$$

∴ USE 2-#7 @ 24" OC



FOUNDATION DESIGN (CASE 2)

BEARING CHECK: $\Sigma P = P_{D1} + P_{D2} \Rightarrow$ CONSERVATIVELY NEGLECT BUOYANT LOAD

$\Sigma P = 3411 \#_1 + 338 \#_1 = 3749 \#_1$

ASSUME CONC DL CENTERED ON FTG

$\Sigma M_{\text{ABOUT } \bar{x}} = \frac{1}{2} (448 \text{ pcf}_1) (7.17') (7.17'/3 + 1.5')$
 $\Sigma M_{\text{ABOUT } \bar{x}} = 6248 \#_1 \text{ ft}_1$

$A = 7.58 \text{ ft}^2_1$

$S = \frac{(7.58 \text{ ft}^2)^2}{6} = 9.58 \text{ ft}^3_1$

$G_{\text{MAX}} = P/A + M/S = \frac{3749 \#_1}{7.58 \text{ ft}^2_1} + \frac{6248 \#_1 \text{ ft}_1}{9.58 \text{ ft}^3_1}$
7.58 ft² ASSUMED

$G_{\text{MAX}} = 1147 \text{ psf} < G_{\text{ALLOW}} = \frac{3000 \text{ psf}}{2.0} = 1500 \text{ psf}$
F.S. 2.0 PER EM 2502 TABLE 4-2

BEARING PRESSURE OK

SLIDING CHECK: \Rightarrow ASSUME LATERAL LOADING RESISTED THROUGH PASSIVE BEARING @ THE LAND SIDE OF THE FOOTING & THE TOP 5' OF THE SHEET PILE

\Rightarrow NEGLECT THE PASSIVE BEARING CONTRIBUTION FROM THE 1' TOPPING SLAB

$\Sigma V = \frac{1}{2} (448 \text{ pcf}) (7.17') = 1604 \#_1$

$q_{\text{REQ}} = \frac{\Sigma V}{\Sigma A_{\text{RES}}} = \frac{1604 \#_1}{(3' + 5')}$
ASSUMED

$q_{\text{REQ}} = 201 \text{ psf} < q_{\text{ALLOW}} = \frac{300 \text{ psf}}{1.33} = 226 \text{ psf}$
F.S. 1.33 PER EM 2502, TABLE 4-2

SLIDING OK





ONE COMPANY
Many Solutions®

Project: SAN FRANCISCO BAY CREEK Computed: CRN Date: 5/2/14
 Subject: FLOOD GATE FOUNDATION Checked: KDL Date: 6/12/14
 Task: Page: 14 of: 16
 Job #: 241-130806 No:

FOUNDATION DESIGN (CASE 2)

SHEET PILE CHECK: ⇒ CHECK SHEET PILE FOR BENDING DUE TO ASSUMED 5' PASSIVE BEARING DEPTH @ T.O. SHEET PILE

$$M_{max} = \underbrace{(20 \text{ plf/ft})}_{q_{pass}} (5')^2 / 2 (12\%)$$

$$M_{max} = 30.2 \text{ k-in/ft}$$

$$S_{min} = M_{max} / .5 f_y = 30.2 \text{ k-in/ft} / (.5)(39 \text{ ksi})$$

$$S_{min} = 1.55 \text{ in}^3/\text{ft}$$

∴ AZ 19-700 SHEET PILE OK ($S = 34.8 \text{ in}^3/\text{ft}$)

PER PREVIOUS CALL

FOOTING DESIGN :

⇒ CHECK FOOTING IN ENERCALL W/ DEAD LOAD & MOMENT APPLIED

⇒ SLIDING CHECK NOT PERFORMED (SHEAR KEY & SHEET PILE NEGLECTED)

⇒ BUOYANT LOAD NEGLECTED

∴ PER FOLLOWING ENERCALL OUTPUT,
FOOTING OK FOR MAX HYDROSTATIC DEMANDS



KDL 6/12/14
15 OF 16

General Footing

Lic. #: KW-06000410

Description: Case 2: Footing Check for Max Hydrostatic Loading

Code References

Calculations per ACI 318-05, IBC 2006, CBC 2007, ASCE 7-05
Load Combinations Used: ASCE 7-10

General Information

Material Properties

f_c : Concrete 28 day strength	=	3.0 ksi
f_y : Rebar Yield	=	60.0 ksi
E_c : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
ϕ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	1.50 ksf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Increases based on footing Depth

Footing base depth below soil surface	=	0.0 ft
Allowable pressure increase per foot of dept when footing base is below	=	0.0 ksf
	=	0.0 ft

Increases based on footing plan dimension

Allowable pressure increase per foot of dept when maximum length or width is greater than	=	0.0 ksf
	=	0.0 ft

3 ksf / 2 = 1.5 ksf
F.S.

Dimensions

Width parallel to X-X Axis	=	7.583 ft
Length parallel to Z-Z Axis	=	1.0 ft
Footing Thickness	=	24.0 in

Pedestal dimensions...

p_x : parallel to X-X Axis	=	0.0 in
p_z : parallel to Z-Z Axis	=	0.0 in
Height	=	0.0 in
Rebar Centerline to Edge of Concrete.. at Bottom of footing	=	4.0 in



Reinforcing

Bars parallel to X-X Axis	=	
Number of Bars	=	2
Reinforcing Bar Size	=	# 5
Bars parallel to Z-Z Axis	=	
Number of Bars	=	7.0
Reinforcing Bar Size	=	# 7

EQUIVALENT TO 1-#7



Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separationg Z-Z Axis	
# Bars required within zone	23.3 %
# Bars required on each side of zone	76.7 %

Applied Loads

	D	Lr	L	S	W	E	H
P : Column Load	=	0.0	0.0	0.0	0.0	0.0	0.0 k
OB : Overburden	=	0.150	0.0	0.0	0.0	0.0	0.0 ksf
M-xx	=	0.0	0.0	0.0	0.0	0.0	0.0 k-ft
M-zz	=	0.0	0.0	0.0	0.0	0.0	6.248 k-ft
V-x	=	0.0	0.0	0.0	0.0	0.0	0.0 k
V-z	=	0.0	0.0	0.0	0.0	0.0	0.0 k

KOL 6/12/14
16 OF 16

General Footing

Lic. # : KW-06000410
Description : Case 2: Footing Check for Max Hydrostatic Loading

Design OK

DESIGN SUMMARY

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.7640	Soil Bearing	1.146 ksf	1.50 ksf	+D+0.750L+0.750S+0.5250E+H about Z-
PASS	n/a	Overturing - X-X	0.0 k-ft	0.0 k-ft	No Overturing
PASS	2.025	Overturing - Z-Z	6.248 k-ft	12.650 k-ft	D+H
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.1608	Z Flexure (+X)	8.70 k-ft	54.104 k-ft	+1.20D+0.50Lr+1.60L+1.60H
PASS	0.02477	Z Flexure (-X)	1.409 k-ft	56.894 k-ft	+1.40D+1.60H
PASS	0.001047	X Flexure (+Z)	0.05075 k-ft	48.495 k-ft	+1.40D+1.60H
PASS	0.001047	X Flexure (-Z)	0.05075 k-ft	48.495 k-ft	+1.40D+1.60H
PASS	0.04424	1-way Shear (+X)	3.634 psi	82.158 psi	+1.40D+1.60H
PASS	0.04424	1-way Shear (-X)	3.634 psi	82.158 psi	+1.40D+1.60H
PASS	n/a	1-way Shear (+Z)	0.0 psi	82.158 psi	n/a
PASS	n/a	1-way Shear (-Z)	0.0 psi	82.158 psi	n/a
PASS	0.008978	2-way Punching	1.475 psi	164.317 psi	+1.40D+1.60H

H_r PER PAGE 3-2
UF PER 2104

$$DCR_{max} = (1.1608)(1.3)(1.7/1.6)$$

$$DCR_{max} = .22 < 1.0$$

LOAD FACTOR
CONVERSION

OK

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APPENDIX B - PG&E Coordination (Email and Figure)

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Jones, Lance

From: Jones, Lance
Sent: Friday, April 20, 2012 1:40 PM
To: 'Lightstone, Michael'
Cc: Johnson, Blake W.; Kevin Murray; 'Bill Springer'; 'Len Materman'; Jimenez, Sergio; Fannin, Scott R (GE&O)'; Sanchez, Patricia'; 'Lodwick, Rick'; Gilleran, Amy; Quintrall, Anthony; Speese, Debbie L
Subject: RE: ET follow up questions from our meeting on 3/29/12
Attachments: C-207.pdf

Mr. Lightstone,

HDR has re-evaluated the elevations required for the LDS pole relocations at San Francisco Creek. This re-evaluation was conducted because PG&E has indicated, via telephone call, that the previously submitted elevations would incur additional construction fees upwards of \$300,000 to reach these elevations. In order to reduce the required construction clearance, HDR will design a spliced sheet pile and will require use of either a Geeken Silent Piler, or an excavator mounted rig to install sheet piles for a short portion of the flood wall at each electrical crossing. Use of this technology will reduce the required clearance at each crossing by 28 to 31 feet.

Listed below, and on the attached map, please find the elevation of the proposed construction equipment at each location. PG&E should add clearance above the indicated equipment elevation to meet OSHA standards and to ensure safety of the conductors during construction.

- Right Bank Levee STA 56+75 – Elevation 42
- Left Bank Levee STA 52+00 – Elevation 33
- Left Bank Levee STA 54+30 – Elevation 36

LANCE M JONES
PE
OSD
LEEDAP

HDR Engineering
Federal, Energy and Resource Management
Project Engineer

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916.817.4746

Lance.Jones@hdrinc.com | hdrinc.com

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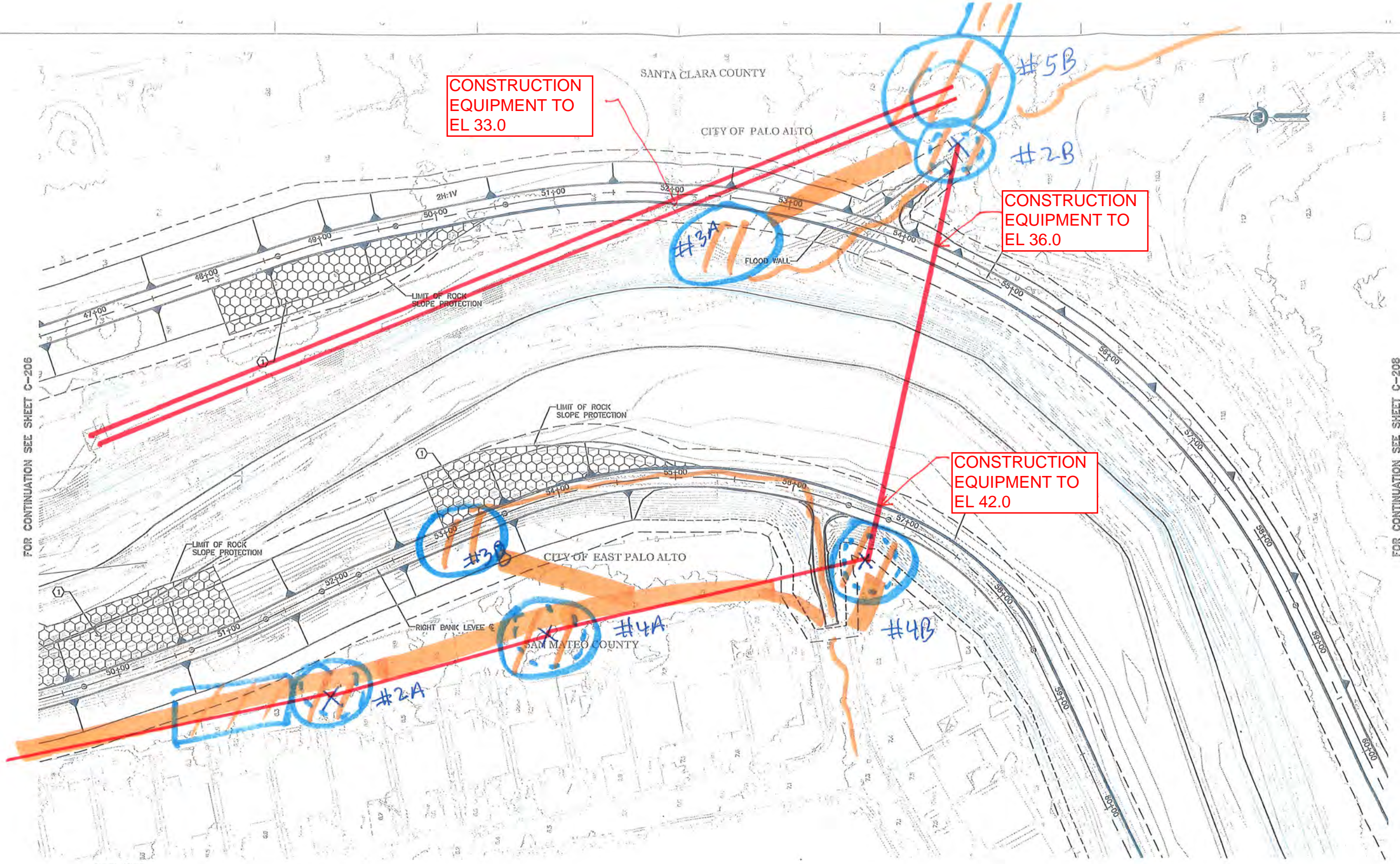
CONSTRUCTION EQUIPMENT TO EL 33.0

CONSTRUCTION EQUIPMENT TO EL 36.0

CONSTRUCTION EQUIPMENT TO EL 42.0

FOR CONTINUATION SEE SHEET C-206

FOR CONTINUATION SEE SHEET C-208



- SHEET NOTES:**
- ① SEE SHEETS C-107 AND C-108 FOR RIGHT BANK LEVEE PLAN AND PROFILE. SEE SHEETS C-112, C-113 AND C-114 FOR LEFT BANK LEVEE PLAN AND PROFILE.
 - ② SEE SHEETS C-306, C-307 AND C-308 FOR RIGHT BANK LEVEE CROSS SECTIONS. SEE SHEETS C-314 AND C-315 FOR LEFT BANK LEVEE CROSS SECTIONS.

- KEY NOTE:**
- ① PLACE ROCK SLOPE PROTECTION PER  C-502

SCALE: 1"=40'

USERNAME: BUISCH, TUE_08_JUL_2008_09:32am
FILENAME: C:\pwworking\hdr\c017134\C-207

DOCUMENT NUMBER: SFC_LP-C-1028-XXXXXX

C:\pwworking\hdr\c017134\C-207.dwg, 3/7/2012 11:53:14 PM, lsuarez


REV	DESCRIPTION	DATE	APPR.
PRELIMINARY 60%			
03-02-2012			

DATE	03-02-12
DESIGN	S. JIMENEZ
DRAWN	H. SUAREZ
CHECKED	B. JOHNSON
PROJECT ENGINEER DATE	




HDR Engineering, Inc.

ENGINEERING CERTIFICATION



PROJECT ENGINEER DATE



ACCEPTED BY DISTRICT

PROJECT ENGINEER DATE

PROJECT NAME AND SHEET DESCRIPTION:

**SAN FRANCISQUITO CREEK
FLOOD PROTECTION CAPITAL PROJECT
EAST BAYSHORE RD. TO S.F. BAY
SCOUR COUNTERMEASURE PLAN**

(6 OF 8)

SCALE: AS SHOWN

VERIFY SCALES

0 1" BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

PROJECT NUMBER: 130806

SHEET CODE: **C-207**

SHEET NUMBER: 54 OF 103

APPENDIX B

Project As-built Drawings

(to be included when project is complete)

APPENDIX C

Santa Clara Valley Water District Inspection Guidelines, Rating Guides and Checklists

Rating Guide		
<p>A - As-built/New B - Good C - Requires FOA Evaluation or Monitoring D - Requires Corrective Action (ie Work Order, Violation, Engineer Review, Notification, etc.) E - Requires Immediate Action</p>		
Item	Rating Guide	Guidance
1. Depressions	B	Minimal depressions or potholes; proper drainage.
	C-D	Some depressions that will not pond water.
	E	Depressions 6" vertical or greater which endangers the integrity of the levee.
2. Erosion	B	No erosions observed.
	C-D	Levees: Erosion of levee crown or slopes that will not interrupt inspection or maintenance access. OTHER: Erosion gullies less than 6 inches deep or deviation of 1 foot from designed grade or section.
	E	Levee: Erosion of levee crown or slopes that has interrupted inspection or maintenance access. OTHER: Erosion gullies greater than 6 inches or deviation of 1 foot or more from designed grade or section.
3. Slope stability	B	No slides present, or erosion of slopes more than 4 inches deep.
	C-D	Minor superficial sliding that with deferred repair does not pose an immediate threat to levee integrity. No displacement or bulges.
	E	Evidence of deep seated sliding (2 foot vertical or greater) requiring repairs to re-establish levee integrity.
4. Cracking	B	No cracks in transverse or longitudinal direction observed in the levee.
	C-D	Longitudinal cracks are no longer than the levee height. No displacement and bulging. No transverse cracks observed.
	E	Longitudinal cracks are greater than levee height with some bulging observed. Transverse cracks are evident.
5. Animal burrows	B	Continuous animal burrow control program that eliminates any active burrowing in a short period of time.
	C-D	Animal burrows present that will not result in seepage or slope stability problems.
	E	Animal burrows present that would result in possible seepage or slope stability problems.

Rating Guide		
A - As-built/New B - Good C - Requires FOA Evaluation or Monitoring D - Requires Corrective Action (ie Work Order, Violation, Engineer Review, Notification, etc.) E - Requires Immediate Action		
Item	Rating Guide	Guidance
6. Unwanted levee growth	B	No large brush or trees exist in the levee. Grass cover well maintained. CHANNELS: Channel capacity for design flows is not affected.
	C-D	Minimal tree (2" diameter or smaller) and brush cover present that will not threaten levee integrity. (NOTE: Trees that have been cut and removed from levees should have their roots excavated and the cavity filled and compacted with impervious material.)
	E	Tree, weed, and brush cover exists in the levee requiring removal to re-establish or ascertain levee integrity. (NOTE: If significant growth on levees exists, prohibit rating of other levee inspection items, then the inspection should be ended until this item is corrected.) CHANNEL: Channel obstructions have impaired the floodway capacity and hydraulic effectiveness.
7. Encroachments	B	No trash, debris, excavations, structures, or other obstructions present.
	C-D	Trash, debris, excavations, structures, or other obstructions present or inappropriate activities occurring that will not inhibit operations and maintenance performance.
	E	Trash, debris, excavations, structures, or other obstructions present or inappropriate activities that would inhibit operations and maintenance performance.
8. Riprap/Revetment	B	Existing protection works which is properly maintained and undamaged.
	C-D	No scouring activity that could undercut banks, erode embankments, or restrict desired channel flow.
	E	Meandering and/or scour activity that is undercutting banks, eroding, embankments (such as levees), or impairs channel flows by causing turbulence, meandering, or shoaling.
9. Stability of Concrete Structures	B	Tilting, sliding, or settling of structures that has been secured which preserves the integrity or performance.
	C-D	Uncorrected sliding or settlement of structures of a magnitude that doesn't affect performance.
	E	Tilting or settlement of structures that has resulted with a threat to the structure's integrity and performance.

Rating Guide		
<p>A - As-built/New B - Good C - Requires FOA Evaluation or Monitoring</p> <p>D - Requires Corrective Action (ie Work Order, Violation, Engineer Review, Notification, etc.)</p> <p>E - Requires Immediate Action</p>		
Item	Rating Guide	Guidance
10. Concrete surfaces	B	Negligible spalling or scaling. No cracks present that are not controlled by reinforcing steel or that cause integrity deterioration or result in inadequate structure performance.
	C-D	Spalling, scaling, and cracking present but immediate integrity of structure not threatened.
	E	Surface deterioration or deep, controlled cracks present that result in an unreliable structure.
11. Structural foundations	B	No scouring or undermining near the structure.
	C-D	Scouring near the footing of the structure but not close enough to impact structure stability during the next flood event.
	E	Scouring or undermining at the foundation which has impacted structure integrity.
12. Culverts	B	[a] No breaks, holes, cracks in the culvert that would result in any significant water leakage. No surface distress that could result in permanent damage. [b] Negligible debris or silt blocking culvert section. None or minimal debris or sediment present which has negligible effect on the operations of the culvert.
	C-D	[a] Culvert integrity not threatened by spalls, scales, or surface rusting. Cracks are present but resulting leakage is not impacting the structure. [b] Debris or sediment present, which is proposed to be removed prior to the next flood event, that minimally affects the operations of the culvert.
	E	[a] Culvert has deterioration such as surface distress and/or has significant leakage in quantity or degree to threaten integrity. [b] Accumulated debris or settlement which has not been annually removed and severely affects the operation of the culvert.
13. Gates	B	Gates open easily and close to a tight seal. Materials do not have permanent corrosion damage and appear to historically been maintained adequately.
	C-D	Gates operate but leak when closed, however, leakage quantity is not a threat to performance. All appurtenances of the facility are in satisfactory condition.
	E	Gates leak significantly when closed or don't operate. Gates and appurtenances have damages which threaten integrity and/or appear not to have been maintained adequately.

Rating Guide		
A - As-built/New B - Good C - Requires FOA Evaluation or Monitoring D - Requires Corrective Action (ie Work Order, Violation, Engineer Review, Notification, etc.) E - Requires Immediate Action		
Item	Rating Guide	Guidance
14. Closure structures	B	Closure structure in good repair. Placing equipment readily available at all times.
	E	Closure structure in poor condition. parts missing. Placing equipment may not be available within normal warning time.
15. Pumps and motors	B	All pumps and motors are operational. Preventative maintenance is occurring and system is periodically subject to performance testing.
	C-D	All pumps are operational and minor discrepancies are such that pumps could be expected to perform through the next projected period of usage.
	E	Pumps are not operational, or noted discrepancies have not been corrected.
16. Power	B	Adequate, reliable, and enough capacity to meet demands.
	E	Power source not considered reliable to sustain operations during a flood condition.
17. Pump Control System	B	Operational and maintained free of damage, corrosion, or other debris.
	C-D	Operational with minor discrepancies.
	E	Not operational or uncorrected noted discrepancies.
18. Metallic items	B	All metal parts in a plant/building protected from permanent damage from corrosion. Trash racks free from damage/debris and are capable of being cleared, if required, during operation. Gates operable.
	C-D	Corrosion on metal parts appears maintainable. Trash racks free from damage and minimum debris present, and capable of being cleared before next flood event or during operation. Gates operable.
	E	Metal parts need replacement. Trash racks damaged, have accumulated debris that have not been cleared annually, or cannot be cleared during operation.
19. Sumps	B	Clear of debris and obstructions, and mechanisms are in place to maintain this condition during operation.
	C-D	Clear of large debris and minor obstructions present and mechanisms are in place to deter further accumulations during operation.
	E	Large debris or major obstructions present in sump or no mechanism exists to prevent debris accumulation during operation.

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SCVWD Inspection Sheet

Date Inspected:

Inspectors:

Creek Name:

Maximo Reach #:

W.O.#:

Facility Type	Category	Photo #	Dir. of Photo	D/S Station	U/S Station	Position (facing U/S) & Condition Code			Fee, Esmt, None	Qty (Unit)	Nearest Cross Street	Description
						Left	Middle	Right				

* Key on back side of sheet

SCVWD Creek and Levee Inspection Key

CONDITION CODES

A = Asbuilt/New

B = Good

C = Requires FOA Evaluation or Monitoring

D = Requires Corrective Action (ie Work Order, Violation, Engineer Review, Notification, etc.)

E = Requires Immediate Action

FACILITY TYPES

Levee Landside (Outboard)	Bridge
Levee Waterside (Inboard)	Cellular Concrete Mat
Levee Crown or Road	Outfall
Earth Channel	Slide Gate
Concrete Lined Channel	Flap Gate
Overflow Channel	Culvert (Box, RCP, CMP, etc.)
Access Road	Fish Structure
Fence	Landscaping
Gate	Recreational Trail
Riprap (Rock or Sack)	Revegetation Site
Gabions	Miscellaneous

CATEGORIES (Maximo Job Plan & Other)

Emergency Debris Removal (EMR)	Misc. Property Maintenance (MSC)
Erosion (ERO)	Pier Nose/Trash Rack/Flapgate Cleaning (PTF)
Fence/Gate Work (FEN)	Sediment (SED)
Fish Structure Maintenance (FSH)	Sign Work (SGN)
Good Neighbor Maintenance (GNM)	Tree (TRE)
Graffiti Removal (GRF)	Trash and Debris (TRS)
Ground Squirrel/Rodent Control (GSC)	Overhanging Growth (VWG)
Hazardous Materials (HAZ)	Typical (TYP)
In Stream Vegetation (ISV)	Violation (VIO)
Levee Maint./Restoration (LEV)*	*reference criteria in WW75161
Motor Grading (MGR)	

Direction of Photo - Upstream (U/S), Downstream (D/S) or At Location (AT)

Criteria used to inspect District facilities are obtained from maintenance guidelines for the specific facility. Reference to each facilities criteria guides the inspection to correctly reflect the level of maintenance required. Some facilities do not have maintenance guidelines or the guidelines are under development. If no specific guidelines exist for a facility, a general reference of criteria is needed to determine if the facility meets any right-of-way or other documented obligations.


The general criteria used in facilities inspection are listed by a specific feature or category of element of the facility. The criteria are listed by specific categories and conditions. These are captured on the SCVWD Facilities Inspection Sheet.

The following are the general criteria are to be used when specific Maintenance Guidelines for a facility do not exist.

Categories	Conditions	Description
Access Roads	A B C D E	New All Weather level minor ruts/surfacing ok moderate ruts surfacing sparse road width <10' surface gone road impassible
Burrowing Animals - including Gophers & Ground Squirrels	A B C D E	None occasional holes/1000' occasional holes/500' noticeable activity/250' extensive infestation/100'
Concrete Structures	A B C D E	New good condition minor distortion wear and cracks moderate distortion wear and cracks failed
Concrete Walls	A B C D E	New good condition minor distortion wear and cracks moderate distortion wear and cracks failed
Debris	A B C D E	none occasional, minor moderate build up few spots moderate build up many spots extensive amount blocking channel
Erosion	A B C D E	no erosion minor erosion no threat at present potential future threat pre exiting problem getting worse extensive damage repair quickly

Categories	Conditions	Description
Fences/Gates/Signs	A B C D E	new still good condition no holes/graffiti minor distortion/bent posts holes in fence graffiti on signs fence down heavy vandalism
Fish Ladders	A B C D E	fully operational good condition minor sediment/wear partially functional non functional/blocked
Flap Gates	A B C D E	new good condition questionable functionality, silt etc. needs service non functional, broken missing parts
Gabions	A B C D E	new baskets/rock good condition minor distortion/erosion/rust erosion/rust/deform moderate structure failure
Graffiti	A B C D E	none occasional very few small spots signs and some small tags concrete a few larger tags racial/gang/offensive tags
Herbaceous Veg	A B C D E	No veg some flex grass/plants moderate stemmy grasses large amount stemmy grasses extensive amount of stemmy grasses
Levee Roads	A B C D E	new all weather level minor ruts/surfacing ok moderate ruts surfacing sparce road width <10' surface gone road impassible
Lower Roads	A B C D E	new all weather level minor ruts/surfacing ok moderate ruts surfacing sparce road width <10' surface gone road impassible

Categories	Conditions	Description
Pipe	A B C D E	new functioning properly potential impaired debris/sed/erosion pipe impaired structural failure
Rip Rap	A B C D E	newly installed good condition minor adjacent erosion, veg cover extensive erosion, deformation structural failure
Sediment	A B C D E	none/acceptable minor acceptable moderate build up maybe problem excessive build up blockage, emergency removal
Slide Gates	A B C D E	new good conditions needs service damaged non functional
Trash	A B C D E	none occasional, minor, litter frequent small volumes infrequent large volumes frequent large volumes
Trash Racks	A B C D E	new small amount of debris rack half full rack 3/4 full rack plugged
Trees	A B C D E	Trees on site ok or no trees minor ok for site trees growing in channel downed single or small cluster extensive blockage of channel
Woody Veg	A B C D E	none minor ok for site common on site may be problem moderate size and density extensive size and density blockage

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1. PURPOSE AND SCOPE:

Adequate levee inspection and maintenance is essential for providing a reliable flood protection system, reducing the risk of flooding and loss of life and property, and maintaining compliance with state and federal regulations for funding and flood insurance requirements. Adequate levee maintenance also ensures accessibility and serviceability during flood events and emergency work.

This document describes general procedures and guidelines for field operations levee inspection and record-keeping.

2. REFERENCE DOCUMENTS:

External References:

U.S. Army Corps of Engineers levee technical guidance documents
U.S. Army Corps of Engineers O&M manuals for certain SCVWD flood protection projects

Internal References:

Q751D02 Control and Oversight of Pesticide Use
WQ75101 Field Operations Work Order Process
WQ75115 Engineering Field Instructions
WF75118 Ordinance Violation Form
WF75161 Levee Field Inspection Rating Guide
WF75165 Field Inspection Checklist
Levee Inventory List (watershed specific)
Levee Safety Technical Guidance Manual
([W:\Watershed Mgmt\Levee Safety Manuals\TechManualComplete](#))
Annual Levee Inspection Report
Event Levee Inspection Report
Facility Maintenance Guidelines/Agreements
As-Built Plans
SMP Binder (BMP Manual/Permits and Supporting Material)
FC 441 (03-21-89)
Land Surveying and Mapping Request for Services (FC 136)


3. DEFINITIONS:

Levee – A raised embankment to prevent a watercourse from flooding beyond its expected course. The “levee” as defined here refers to all elements of the flood protection system. This includes the embankment itself and any stability or seepage berms, toe drains, flood walls, relief wells, and any waterside erosion protection system. It also includes other ancillary structures, facilities and appurtenances encroaching on the levee.

Net grade – The as-built elevation of a levee.

Event-driven inspection –

An inspection that should take place during or immediately after a natural hazard such as flood, earthquake, storm and other events having the potential of damaging the flood protection system.

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4. ROLES AND RESPONSIBILITIES:

None

5. REQUIREMENTS:

5.1. **ISO 9001** - 7.5.1 Control of Production and Service Provision

5.2. **ISO 14001** - 4.4.6 Operational Control

5.3. **Other Requirements**

Q751D02 Control and Oversight of Pesticide Use
SMP Permits & CEQA documents

6. MONITORING AND MEASUREMENT:

None

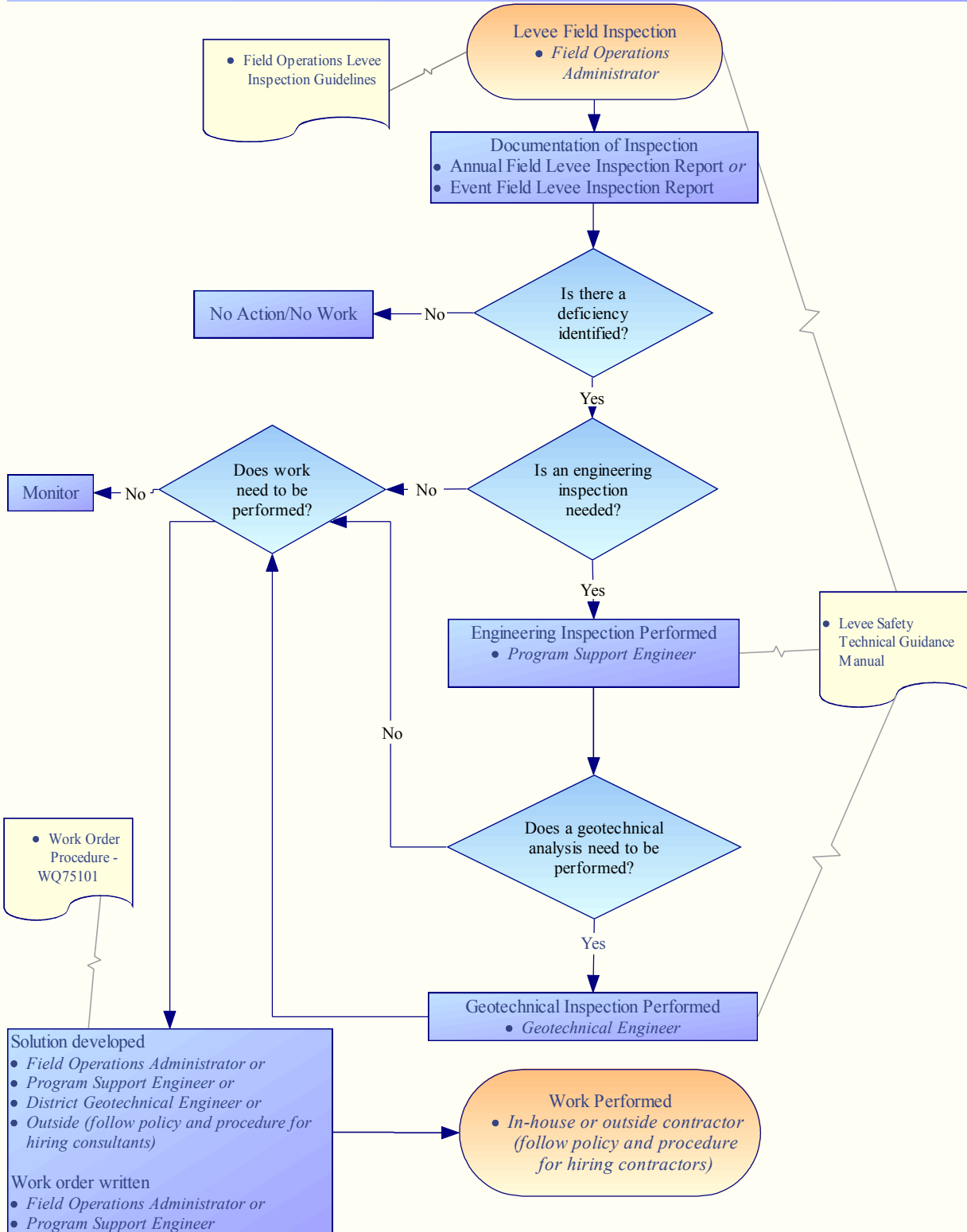
7. PROCEDURE:

7.1. **Field Operations Levee/Work Inspection Flow Chart**

The following flowchart represents typical critical paths from initial levee inspection to final work initiation. Although this flowchart cannot be used for every levee inspection/work scenario, it is shown here to represent a basis for most typical situations.

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LEVEE INSPECTION/WORK FLOWCHART



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7.2. Field Operations Levee Inspection Procedure

ACTION STATEMENT & ROLE	DETAILS (DESCRIBE STEPS)	QUALITY RECORDS (OUTPUT FROM STEP)
<p>(1)</p> <p>Plan inspections</p> <p>(Field Operations Administrator (FOA))</p>	<ul style="list-style-type: none"> • Routine Field Levee Inspections are conducted by the Field Operations Administrator to assess the condition of levees. This assessment can help identify deficiencies including those that may threaten the integrity of the levees within the watershed. • Inspection frequency should be governed by government minimum requirements, facility maintenance guidelines/agreements, and the perceived needs for inspections. In the absence of documented mandated inspection frequencies, levees should be routinely inspected at least annually, so that any necessary repairs can be designed and constructed prior to the next rainy season. • Identify all District levees within each Watershed using the levee inventory list. The Levee Inventory List is compiled, maintained, and kept by FOA. • Prepare a schedule of levee inspections 	<p>Levee Inventory List</p>
<p>(2)</p> <p>Inspect Levees</p> <p>(Field Operations Administrator (FOA))</p>	<ul style="list-style-type: none"> • The annual inspection involves walking the levees and noting any observable distress. All relevant aspects are noted in section 10, ADDENDA: Levee Inspection Guidelines. • The Field Inspection Checklist shall be used to capture all field gathered data. Field-gathered data including location, description of findings, and photo documentation are transferred into the Oracle online photo archive database and then compiled into an Annual Levee Inspection Report. • The results from the levee field inspections are categorized in inspection reports providing site-specific information for on-going monitoring and prioritizing deficiencies. The report is also used to identify and prioritize other minor routine maintenance in levees. • A report of inspection will be prepared by the Field Operations Administrator for permanent record, reference, and as a basis for needed remedial work for all periodic inspections. This report should be based on a systematic field inspection of each facility and its individual components regarding its safety, stability, and operational adequacy. 	<p>Field Inspection Checklist</p> <p>Levee Inspection Report</p>
<p>(3)</p> <p>Event-driven Inspections</p>	<ul style="list-style-type: none"> • Event-driven inspections should also take place during or immediately after a natural hazard such as flood, earthquake, storm, and other events having the potential for damaging the flood protection system. • A record of emergency investigation containing all pertinent information is prepared and filed as part of the flood 	




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ACTION STATEMENT & ROLE	DETAILS (DESCRIBE STEPS)	QUALITY RECORDS (OUTPUT FROM STEP)
(Field Operations Administrator (FOA))	<p>protection system record.</p> <ul style="list-style-type: none"> • Make additional inspections after significant events such as floods and earthquakes. The emphasis of these inspections will depend on the event triggering the inspection. <ul style="list-style-type: none"> ○ Specific items to be checked should include: waterside erosion protection and encroachments, evidences of seepage, levee settlement, slumps, lateral spreading, cracking, evidence of liquefaction (boils and cracking), and slope failures. ○ Other items to be observed and reported should include any mechanical equipment and facilities such as pipes, gates and valves, inlet and outlet structures, and bridge abutments. • An earthquake inspection is particularly urgent if the earthquake occurs just before or during the rainy season. • During flood periods, frequent patrols of the levee are made to locate flood-related deficiencies in levees, floodwalls, and other flood protection structures and facilities. The specific frequency of these patrols will depend on the flood level, and may vary from daily to essentially continuously. • A report of an event-driven inspection is prepared by the FOA for permanent record, reference, and as a basis for needed remedial work for all periodic inspections. Field-gathered data including location, description of findings and photo documentation are transferred into the Oracle online photo archive database and then compiled into an Event Levee Inspection Report. 	Event Levee Inspection Report
(4) Deficiency Correction (Field Operations Administrator (FOA))	<ul style="list-style-type: none"> • If a deficiency revealed during the course of the field levee inspection requires correction, a solution is developed by the FOA and implemented. • FOA will document any work required in accordance with WQ75101 Field Operations Work Order Process. • If the FOA determines that a deficiency revealed during the course of the field levee inspection requires engineering analysis, a Watershed Program Support Engineer shall be consulted and if necessary, a solution developed. The Watershed Program Support engineer will develop a solution in accordance with WQ75115 Engineering Field Instructions. • If the Watershed Program Support Engineer determines that a geotechnical inspection is necessary, a <i>geotechnical engineer</i> or <i>outside consultant</i> will be consulted, and if necessary, a solution developed. 	

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8. QUALITY RECORDS:

QUALITY RECORD	LOCATION KEPT	FILING ORDER	RECORDS RETENTION SCHEDULE SERIES No.	COMMENTS
Levee Field Inspection Checklist	FOA's office and Network	facility name, number and date	RS-1015	
Annual Levee Inspection Report	FOA's office and Network	facility name, and date	RS-1015	
Event Levee Inspection Report	FOA's office and Network	facility name and date	RS-1015	
Levee Inventory List	FOA's office and Network	facility name and date	RS-1015	

9. CHANGE HISTORY:

Date	Revision	Comments
12/19/06	R1	New release
07/29/09	R2	Clean up of Quality Records. New template. Change of Process Owner from Gary Nagaoka to Carol Fredrickson. Added link to Levee Safety Technical Guidance Manual (29 April 2002)
03/15/10	R3	Change of process owner from Carol Fredrickson to Roger Narsim, revision number, and effective date due to 02/01/10 reorg.
02/15/11	R4	Changed Template and minor text and formatting changes made to Sections 1, 2, 3, 5, 7, and 10.

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10. ADDENDA:

Levee Inspection Guidelines

More detailed information can be in the *Levee Safety Technical Guidance Manual*

The guidelines listed below were derived from the [Levee Safety Technical Guidance Manual \(29 April 2002\)](#) and are intended to provide a general basis for conducting field operations levee inspections. All aspects of the guidelines will not apply to every levee and must be applied on a case-by-case basis as appropriate.

Flood Protection Levees

Levee Geometry

Inspection should identify any apparent deviations from the as-built geometry of the levee. Levee embankments should be maintained to not less than the net grade and section by replacing any loss of material from the crest, slopes, or any bench/berm. Ruts, washes, slides and areas of subsidence should be noted and promptly repaired and the entire embankment maintained sufficiently smooth for power mowing. Levee crests should be graded as necessary to drain freely and prevent impoundment of rain water. When the crest of the levee is used as maintenance road, and unless the crest road is paved in accordance with standard roadway pavement and traffic criteria, the levee crest should be covered by at least 6 inches of a gravel/aggregate base overlying a filter fabric.


Cracking

During the levee inspection, any observed cracks along the crest or the side slopes should be recorded for further assessment of impact to levee integrity. Longitudinal cracks with down scarps toward the levee slope may be an indication of incipient slope instability. Generally these surface cracks will exacerbate potential sloughing or sliding during wet and prolonged rainy seasons. As the water infiltrates the cracks, it adds lateral hydrostatic pressures on the walls of the cracks and hence promotes potential slips. Random cracks that do not show any sign of down slope movements are generally caused by high shrink-swell levee material, such as high-plasticity clay or organic rich material. The long term cycles of shrink-swell may cause the levee material to deteriorate and weaken. It is recommended that these cracks be repaired as soon as reported.

Erosion and Condition of Slope Protection

Erosion or scour of levees and banks commonly occurs along non-protected levee and bank slopes. The amount and extent of erosion depend typically on the flow velocity, material-type irregularities and contacts between hard and soft material. Silty and sandy unconsolidated alluvium are highly susceptible to erosion and scour. Even levees and banks equipped with erosion protection can experience scour during high river stages. Usually these occurrences take place in areas where the erosion protection system has not been well maintained and has deteriorated with time, or in areas where the erosion protection system was under-designed for the damaging flood. Erosion protection comes in various forms; from concrete surfacing and rock protection to more environmentally friendly solutions such as bio-engineered slope protection, to non-protection by design to allow the river to meander and run its natural course. The latter usually is associated with a system of set-back levees.

When slope erosion protection is provided, observations during the levee inspection should ascertain that the erosion protection is maintained in accordance with the intent of the design; that the levee maintains its uniformity and its integrity; that no irregularities are developing that may become points of weakness. If

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such events are observed, repairs should be undertaken immediately to bring the protection system to its original design.

Erosion and scour are probably the leading cause of levee failures during flood events. Levee material, rock, plastic sheeting (Visqueen), and filter fabric should be stockpiled near the flood protection system in locations where they are quickly and efficiently accessible for emergency repairs.

Levee Settlement and Subsidence

The levee crest may be lowered over time due to settlement or subsidence.

Settlement is a lowering due to consolidation of soils under loads. Typically settlements under the self-weight of the levee are estimated prior to construction, and the levee is overbuilt by an appropriate amount. However, there may be other factors causing later levee settlements. There may be compressible layers or lenses that were not adequately recognized in design. There may have been later nearby construction that applied additional loads on the soils under the levee. There may have been loss of ground from under the levee due to internal erosion or due to adjacent excavations. There may have been slumping of the entire levee due to overstressing of foundation soils.

Levee settlements and differential settlements, and their observation, are particularly important for levees constructed on compressible soils, as is typically the case for levees built near the Bay.

Subsidence is a lowering of the levee crest over some length of the levee, due to deep-seated compression of soil layers caused by extraction of water, gas or oil, The lowering of the levee crest might compromise the flood protection of the subject levee. Levee inspections should include looking for signs of crest lowering over short stretches of the levee crest. Any such evidence should be noted and followed promptly by a topographic survey of the levee crest. Levee crest lowering over some length (say, hundreds of feet) can probably only be identified by an elevation survey. Such surveys are advisable at regular intervals (e.g., 5-year intervals).


Landside Seeps and Boils

Seepage is prevalent along flood protection levees. Because of the condition of the levees and foundation, seepage is often observed during flood events. Both seepage through the levee and underseepage are common. Pervious layers within the levees or in the foundation have caused seeps to occur on the side slopes of the levees and seeps and boils near the levees' landside toe. Emergency response during a flood event typically involves the construction of sandbag rings around boils to slow the migration of fines out of the foundation soils by allowing a hydrostatic head to build up inside the sandbag rings.

When observed, seeps and boils should be recorded in the field noting location, size, and amount of soil ejected with the flow of water. A note should also be made as to whether the boils are stable or growing in size. If the seeps and boils are evolving and give indication of potential deteriorating conditions, an evaluation should be made to assess the criticality of the situation and develop prompt remedial measures.

Prevention of Encroachment

Inspection should verify that the levees are not encroached upon. Buildings, structures, and storage of miscellaneous materials or equipment should not be permitted on the levee. Refuse dumps are an item of

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frequent concern and should not be permitted. Following each high water season, any drift which has been deposited on the channel and levee slopes should be removed promptly.

River Channel

The river channels and overflow banks are natural areas of planned and unplanned riparian vegetation. Unplanned growth, if abundant, can restrict channel hydraulic capacity, particularly at constricted locations such as at bridge overpasses, culverts and other river crossings. It is recognized that most of the vegetation and trees within the river channel and banks foster and restore riparian corridors and shaded riverine canopy that are critical for terrestrial and aquatic life. Habitat is highly regulated by State and Federal agencies. If serious obstructions due to vegetation growth threaten the flood protection system, these observations should be noted, reported, and acted upon accordingly.

Sediments tend to deposit in areas of reduced channel slope, drop structures, and diversion facilities. The inspection should note and report the degree of silting that is occurring along these facilities, and make recommendations for cleaning and de-silting the obstructed facilities.

Floodwalls and Retaining Walls


As part of the periodic inspections, floodwalls and retaining walls in levees should be inspected for any distress including: cracking, undermining (scour, erosion at the wall footing), settlement, misalignment, and any other signs that could potentially affect the structural integrity of the walls. The levee inspector should look for and record with photographs and drawings, indicating exact locations with respect to levee miles and offset distances from the levee centerline, any signs of:

- Wall cracks, fissures, chipping, and breaks or spalls
- Settlement and offsets
- Out of plumb and misaligned sections of walls
- Seepage, boils, and saturated areas
- Scour holes and erosion
- Roots that may undermine the wall footing
- Accumulation of trash, debris or any undesirable rubbish
- Unauthorized encroachment such as: boats against or tied up to the floodwall.

Structures, Facilities and Appurtenances

Various facilities and appurtenances encroach on the levees. During inspections, care should be taken to verify that these facilities are operating in satisfactory conditions. Because these facilities generally create a hard contact with the levee/bank material, inspection for scour and undermining at these localities is important. Inspections should verify that:

- Pipes, gates, and valves are in good working conditions and that no erosion is occurring around pipes and drainage structures.
- Grade control and energy dissipating structures are not undermined and exposed or silted up.
- Drainage ditches and channels are open and clear from overgrowth and any undesirable rubbish that may impact the normal flow and proper discharge. Note abnormal occurrence of silt and sand mounds within the drainage ditches.
- Drainage inlet structures are inspected and kept free from debris and accumulation that may cause clogging.
- Flap gates on storm drainage discharge pipe outlets are kept clean from accumulated debris between the gates and the pipes which could impede the normal function of the gates.

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- Bridge and culvert abutments should be checked for structural distress and erosion effects.
- Pumps are well maintained and in good working condition.

Miscellaneous Levee Facilities and Appurtenances

Miscellaneous levee facilities (e.g., relief wells, check valves, slide gates) that are constructed on, over or through the levee should be maintained in a good state of repair and/or in good operating condition. The condition of these facilities should be inspected at least annually, and those items that are operative only during high river stages should be checked carefully and repaired as necessary immediately prior to the high water season. Relief wells should be checked during periods of high water. Wells that do not flow for an extended period of time may have to be tested by pumping to determine the extent of deterioration. Where wells are found to be critically deteriorated, they should be rehabilitated by cleaning, surging, and pumping. Check valves should be inspected to ensure that they open freely and that the gaskets are in good condition.

Periodic Elevation Surveys

Periodic surveys of the elevation of the levee crest are advisable to monitor any potential deviation from the design levee profile. Specific facility maintenance guidelines and/or agreements may dictate survey requirements.

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1. PURPOSE AND SCOPE:

The purpose of this document is to provide guidelines for inspections of District Watershed facilities. This includes routine and emergency inspections for detecting various problems before they threaten the integrity of facilities against the possibility of flooding and property damage. Inspections are conducted to identify conditions that may jeopardize the quality and integrity of the watershed facilities. The conditions are documented by measuring and recording the condition for corrective action or future monitoring. Inspections record the type, size, and location of any conditions requiring either correction or monitoring. Conditions identified as those to be monitored are to be re-evaluated during the next inspection cycle until the condition is corrected.

2. REFERENCE DOCUMENTS:

External References:

USACE Operation and Maintenance (O&M) Manuals

Internal References:

WQ75101 Field Operations Work Order Process
WQ75115 Develop Engineering Field Instructions
WW75100 Vegetation Control Work Instructions
WW75121 Work Project Planning Tool
WW75401 Flood Control Maintenance on Private Property
WW75167 Chipping of Woody Debris Stockpiles
WF75118 Ordinance Violation Form
WF75121 SMP Project Prioritization Matrix
WF75161 Levee Field Inspection Rating Guide
WF75165 Field Operations Inspection Sheet
WF75166 Facilities Inspection Rating Guide
SMP Binder (BMP Manual/Permits and Supporting Material)
Facilities Maintenance Guidelines
Levee Inventory List (watershed specific)

3. DEFINITIONS:

Access: A location to enter the District -right--of-way from either a public street or private property with agreed-upon right-of-way.

Creek bank: The side slope of a creek

Creek channel:

The depression in the land surface the water in the creek flows in.

Creek Name and Creek Number:

Referenced in the Maximo designations for the facilities inspected.

Easement: Property where there is a limited District responsibility and is most often a “flood control easement”. This would invoke the responsibility of maintaining the creek to

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meet District Flood Control guidelines. Ingress/egress, flowage, or other forms of easement require much less maintenance responsibilities. Easements are indicated in yellow on District maps.

Fee Title: Property where the deed lists the Santa Clara Valley Water District as the property owner. Fee titles are indicated in green on District maps.

GIS: Geographic Information System. A geographic database of layers of information. Primarily used by Watershed Field staff for right-of-way and location information.

Inspection: The evaluation of the watershed facilities to identify and record corrective action or monitoring of any condition that could jeopardize the quality of the facility (creeks, levees, property and habitat) in the watersheds.

Major facilities:
Major tributaries with the greatest potential for catastrophic flooding and property damage. Generally have high water flows and are historically problematic.

Minor facilities:
Feed into major tributaries and have a potential for localized flooding and limited property damage. Generally have low flows and historically have low occurrence of problems.

NRCS facilities:
Facilities where flood protection projects were constructed cooperatively with the Natural Resources Conservation Service (NRCS).

Orientation: The right and left bank orientation is determined by facing upstream.

Right-of-Way:
Property the District has some form of responsibility recorded by legal deed. This includes **Easement** and/or **Fee Title**.

Stationing: A geometric/geographic measurement that starts at the furthest most downstream point of the creek. It is referenced by the starting point of 0+00 (hundreds of feet) = 0 feet measuring upstream from the mouth of the creek.

USACE facilities:
Facilities where flood protection projects were constructed cooperatively with the **U.S. Army Corps of Engineers (USACE)**. This cooperative relationship requires semi-annual inspections and annual reports to USACE.

4. ROLES AND RESPONSIBILITIES:

None

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5. REQUIREMENTS:

5.1. ISO 9001 - 7.5.1 Control of Production and Service Provision

5.2. ISO 14001 - 4.4.6 Operational Control

5.3. Other Requirements
SMP Permits & CEQA documents

6. MONITORING AND MEASUREMENT:

Creek inspection reports will be completed annually and reviewed with Management.

7. PROCEDURE:

ACTION STATEMENT & ROLE	DETAILS (DESCRIBE STEPS)	QUALITY RECORDS (OUTPUT FROM STEP)
<p>(1)</p> <p>Plan Inspections</p> <p>(Field Operations)</p>	<ul style="list-style-type: none"> • Routine inspection of Watershed facilities are conducted by the Field Operations Administrator to inventory conditions. • Inspection cycle: <ul style="list-style-type: none"> • USACE facilities will be inspected at least twice a year. • NRCS facilities will be inspected annually. • Major facilities will be inspected once a year. • Minor facilities may be inspected once every two years. • Storage Yards will be inspected annually. • Routine inspection frequency should be determined by permits, facility maintenance guidelines, facility maintenance agreements, and the perceived need for inspections. • FOA will identify all Watershed facilities on facilities hierarchy (list of facilities). This listing is compiled, maintained, and kept by the FOA. Each inspection will be scheduled by the FOA. • Only Watershed facilities on District right-of-way (including easement and fee title obligations) will be inspected unless authorized by WW75401 Flood Control Maintenance on Private Property. Use GIS and stationing to verify District right-of-way for inspection area. • Review maintenance guidelines, past inspection notes, and annual creek inspection reports for facilities being inspected. • All inspections will have a work order in accordance with WQ75101 Field Operations Work Order Process. • Obtain any special equipment and/or materials required for inspection including a camera, probe, waders, and safety 	<p>Inspection Notes</p>



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ACTION STATEMENT & ROLE	DETAILS (DESCRIBE STEPS)	QUALITY RECORDS (OUTPUT FROM STEP)
Administrator (FOA))	<p>equipment.</p> <ul style="list-style-type: none"> Notify and coordinate with any others involved in the inspection (confined space team, etc.), if applicable. 	
<p>(2)</p> <p>Inspect Facilities</p> <p>(Field Operations Administrator (FOA) and Engineering Technician)</p>	<ul style="list-style-type: none"> Inspection criteria to be used for each facility will come from Maintenance Guidelines for that facility, where applicable. Watershed Program Support Units will develop and maintain guidelines. FOA is provided hard copies of guidelines as they are developed. Routine inspections involve a complete visual review of the facilities and noting any observable condition that might need correction or future monitoring. Conditions are documented by measuring and recording the condition for corrective action or future monitoring. District materials storage yards will be inspected annually and woody debris stockpiles will be evaluated. <ul style="list-style-type: none"> If the woody debris is not set aside for use in erosion repair and the volume of the woody debris has accumulated for more than 2 years or 500 CY, the woody debris should be ground into chips in accordance with WW75167 Chipping of Woody Debris Stockpiles. FOA will document any work required in accordance with WQ75101 Field Operations Work Order Process. Inspections are conducted using the Watershed Field Inspection Sheet (WF75165) to record conditions observed. Field-gathered data includes location, description of conditions, and photo documentation. Condition codes used on WF75165 are: <ul style="list-style-type: none"> A= Asbuilt / New. No action required. B= Good. No action required. C= Requires FOA evaluation and/or monitoring. FOA will re-inspect this in the next inspection cycle. D= Requires corrective action (i.e., Violation, Engineer Review, notification, etc.). Initiate a work order for routine processing. E= Requires immediate corrective action. Initiate a work order for expedited processing. During the routine inspections, sediment bars are measured and noted. Following the winter creek flows, these sediment bars might be inspected again. The sediment inspection list is given to Program Support for review. To provide accurate sediment quantity estimates for major sediment removal projects where channel conditions are moderately or highly uncertain (as determined by the Program Support Engineer), cross-section surveys will be performed. Survey results will be incorporated into the work plan and budget development process. 	<p>WF75165 Watershed Field Inspection Sheet</p> <p>Photo documentation</p> <p>Sediment Inspection List</p> <p>USACE facility inspection report</p> <p>Annual Inspection Report</p>

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ACTION STATEMENT & ROLE	DETAILS (DESCRIBE STEPS)	QUALITY RECORDS (OUTPUT FROM STEP)
	<ul style="list-style-type: none"> Inspection data is gathered on USACE facilities and compiled in the annual inspection report sent to USACE. Inspection data gathered in the field will be compiled into the Annual Inspection report given to management during the first quarter of a calendar year. 	
(3) Perform Event-driven Inspections (Field Operations Administrator (FOA) and Engineering Technician)	<ul style="list-style-type: none"> Event-driven inspections should also take place after a natural hazard such as flood, storm and other events having the potential of damaging the flood control system and hazards for public safety. For USACE facilities, refer to the appropriate O&M manual for specific requirements related to event-driven inspections. Inspections should identify any disruption of flows, erosion sites, and any other sites that need further monitoring. Inspections will be documented using photos. Photos should be identified by facility and reach, month and date, and photo sequence. A report of emergency inspection will be prepared by the FOA as a basis for needed remedial work for all periodic inspections. Remedial work will be performed in accordance with WQ75101 Field Operations Work Order Process. 	Photos from inspection
(4) Corrective Action (Field Operations Administrator (FOA))	<ul style="list-style-type: none"> If the FOA recorded a condition of C during the inspections, then another inspection should be scheduled for the next season. FOA will document any work required in accordance with WQ75101 Field Operations Work Order Process. If the FOA recorded a condition of D during the inspections, then a solution will be developed by the FOA and implemented. FOA will document any work required in accordance with WQ75101 Field Operations Work Order Process. If the FOA recorded a condition of E during the inspections, then a solution will be developed immediately by the FOA and implemented. FOA will document any work required in accordance with WQ75101 Field Operations Work Order Process. If the FOA determines that a deficiency revealed during the course of the inspection requires engineering analysis, the Watershed Program Support Engineer shall be consulted and if necessary, a solution developed. Deficiencies will be prioritized by the Field Operations and Watershed Program Support Units in accordance with WW75121 (Work Project Planning Tool) and WF75121 (SMP Project Prioritization Matrix) as necessary. The Watershed Program Support Engineer will develop a solution in accordance with WQ75115 Develop Engineering Field Instructions. 	WF75165 Watershed Field Inspection Sheet Work Order

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8. QUALITY RECORDS:

QUALITY RECORD	LOCATION KEPT	FILING ORDER	RECORDS RETENTION SCHEDULE SERIES No.	COMMENTS
Inspection Notes	Field Operations Unit Files	Facility Number & Date	RS-1015	
Field Inspection Sheet	With Work Order	Facility Number & Date	RS-1015	
Work Order	SOS	Facility Number & Date	RS-0172	
Photos from inspection	District IT Network	Facility & Reach	RS-1015	
Army Corps of Engineers facility inspection report	Central Files	Date	RS-1015	

9. CHANGE HISTORY:

Date	Revision	Comments
12/19/06	R1	New Release
01/29/07	R2	Added reference document of Fac. Maint. Guidelines and misc corrections.
03/26/08	R3	Added bullet in step 2 in response to CPAR 191 – estimating sediment.
03/15/10	R4	Change of process owner to Roger Narsim
04/09/10	R5	Added inspection of District materials storage yards (cpar 211) & reference to WW75167 Chipping of Woody Debris Stockpiles
02/15/11	R6	Change of template and minor text and formatting changes made to Sections 1, 2, 3, 6, 7, and 10.

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10. ADDENDA:

SCVWD Creek and Levee Inspection Key

CONDITION CODES
A = Asbuilt/New
B = Good
C = Requires FOA Evaluation or Monitoring
D = Requires Corrective Action (ie Work Order, Violation, Engineer Review, Notification, etc.)
E = Requires Immediate Action

FACILITY TYPES	
Bridge Abutment (BAB)	Miscellaneous (MSC)
Bridge Footing (BFG)	Overflow Channel (OFC)
Culvert (BOX)	Outfall (OTF)
Bridge Pier (BPR)	Pipe (PIP)
Bridge (BRG)	Pond (PND)
Concrete Channel (CCH)	Perc Pond (PRC)
Cellular Concrete Mat (CCM)	Access Road (RAC)
Concrete-lined Channel (CLC)	Reinforced Concrete Pipe (RCP)
Corrugated Metal Pipe (CMP)	Recreational (REC)
CPRU Code Enforcement Violation (CPR)	Recreation Trail (RET)
Drop Structure (DST)	Riparian (RIP)
Earth Channel (ECH)	Riprap (RIR)
Fence / Gate (FAG)	Levee Road (RLR)
Flood Walls (FDW)	Access Road - Lower (RLW)
Fence (FEN)	Revegetation Site (RVS)
Flap Gate (FGT)	Structure - Concrete (SCN)
Fish (FIS)	Sediment Debris Basin (SDB)
Flood Plain (FLP)	Stream Gage (SGG)
Fish Ladder (FSH)	Sign (SGN)
Gabion (GAB)	Slide Gate (SLG)
Gate (GAT)	Slope Protection (SLP)
Levee (LEV)	Structure - Steel (SST)
Landscaping (LSC)	Trash Rack (THK)
Levee Crown (LVC)	Valve (VLV)
Levee Landside (LVL)	Weir (WER)
Levee Waterside (LVW)	Wetland (WTL)



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CATEGORIES (Maximo Job Plan & Other)	
Emergency Debris Removal (EMR)	Misc. Property Maintenance (MSC)
Erosion (ERO)	Pier Nose/Trash Rack/Flapgate Cleaning (PTF)
Fence/Gate Work (FEN)	Sediment (SED)
Fish Structure Maintenance (FSH)	Sign Work (SGN)
Good Neighbor Maintenance (GNM)	Tree (TRE)
Graffiti Removal (GRF)	Trash and Debris (TRS)
Ground Squirrel/Rodent Control (GSC)	Overhanging Growth (VWG)
Hazardous Materials (HAZ)	Typical (TYP)
In Stream Vegetation (ISV)	Violation (VIO)
Levee Maint./Restoration (LEV)*	*reference criteria in WW75161
Motor Grading (MGR)	
Direction of Photo - Upstream (U/S), Downstream (D/S) or At Location (AT)	

APPENDIX D

Maintenance Activities List

APPENDIX D - MAINTENANCE ACTIVITIES LIST

Best Management Practices

A. SECTION A –Pre-Project Planning and General BMPs

General BMPs are applicable program-wide, for most routine SMP maintenance activities. These measures include standard construction practices and impact avoidance measures that will minimize potential environmental impacts. These BMPs will be implemented by the stream maintenance crew, as appropriate and as overseen by site managers, for all activities associated with the maintenance program. The majority of these BMPs are implemented prior to and during maintenance operations, though the level of activity varies depending on the work type.

Other General BMPs are conducted prior to implementing maintenance activities on site. This group of measures includes procedures to identify site or maintenance constraints, such as biological or cultural resource surveys which coincide with permit compliance requirements. Site design constraints for sediment and bank stabilization activities in particular are also identified as part of the pre-project planning process.

BMP Number	BMP Title	BMP Description
GEN-1	In-Channel Work Window	<p>All ground-disturbing maintenance activities (i.e., sediment removal, bank stabilization, tree removal, and mechanized vegetation management) occurring in the channel (below bankfull) will take place between June 15 and October 15. Requests for work window extensions must be submitted to the regulatory agencies by October 1st, listing the creek names and reaches where a work extension will occur. Work extensions vary per work activity. The agencies will provide a single response within one week. Significant rainfall applies after October 15. An extension through December 31 may apply if the following requirements are met and regulatory agency approval is received:</p> <p>For ground-disturbing activities:</p> <ul style="list-style-type: none"> ▪ Work may continue if no significant rainfall, defined as greater than 0.5 inches per 24 hours within a local watershed, is either forecasted¹ or observed. Following October 15th, maintenance work shall cease for the season if such a rain event is forecasted or observed. ▪ In the Pajaro Basin, winterized sites will be visually inspected prior to, and within 48 hours following, each significant rain event (defined as rainfall 0.5 inch or greater within a 24-hour period in the subject watershed) to ensure that winterization measures are properly implemented and maintained. <p>Sediment removal</p> <ul style="list-style-type: none"> ▪ Extended Work Window: <ol style="list-style-type: none"> 1. Creeks supporting anadromous fish: An extended work window may occur from October 15 through October 31, or until local rainfall of 0.5 inches or greater falls within the subject watershed within a 24-hour period, whichever occurs first. 2. Creeks not supporting anadromous fish: An extended work window may occur from October 15 through November 30th, or until local rainfall of 0.5 inches or greater falls within the subject watershed within a 24-hour period, whichever occurs first. ▪ Extended Work Window in Lower Quality Areas:

¹ Weather Forecasts. No phase of the project may be started if that phase and its associated erosion control measures cannot be completed prior to the onset of a storm event if that construction phase may cause the introduction of sediments into the stream. Seventy-two-hour weather forecasts from the National Weather Service or other localized and more detailed weather forecast service will be consulted prior to start up of any phase of the project that may result in sediment runoff to a stream.

BMP Number	BMP Title	BMP Description
		<ol style="list-style-type: none"> 1. Sediment removal work may occur until December 31. 2. Work will only occur on Berryessa Creek (0-88+80; 232+70-236+00; 284+30-288+00), Lower Silver Creek (Reach 3 between Stations 37+40 and 381+19), Thompson Creek (0+00-10+00), Canoas Creek (0+00-390+00), Ross Creek (0+00-86+30), Calabazas Creek (35+00-105+00), and San Tomas Aquino Creek (80+00-100+00) with the following conditions: <ul style="list-style-type: none"> o site conditions are dry and access for all construction equipment and vehicles will not impact waterways; and o all work will stop if any rainfall is forecast for the next 72 hour period. 3. Work may occur after a significant rainfall event but no later than December 31. 4. Sites must be maintained in a rapidly winterizable² state (implement control measures BMP GEN-20). <p>Bank stabilization projects may continue until the approved date stated below. Prior to a forecasted significant rainfall event (0.5 in/24 hrs), all incomplete bank stabilization projects must be winterized.</p> <ol style="list-style-type: none"> 1. In Creeks Supporting Anadromous Fish <ul style="list-style-type: none"> o An extended work window may occur until October 31st for bank stabilization projects that will be 50% complete by October 15th. 2. In Creeks Not Supporting Anadromous Fish <ul style="list-style-type: none"> o An extended work window may occur until November 30th for projects that will be 50% complete by October 15th or until significant rainfall. o An extended work window may occur until November 30th for new bank stabilization projects that will be completed in five (5) days or less, or until significant rainfall. <ul style="list-style-type: none"> ▪ Instream hand pruning and hand removal of vegetation will occur year round, except when: <ul style="list-style-type: none"> o Wheeled or tracked equipment needs to access the site by crossing a creek, ponded area, or secondary channel; or o Work occurs in streams that support steelhead. In these streams instream vegetation maintenance will cease on December 31 or when local rainfall greater than 0.5 inches is predicted within a 24-hour period of planned activities, whichever happens first. <p>Modification and removal of instream large woody debris will occur at any time of the year, and as further described in the NMFS Biological Opinion.</p>
GEN-2	Instream Herbicide Application Work Window	<p>Instream herbicide applications will take place between June 15 and October 15, or until the first occurrence of any of the following conditions; whichever happens first:</p> <ul style="list-style-type: none"> ▪ local rainfall greater than 0.5 inches is forecasted within a 24-hour period from planned application events; or ▪ when steelhead begin upmigrating and spawning in the 14 anadromous steelhead creeks, as determined by a qualified biologist (typically in November/December), <ul style="list-style-type: none"> o A qualified biologist will determine presence/absence of sensitive resources in designated herbicide use areas and develop site-specific control methods (including the use of approved herbicide and surfactants). Proposed herbicide use would be limited to the aquatic formulation of glyphosate (Rodeo or equal). Surfactant use would be limited to non-ionic products, such as Agri-

² Winterization is the process to maintain work sites with the appropriate BMP's to prevent erosion, sediment transport, and protect water quality. Winterization occurs upon completion of bank repairs or on incomplete projects after October 15 and prior to the forecast of significant rainfall, 0.5 inches or greater of local watershed rainfall within 24 hours. Winterization shall be completed prior to the occurrence of such actual significant rainfall.

BMP Number	BMP Title	BMP Description
		<p>dex, Competitor, or another brand name using the same ingredients. Any modifications to these materials would require review and approval by NMFS and CDFW.</p> <ul style="list-style-type: none"> o A qualified fisheries biologist will review proposed herbicide application methods and stream reaches. The fisheries biologist would conduct a pre-construction survey (and any other appropriate data research) to determine whether the proposed herbicide application is consistent with SMP approvals concerning biological resources and determine which BMPs would be instituted for work to proceed. <p>In addition, herbicide application requirements are as follows:</p> <ul style="list-style-type: none"> ▪ no direct application into water; ▪ herbicide application shall not occur when wind conditions may result in drift; ▪ herbicide solution shall be applied only until there is a “wet” appearance on the target plants in order to avoid run off; and ▪ where permitted, surfactants shall be added to the spray solution prior to application.
GEN-3	Avoid Exposing Soils with High Mercury Levels	<p>Sediment removal and bank stabilization projects in portions of the Guadalupe River watershed affected by historic mercury mining may expose soils containing mercury.</p> <ol style="list-style-type: none"> 1. In Basin Plan identified creeks in the Guadalupe River Basin, soils that are likely to be disturbed or excavated shall be tested for mercury (Hg). Soils shall be remediated if disturbed or excavated soils exposed to streamflow have a residual sample test exceeding 0.2 mg mercury per kg erodible sediment (dry wt., median). 2. Remediation may be accomplished either by: <ol style="list-style-type: none"> a. treating the site so that contaminated soils excavated for the purpose of bank stabilization shall not be susceptible to erosion; or b. further excavating contaminated soils and replacing them with clean fill or other bank stabilization materials that are free from contaminants. c. Soils with residual sample mercury concentrations exceeding 0.2 mg mercury per kg erodible sediment (dry wt., median) shall be removed and disposed of in a Class I landfill following established work practices and hazard control measures. Soils with residual sample mercury concentrations less than 0.2 mg mercury per kg erodible sediment (dry wt., median) will remain at the project site. 3. To ensure worker safety during sediment removal and bank stabilization projects with elevated mercury concentrations in the exposed surfaces, personal protective equipment will be required during project construction to maintain exposure below levels established by the Occupational Safety and Health Agency (OSHA).

Biological Resources

GEN-4	Minimize the Area of Disturbance	To minimize impacts to natural resources, soil disturbance will be kept to the minimum footprint necessary to complete the maintenance operation.
GEN-5	Mitten Crab Control Measure	Sediment from the San Francisco Bay Watershed, including that for reuse, cannot be moved to areas any farther south than Coyote Creek Golf Drive in south San Jose, and the intersection of McKean and Casa Loma Roads.
GEN-6	Minimize Impacts to Nesting Birds via Site	<ol style="list-style-type: none"> 1. For activities occurring between January 15 and August 31, project areas will be checked by a qualified biologist or Designated Individuals (DI – for limited ground nesting species surveys) for nesting birds within 2

BMP Number	BMP Title	BMP Description
	Assessments and Avoidance Measures	<p>weeks prior to starting work. If a lapse in project-related work of 2 weeks or longer occurs, another focused survey will be conducted before project work can be reinitiated.</p> <ol style="list-style-type: none"> 2. If nesting birds are found, a buffer will be established around the nest and maintained until the young have fledged. Appropriate buffer widths are 0.5 mile for bald and golden eagles; 250 feet for other raptors and the least Bell's vireo, herons, and egrets; 25 feet for ground-nesting non-raptors; 700 feet for the California clapper rail; 600 feet for the California least tern and western snowy plover; and 50 feet for non-raptors nesting on trees, shrubs and structures. Mowing and weed whacking will have a 25 feet buffer. A qualified biologist may identify an alternative buffer based on a site specific-evaluation. No work within the buffer will occur without written approval from a qualified biologist, for as long as the nest is active. 3. All vegetation management, sediment reuse, road grading, or other SMP activities in or immediately adjacent to suitable California clapper rail or Alameda song sparrow nesting habitat, as determined by a qualified biologist, shall not be conducted prior to September 1 (the non-nesting season). 4. If a pre-activity survey in high-quality San Francisco common yellowthroat breeding habitat (as determined by a qualified biologist) identifies more singing male San Francisco common yellowthroats than active nests, then the inconspicuous nests of this species might have been missed. In that case, maintenance activities in that area shall be delayed until the San Francisco common yellowthroat non-breeding season (i.e., August 16–March 14). 5. The boundary of each buffer zone will be marked with fencing, flagging, or other easily identifiable marking if work will occur immediately outside the buffer zone. 6. All protective buffer zones will be maintained until the nest becomes inactive, as determined by a qualified biologist. 7. If monitoring shows that disturbance to actively nesting birds is occurring, buffer widths will be increased until monitoring shows that disturbance is no longer occurring. If this is not possible, work will cease in the area until young have fledged and the nest is no longer active.
GEN-6.5	Protection of Nesting Least Bell's Vireos	<ol style="list-style-type: none"> 1. To the extent feasible, SMP activities within those areas mapped as vireo habitat in the Santa Clara Valley Habitat Plan shall be scheduled to occur outside of the least Bell's vireo nesting season (March 15 – July 31). If it is not feasible for maintenance activities along these reaches to be scheduled during the non-nesting season, the following measures will be implemented. 2. For activities within woody riparian habitat mapped as vireo habitat in the Santa Clara Valley Habitat Plan that will occur between March 15 and July 31, any work will be preceded by a focused survey for least Bell's vireos. Pre-activity surveys will consist of two site visits, conducted on separate days within 14 days before the initiation of maintenance activities in the given area, with at least one of these surveys occurring within 5 calendar days before the initiation of such activities. Surveys will be conducted between dawn and 11:00 a.m., during mild weather conditions (i.e., not during excessive cold, heat, wind, or rain), within all riparian habitat in and within 250 feet of any proposed maintenance location along these reaches. The surveys will be conducted by a qualified biologist who is familiar with the visual and auditory identification of this species. 3. To minimize impacts to nesting least Bell's vireos and other birds, the biologist will not initially be looking for Bell's vireo nests during these surveys. Rather the biologist will look and listen for individual vireos. If a least Bell's vireo is detected, it will be observed to determine whether it is actively nesting. The biologist will note the nest location, or if finding the actual nest could result in excessive disturbance or risk damaging the nest, the biologist will determine the approximate location, based on observation of birds carrying nesting material,

BMP Number	BMP Title	BMP Description
		<p>carrying food, or repeatedly visiting a certain area.</p> <ol style="list-style-type: none"> 4. If an active nest is found, a minimum 250-foot no-activity buffer will be established around the nest. If a territorial male is found but no nest can be detected, then the approximate centroid of the bird's area of activity will be the point from which the buffer will be applied. The required buffer may be reduced in areas where dense riparian forest occurs between the construction activities and the active nest or where sufficient barriers or topographic relief exists to protect the nest from excessive noise or other disturbance. The biologist will coordinate with the USFWS and CDFW to evaluate exceptions to the minimum no-activity buffer distance on a case-by-case basis. 5. No work will occur within the buffer without verification by a biologist that the nest is inactive and until any fledged young are no longer dependent on adults for food. 6. If a least Bell's vireo and/or its nest is detected during pre-activity surveys, the District will contact the USFWS and CDFG within two working days regarding the presence and location of the bird/nest.
GEN-7	Protection of Burrowing Owls	<ol style="list-style-type: none"> 1. If occupied burrows are identified, a 250 foot radius no work buffer zone will be established around the burrow. The buffer may be modified, with CDFW approval, to take into consideration of paved roads, intervening riparian corridors and levees. 2. No construction work will occur within the 250 foot buffer zone until after the nesting season. 3. After the nesting season work may occur within the 250 foot buffer zone provided: <ol style="list-style-type: none"> a. A qualified biologist monitors the owls for at least 3 days prior to construction to determine baseline foraging behavior (i.e., behavior without construction) b. The same qualified biologist monitors the owls during construction and finds no change in owl foraging behavior in response to construction activities. c. If there is any change in owl foraging behavior as a result of construction activities, these activities will cease within the 250-foot buffer. d. If the owls are gone for at least one week, the project proponent may request approval from the Santa Clara County Habitat Agency that a qualified biologist excavate the usable burrows to prevent owls from re-occupying the site. After the usable burrows are excavated, the buffer zone will be removed and construction may continue. e. Monitoring must continue as described above for the non-breeding season as long as the burrow remains active. 5. Routine use of existing District maintenance roads within the 250 foot buffer will be allowed. However, no construction traffic will be allowed to use the maintenance road during the active nesting period. 6. Exceptions. <ol style="list-style-type: none"> a. Mowing on levees may occur during the nesting season and within 250 feet of active burrows provided the burrows are marked by a qualified biologist. b. No vehicle mounted mowers will be used within 10 ft of occupied burrows. c. A qualified biologist will monitor the mowing within the buffer zone and stop the mowing if burrowing owls are observed on the surface at the nest or another burrow. d. Areas within 10 feet of the burrows may be mowed using hand equipment when no owls are visible on the surface. e. All mowing activities within the buffer zone will be completed within 30 minutes.
GEN-8	Protection of Sensitive	Approved herbicides and adjuvants may be applied in habitat areas for sensitive wildlife species (including

BMP Number	BMP Title	BMP Description
	Fauna Species from Herbicide Use	<p>steelhead, California red-legged frog, California tiger salamander, salt marsh harvest mouse, and Bay checkerspot butterfly); all applications will occur in accordance with federal and state regulations.</p> <p>For sprayable or dust formulations: when the air is calm or moving away from sensitive wildlife habitat, applications will commence on the side nearest the habitat and proceed away from the habitat. When air currents are moving toward habitat, applications will not be made within 200 yards by air or 40 yards by ground upwind from occupied habitat. However, these distances may be modified for the control of invasive species on salmonid streams if the following measures are implemented:</p> <ul style="list-style-type: none"> ▪ A qualified biologist will determine presence/absence of sensitive resources in designated herbicide use areas and develop site-specific control methods (including the use of approved herbicide and surfactants). Proposed herbicide use would be limited to the aquatic formulation of glyphosate (Rodeo or equal). Surfactant use would be limited to non-ionic products, such as Agri-dex, Competitor, or another brand name using the same ingredients. Any modifications to these materials would require review and approval by NMFS and CDFW. ▪ A qualified fisheries biologist will review proposed herbicide application methods and stream reaches. The fisheries biologist would conduct a pre-construction survey (and any other appropriate data research) to determine whether the proposed herbicide application is consistent with SMP approvals concerning biological resources and determine which BMPs would be instituted for work to proceed.
GEN-9	Avoid Impacts to Special-Status Plant Species and Sensitive Natural Vegetation Communities	<p>A qualified botanist will identify special status plant species and sensitive natural vegetation communities and clearly map or delineate them as needed in order to avoid and/or minimize disturbance, using the CDFW protocols and the <i>CNPS Botanical Survey Guidelines</i> to formulate the following protocols:</p> <ol style="list-style-type: none"> 1. A qualified botanist will use the GIS database, CNDDDB, and/or other suitable tools to identify special status plants and sensitive natural vegetation communities located within or near work areas. 2. Surveys of areas identified as sensitive natural communities or suitable habitat for special status plant species will be conducted by a qualified botanist prior to commencement of work. 3. Surveys will be conducted during the appropriate time of the year to adequately identify special-status plants that could occur on the site of proposed maintenance activities. 4. The qualified botanist will ensure avoidance and/or minimize impacts by implementing one or more of the following, as appropriate, per the botanist’s recommendation: <ol style="list-style-type: none"> a) Flag or otherwise delineate in the field the special status plant populations and/or sensitive natural community to be protected; b) Allow adequate buffers around plants or habitat; the location of the buffer zone will be shown on the maintenance design drawings and marked in the field with stakes and/or flagging in such a way that exclusion zones are visible to maintenance personnel without excessive disturbance of the sensitive habitat or population itself (e.g., from installation of fencing). c) Time construction or other activities during dormant and/or non-critical life cycle period; d) Store removed sediment off site; and e) Limit the operation of maintenance equipment to established roads whenever possible. 5. No herbicides, terrestrial or aquatic, will be used in areas identified as potential habitat for special status plants species or containing sensitive natural communities, until a qualified botanist has surveyed the area and determined the locations of special status plant species present. 6. If special status plant species or sensitive communities are present, then a qualified botanist will determine if a given type of vegetation management method is ecologically appropriate for a given area. Alternative

BMP Number	BMP Title	BMP Description
		<p>strategies based on the botanist’s recommendations will be coordinated with appropriate staff.</p> <p>7. All impacts to sensitive natural communities and special status plants identified by the qualified botanist will be avoided and/or minimized</p>
GEN-10	Avoid Impacts to Bay Checkerspot Butterfly and Associated Critical Habitat	<ol style="list-style-type: none"> 1. Areas supporting Bay checkerspot larval host plants will be identified by a qualified botanist and protected from disturbance to the extent feasible, by establishing buffer zones around individual plants or populations. The size of the buffer will be determined by a qualified botanist; the actual distance will depend on the plant species potentially affected and the type of disturbance. No herbicide will be applied to the buffer area, and to the extent feasible, maintenance personnel and equipment will not operate within such areas. 2. Herbicides may be used in serpentine areas that do not contain Bay checkerspot butterfly larval host plants or sensitive plant species and habitat when approved by a qualified botanist and for the following maintenance purposes: <ol style="list-style-type: none"> a) To protect sensitive species and habitat; b) To manage for control of invasive and non-native plants; and/or c) To maintain access to a facility.
GEN-11	Protection of Salt Marsh Harvest Mouse and California Clapper Rail	<ol style="list-style-type: none"> 1. A District qualified biologist will conduct a desk audit to determine whether suitable Salt Marsh Harvest Mouse (SMHM) or California Clapper Rail (CCR) habitat is present in or adjacent to a maintenance activity. 2. Within 7 days prior to work within the range of the Salt Marsh Harvest Mouse (SMHM) or California Clapper Rail (CCR), as depicted on the District’s GIS layers, the proposed project area will be surveyed by a qualified biologist to identify specific habitat areas. Surveyed areas will include work locations and access routes. The range of the salt marsh harvest mouse and California clapper rail is based on the SCVWD’s GIS mapping reflecting occurrence information and potential habitat. If this mapping is revised, it will be provided to the Service for review. 3. To minimize or avoid the loss of individuals, activities within or adjacent to California clapper rail and salt marsh harvest mouse habitat will not occur within two hours before or after extreme high tides (6.5 feet or above) when the marsh plain is inundated, because protective cover for those species is limited and activities could prevent them from reaching available cover. 4. Specific habitat areas are vegetated areas of cordgrass (<i>Spartina</i> spp), marsh gumplant (<i>Grindelia</i> spp.), pickleweed (<i>Sarcocornia pacifica</i>), alkali heath, (<i>Frankenia</i> sp.), and other high marsh vegetation, brackish marsh reaches of creek with heavy accumulations of bulrush thatch (old stands), and high water refugia habitat that may include annual grasses, and shrubs immediately adjacent to channels. 5. Within the identified specific habitat areas, vegetation will be removed by hand from areas to be directly impacted by the work activities if possible (hand removal of vegetation in some channels may not be possible). If within the mapped range of the mouse but outside of areas identified as specific habitat areas, then other methods may be possible. 6. Prior to the initiation of work each day for all vegetation management work, ground or vegetation disturbance, operation of large equipment, grading, sediment removal, and bank stabilization work and prior to expanding the work area, if suitable habitat occurs within the immediate work area, a qualified biologist will conduct a pre-construction survey of all suitable habitat that may be directly or indirectly impacted by the day’s activities (work area, access routes, staging areas). <ol style="list-style-type: none"> a. If during the initial daily survey or during work activities a CCR is observed within or immediately

BMP Number	BMP Title	BMP Description
		<p>adjacent to the work area (50 feet), initiation of work will be delayed until the CCR leaves the work area.</p> <p>b. If during the initial daily survey or during work activities a SMHM or similar rodent is observed within or immediately adjacent to the work area (50 feet), initiation of work will be delayed until a <i>Site Specific Species Protection Form</i> can be developed and implemented by a qualified biologist to protect the SMHM or similar rodent is developed and implemented by the qualified biologist. Acceptable plan activities may include one or more of the following activities: 1) establishment of a buffer zone at least 50 feet in radius from the rodent; 2) ongoing active monitoring, 3) construction of silt fence barrier between maintenance work and location of the rodent, 4) delay of work activity until the qualified biologist can provide CDFW and the Service a suggested course of action and seek concurrence.</p> <p>7. Mowing using heavy equipment (tractors, boom mowers, rider mowers) will not be conducted in habitat areas or within 50 feet of habitat areas. If mowing with hand equipment is necessary within 50 feet of habitat areas, an on-site monitor will observe the area in front of the mower from a safe vantage point while it is in operation. If SMHM are detected within the area to be mown, no mowing will occur in that area. If CCR are detected within the area to be mown, the mowing will stop until the individual(s) have left the work area.</p> <p>8. See ANI-2 for additional restrictions.</p> <p>9. If visual observation cannot confirm California clapper rail left the work area then it is assumed that the individual(s) remains in the work area and the work will not resume until the area has been thoroughly surveyed (and absence confirmed) or the Service has been contacted for guidance.</p>
GEN-12	Protection of Special-Status Amphibian and Reptile Species	<p>1. A District qualified biologist will conduct a desk audit to determine whether suitable special-status amphibian or reptile habitat is present in or adjacent to a maintenance activity based on all available information including the habitats modeled in the Valley Habitat Plan.</p> <p>2. If the District Wildlife or Fisheries Biologist determines that a special-status amphibian or reptile could occur in the activity area, a qualified biologist will conduct one daytime and one nighttime survey within a 7 day period preceding the onset of maintenance activities.</p> <p>a. If a special-status amphibian or reptile, or the eggs or larvae of a special status amphibian or reptile, are found within the activity area during a pre-activity survey or during project activities, the qualified biologist shall notify the project proponent about the special-status species and conduct the following work specific activities:</p> <p>i. For minor maintenance activities and for vegetation removal activities that will take less than 1 day, a qualified biologist shall conduct a special status species survey on the morning of and prior to the scheduled work.</p> <p>A. If no special status species is found, the work may proceed.</p> <p>B. If eggs or larvae of a special status species are found, a buffer will be established around the location of the eggs/larvae and work may proceed outside of the buffer zone. No work will occur within the buffer zone. Work within the buffer zone will be rescheduled until the time that eggs have hatched and/or larvae have metamorphosed.</p> <p>C. If an active western pond turtle nest is detected within the activity area, a 50-foot buffer zone around the nest will be established and maintained during the breeding and nesting season (April 1 – August 31). The buffer zone will remain in place until the young have left the nest, as determined by a qualified biologist.</p> <p>D. If adults or non-larval juveniles of a special status species are found, one of the following two</p>

BMP Number	BMP Title	BMP Description
		<p>procedures will be implemented:</p> <ul style="list-style-type: none"> i. If, in the opinion of the qualified biologist, capture and removal of the individual to a safe place outside of the work area is less likely to result in adverse effects than leaving the individual in place and rescheduling the work (e.g., if the species could potentially hide and be missed during a follow-up survey), the individual will be captured and relocated by a qualified biologist (with USFWS and/or CDFW approval, depending on the listing status of the species in question), and work may proceed. ii. If, in the opinion of the qualified biologist, the individual is likely to leave the work area on its own, and work can be feasibly rescheduled, a buffer will be established around the location of the individual(s) and work may proceed outside of the buffer zone. No work will occur within the buffer zone. Work within the buffer zone will be rescheduled. <ul style="list-style-type: none"> ii. For minor maintenance and vegetation removal activities that will take more than 1 day, the qualified biologist shall conduct a special-status species survey on each morning of and prior to the scheduled work commencing. <ul style="list-style-type: none"> E. If eggs or larvae of a special status species are found, a buffer will be established around the location of the eggs/larvae and work may proceed outside of the buffer zone. No work will occur within the buffer zone. Work within the buffer zone will be rescheduled until the time that eggs have hatched and/or larvae have metamorphosed. F. If an active western pond turtle nest is detected within the activity area, a 50 ft-buffer zone around the nest will be established and maintained during the breeding and nesting season (April 1 – August 31). The buffer zone will remain in place until the young have left the nest, as determined by a qualified biologist. G. If adults or non-larval juveniles of a special status species are found, the individual will be captured and relocated by a qualified biologist (with USFWS and/or CDFW approval, depending on the listing status of the species in question), and work may proceed. iii. For Sediment Removal and Bank Stabilization Projects the wildlife or fisheries biologist in cooperation with the project proponent shall complete a <i>Site Specific Species Protection Form for the project</i>. Elements of the form include: work rescheduling, training work crews, daily surveys, establishment of buffers and buffer fencing, on-site monitoring, habitat modification in advance of work activities, capture and relocation of individual special-status species, methods of documentation, and reporting of results. b. If no special status amphibian or reptile is found within the activity area during a pre-activity survey, the work may proceed. c. During animal conflict management activities, if special status species are found within a burrow proposed for destruction, a qualified biologist will determine an appropriate buffer distance around that burrow to ensure adequate protection of the habitat. The buffer area may include not destroying adjacent burrows as that may damage subterranean networks of the occupied burrow or produce substrate vibrations which could interfere with prey detection mechanisms. If two consecutive follow up surveys are conducted (spaced 30 days apart) in which the burrow is found to be unoccupied, work can proceed as planned. A naturally found back filled burrow known to have been inhabited by a special-status species will be presumed to still be occupied by that species and a clearly delineated buffer demarcation of the burrow area will be in place for the duration of nearby work activities. In rare instances in which destruction of the burrow is not avoidable during animal conflict management, the animal will be relocated to a safe burrow outside the

BMP Number	BMP Title	BMP Description
		<p>impact area, with USFWS and/or CDFW approval, depending on the listing status of the species in question. A biologist will observe the relocated animal until it is certain that the animal is not in immediate danger of desiccation or predation.</p>
GEN-13	Protection of Bat Colonies	<ol style="list-style-type: none"> 1. A District Wildlife Biologist will conduct a desk audit to determine whether suitable habitat (appropriate roost trees or anthropogenic structures) is present for bat colonies within 100 feet of the work site, staging areas, or access routes. 2. If potential bat colony habitat is determined to be present, within two weeks prior to the onset of work activities a qualified biologist will conduct a survey to look for evidence of a bat use. If evidence is observed, or if potential roost sites are present in areas where evidence of bat use might not be detectable (such as a tree cavity), an evening survey and/or nocturnal acoustic survey may be necessary to determine if the bat colony is active and to identify the specific location of the bat colony. 3. If an active bat colony is present then the qualified biologist will make the following determinations: <ol style="list-style-type: none"> a. The work can proceed without unduly disturbing the bat colony b. There is a need for a buffer zone to prevent disturbance to the bat colony, and implementation of the buffer zone (determined on a case-by-case basis by a qualified biologist) will reduce or eliminate the disturbance to an acceptable level. 4. If a bat colony is found in a tree or structure that must be removed or physically disturbed the qualified biologist will consult with DFW prior to initiating any removal or exclusion activities.
GEN-14	Protection of San Francisco Dusky-footed Woodrat	<ol style="list-style-type: none"> 1. Prior to work within riparian, oak woodland, or coyote brush scrub habitat, or the removal of any oak trees outside these habitats, a District Wildlife Biologist will conduct a desk audit to determine whether woodrats could be present within suitable habitat for San Francisco dusky-footed woodrat or is known to be present in or adjacent to a maintenance activity site. 2. If the District Wildlife Biologist determines that no San Francisco dusky-footed woodrat habitat is present, or there is habitat present but it will not be affected by the maintenance activity, then no further action is required. 3. If the District Wildlife Biologist determines that suitable San Francisco dusky-footed woodrat habitat is present and may be affected by the maintenance activity, a qualified biologist shall conduct a pre-activity survey within 2 weeks prior to the start of work to determine if woodrat nests are present, or within 5 feet of, the immediate activity area. If woodrat nests are determined to be present, the following measures shall be implemented: <ol style="list-style-type: none"> a. To the extent feasible, impacts to woodrat nests will be avoided by maintaining a minimum 5-ft buffer between maintenance activities and nests. Even if a 5-ft buffer cannot be maintained, the District will minimize impacts to nests by avoiding the direct destruction or modification of the nests to the extent feasible. b. If one or more woodrat nests are determined to be present and physical disturbance or destruction of the nests cannot be avoided, then the woodrats shall be evicted from their nests and the nest material relocated outside of the disturbance area, prior to onset of activities that would disturb the nest, to avoid injury or mortality of the woodrats. First, an alternate location for the nest material shall be chosen by a qualified biologist based on the following criteria: 1) proximity to current nest location; 2) safe buffer distance from planned work; 3) availability of food resources; and 4) availability of cover. An alternate nest structure will then be built at the chosen location. The structure will be made up of small logs (e.g., available materials 2 inches in diameter or greater) stacked to provide a foundation

BMP Number	BMP Title	BMP Description
		<p>on which the woodrats can add nest material. Subsequently, during the evening hours (i.e., within 2 hours prior to sunset), a qualified biologist will slowly dismantle the existing woodrat nest to allow any woodrats to flee and seek cover. All sticks from the nest will be collected and spread over the alternate structure. If young woodrats that are still dependent on their mother are discovered, relocation efforts will cease for the evening and the California Department of Fish and Wildlife will be contacted for guidance on how to proceed.</p>
GEN-15	Salvage Native Aquatic Vertebrates from Dewatered Channels	<p>If fisheries or native aquatic vertebrates are present when cofferdams, water bypass structures, and silt barriers are to be installed, a fish and native aquatic vertebrate relocation plan shall be implemented to ensure that fish and native aquatic vertebrates are not stranded. Relocation efforts will be based on the District's Fish Relocation Guidelines (Attachment B). Streams that support a sensitive species (i.e. steelhead) will require a relocation effort and/ or initial onsite monitoring by a qualified biologist depending on seasonal conditions:</p> <ol style="list-style-type: none"> 1. In non-tidal channels, where water is to be diverted, prior to the start of work or during the installation of water diversion structures, native aquatic vertebrates shall be captured in the work area and transferred to another reach as determined by a qualified biologist. Timing of work in streams that supports a significant number of amphibians will be delayed until metamorphosis occurs to minimize impacts to the resource. Capture and relocation of aquatic native vertebrates is not required at individual work sites when site conditions preclude reasonably effective operation of capture gear and equipment. 2. Aquatic invertebrates will not be transferred (other than incidental catches) because of their anticipated abundance and colonization after completion of the repair work.
GEN-15.5	Avoidance of Impacts on the San Joaquin Kit Fox	<ol style="list-style-type: none"> 1. A qualified District biologist will conduct a desk audit to determine whether an SMP activity will occur in an area where the San Joaquin kit fox could potentially occur (i.e., roughly east of Frazier Lake Road and south of Bloomfield Avenue), and in potential habitat for the species. 2. If the District biologist determines that an SMP activity could occur in an area that could potentially support a kit fox, the SCVWD will implement applicable pre-activity surveys and other measures in accordance with the USFWS's <i>San Joaquin Kit Fox Survey Protocol for the Northern Range</i>, as follows: <ol style="list-style-type: none"> a) Conduct a preconstruction/pre-activity survey no less than 14 days and no more than 30 days prior to the beginning of project implementation. Surveys shall identify kit fox habitat features on the project site and evaluate use by kit fox and, if possible, and assess the potential impacts to the kit fox by the proposed activity. The status of all dens shall be determined and mapped in accordance with the survey protocol. b) If a natal/pupping den is discovered within the project area or within 200 feet of the project boundary, the USFWS shall be immediately notified. Disturbance to all San Joaquin kit fox dens should be avoided to the maximum extent possible. Destruction of any known or natal/pupping kit fox den would require take authorization from the USFWS. c) The project proponent will establish exclusion zones around the kit fox dens, if determined to be present. The configuration of the exclusion should have a radius measured outward from the entrance or cluster of entrances. The following radii are minima to be applied: <ul style="list-style-type: none"> ▪ Potential den: 50 feet ▪ Known den: 100 feet ▪ Natal/pupping den: Service must be contacted (occupied and unoccupied) ▪ Atypical den: 50 feet.

BMP Number	BMP Title	BMP Description
		3. If take of the San Joaquin kit fox will occur, take authorization from the USFWS and CDFW will be necessary.

General Maintenance Practices

GEN-16	In-Channel Minor Activities	For in-channel minor work activities, work will be conducted from the top of the bank if access is available and there are flows in the channel.
GEN-17	Employee/Contractor Training	All appropriate District staff and contractors will receive annual training on Stream Maintenance Program BMPs. The training will also include an overview of special-status species identification and habitat requirements. District staff and contractors will receive fact sheets to assist with in-the-field identification of special-status species and their habitats.
GEN-18	Paperwork Required On-site	<ol style="list-style-type: none"> 1. Copies of regulatory permits related to the Stream Maintenance Program will be kept on-site and available for review, if requested by regulatory personnel. 2. Copies of the Stream Maintenance Program Manual and this BMP Manual will be kept on-site.
GEN-19	Work Site Housekeeping	<ol style="list-style-type: none"> 1. District employees and contractors will maintain the work site in neat and orderly conditions on a daily basis, and will leave the site in a neat, clean, and orderly condition when work is complete. 2. Slash, sawdust, cuttings, etc. will be removed to clear the site of vegetation debris. As needed, paved access roads and trails will be swept and cleared of any residual vegetation or dirt resulting from the maintenance activity. 3. For activities that last more than one day, materials or equipment left on the site overnight will be stored as inconspicuously as possible, and will be neatly arranged. Any materials and equipment left on the site overnight will be stored to avoid erosion, leaks, or other potential impacts to water quality (see BMPs GEN-24). 4. The District's maintenance crews are responsible for properly removing and disposing of all debris incurred as a result of construction within 72 hours of project completion. 5. All trash that is brought to a project site during maintenance activities (e.g., plastic water bottles, plastic lunch bags, cigarettes) will be collected at the site daily.
GEN-20	Erosion and Sediment Control Measures	<ol style="list-style-type: none"> 1. Soils exposed due to maintenance activities will be seeded and stabilized using hydroseeding, straw placement, mulching, and/or erosion control fabric. These measures will be implemented such that the site is stabilized and water quality protected prior to significant rainfall. The channel bed and areas below the Ordinary High Water Mark (OHWM) are exempt from this BMP. 2. The preference for erosion control fabrics will be to consist of natural fibers; however, steeper slopes and areas that are highly erodible may require more structured erosion control methods. No non-porous fabric will be used as part of a permanent erosion control approach. Plastic sheeting may be used to temporarily protect a slope from runoff, but only if there are no indications that special-status species would be impacted by the application. 3. Erosion control measures will be installed according to manufacturer's specifications. 4. Appropriate measures include, but are not limited to, the following: <ul style="list-style-type: none"> ○ Silt Fences ○ Straw Bale Barriers ○ Brush or Rock Filters ○ Storm Drain Inlet Protection ○ Sediment Traps

BMP Number	BMP Title	BMP Description
		<ul style="list-style-type: none"> ○ Sediment Basins ○ Erosion Control Blankets and Mats ○ Soil Stabilization (i.e. tackified straw with seed, jute or geotextile blankets, etc.) ○ Wood chips ○ Straw mulch <p>5. All temporary construction-related erosion control methods shall be removed at the completion of the project (e.g. silt fences).</p> <p>6. Surface barrier applications installed as a method of animal conflict management, such as chain link fencing, woven geotextiles, and other similar materials, will be installed no longer than 300 feet, with at least an equal amount of open area prior to another linear installation; and only on one side of levee slopes. Inboard and outboard areas will only have installations set in an alternating pattern, such that no inboard and outboard levee faces would have erosion control blankets along the same levee stationing.</p> <p>7. Each maintenance site will be visually inspected at least once daily during extended storm events to confirm that BMPs are effective and maintained as necessary.</p> <p>8. Each maintenance site will be visually inspected within two business days (48 hours) after each significant rain event to determine whether BMPs were effective and identify the need to modify or maintain existing BMPs or include additional BMPs to be protective.</p>
GEN-21	Staging and Stockpiling of Materials	<p>1. To protect on-site vegetation and water quality, staging areas should occur on access roads, surface streets, or other disturbed areas that are already compacted and only support ruderal vegetation. Similarly, all maintenance equipment and materials (e.g., road rock and project spoil) will be contained within the existing service roads, paved roads, or other pre-determined staging areas.</p> <p>2. Building materials and other maintenance-related materials, including chemicals and sediment, will not be stockpiled or stored where they could spill into water bodies or storm drains. Materials will not be stockpiled longer than seven (7) calendar days.</p> <p>3. No runoff from the staging areas may be allowed to enter water ways, including the creek channel or storm drains, without being subjected to adequate filtration (e.g., vegetated buffer, swale, hay wattles or bales, silt screens).</p> <p>4. The discharge of decant water to water ways from any on-site temporary sediment stockpile or storage areas is prohibited.</p> <p>5. Wet material removed from an isolated creek reach may be pulled to the side of the channel (within the channel and below top of bank) and allowed to naturally drain prior to removal from the channel. Pulled material will be removed from the channel prior to deactivation of the site or forecast of rain.</p> <p>6. During the wet season, no stockpiled soils will remain exposed, unless surrounded by properly installed and maintained (i.e., per manufacturer specifications) silt fencing or other means of erosion control. During the dry season; exposed, dry stockpiles will be watered, enclosed, covered, or sprayed with non-toxic soil stabilizers (GEN-24).</p> <p>7. All pipes, culverts, or similar structures stored at a site within sensitive species areas, for one or more overnight periods shall be securely capped prior to storage or inspected before the pipe is subsequently moved. If any potential special-status species are observed within a pipe, a District biologist shall be consulted on what steps should be taken to protect the species. If a District biologist is on-site, they may remove the special status species from the pipes and relocate to the nearest appropriate and unaffected habitat.</p>

BMP Number	BMP Title	BMP Description
GEN-22	Sediment Transport	To prevent sediment-laden water from being released back into waterways during transport of spoils to disposal locations, truck beds will be lined with an impervious material (e.g., plastic), or the tailgate blocked with wattles, hay bales, or other appropriate filtration material. Trucks may then drain excess water by slightly tilting the loads and allowing the water to drain out through the applied filter, but only within the active project area of the creek where the sediment is being loaded into the trucks or within an identified vegetated area (swale) that is separated from the creek.
GEN-23	Stream Access	<p>District personnel will use existing access ramps and roads to the extent feasible. If necessary to avoid large mature trees, native vegetation, or other significant habitat features, temporary access points will be constructed in a manner that minimizes impacts according to the following guidelines:</p> <ol style="list-style-type: none"> 1. Temporary access points will be constructed as close to the work area as possible to minimize equipment transport 2. In considering channel access routes, slopes of greater than 20 percent will be avoided, if possible. 3. Any temporary fill used for access will be removed upon completion of the project and pre-project topography will be restored to the extent possible. 4. When temporary access is removed, disturbed areas will be revegetated or filled with compacted soil, seeded, and/or stabilized with erosion control fabric immediately after construction to prevent future erosion. 5. Personnel will use the appropriate equipment for the job that minimizes impacts and disturbance to the stream bottom. Appropriately-tired vehicles, either tracked or wheeled, will be used depending on the site and maintenance activity.
GEN-24	On-Site Hazardous Materials Management	<ol style="list-style-type: none"> 1. An inventory of all hazardous materials used (and/or expected to be used) at the worksite and the end products that are produced (and/or expected to be produced) after their use will be maintained by the worksite manager. 2. As appropriate, containers will be properly labeled with a “Hazardous Waste” label and hazardous waste will be properly recycled or disposed of off-site. 3. Contact of chemicals with precipitation will be minimized by storing chemicals in watertight containers with appropriate secondary containment to prevent any spillage or leakage. 4. Quantities of toxic materials, such as equipment fuels and lubricants, will be stored with secondary containment that is capable of containing 110% of the primary container(s). 5. Petroleum products, chemicals, cement, fuels, lubricants, and non-storm drainage water or water contaminated with the aforementioned materials will not contact soil and not be allowed to enter surface waters or the storm drainage system. 6. All toxic materials, including waste disposal containers, will be covered when they are not in use, and located as far away as possible from a direct connection to the storm drainage system or surface water. 7. Sanitation facilities (e.g., portable toilets) will be placed outside of the creek channel and floodplain. Direct connections with soil, the storm drainage system, and surface waters will be avoided. 8. Sanitation facilities will be regularly cleaned and/or replaced, and inspected daily for leaks and spills.-
GEN-25	Existing Hazardous Materials	If hazardous materials, such as oil, batteries or paint cans, are encountered at the maintenance sites, the District will carefully remove and dispose of them according to applicable regulatory requirements. District staff will wear proper protective gear and store the waste in appropriate hazardous waste containers until it can be disposed at a hazardous waste facility.
GEN-26	Spill Prevention and Response	The District will prevent the accidental release of chemicals, fuels, lubricants, and non-storm drainage water into channels following these measures:

BMP Number	BMP Title	BMP Description
		<ol style="list-style-type: none"> 1. District field personnel will be appropriately trained in spill prevention, hazardous material control, and clean up of accidental spills. 2. Equipment and materials for cleanup of spills will be available on site and spills and leaks will be cleaned up immediately and disposed of according to applicable regulatory requirements. 3. Field personnel will ensure that hazardous materials are properly handled and natural resources are protected by all reasonable means. 4. Spill prevention kits will always be in close proximity when using hazardous materials (e.g., at crew trucks and other logical locations). All field personnel will be advised of these locations. 5. District staff will routinely inspect the work site to verify that spill prevention and response measures are properly implemented and maintained. <p><i>Spill Response Measures:</i></p> <p>For small spills on impervious surfaces, absorbent materials will be used to remove the spill, rather than hosing it down with water. For small spills on pervious surfaces such as soil, the spill will be excavated and properly disposed rather than burying it. Absorbent materials will be collected and disposed of properly and promptly.</p> <p>If a hazardous materials spill occurs that cannot be contained or cleaned up with the onsite materials, the onsite District field personnel will be responsible for immediately initiating an emergency response sequence by notifying the proper authorities (i.e., District Emergency Response (ER) Team and public fire and hazmat agencies) of the release; taking appropriate defensive steps from a safe distance to secure the site to minimize damage to people, environment, and property (PEP); and deferring all other response activities to public emergency response agencies and/or the District Emergency Response (ER) Team or District ER Contractor. Depending on the nature of the release, the District ER Team’s actions will include: urgent (responding within 2 hours of notification) field response site reconnaissance, emergency sequence initiation, defensive containment, release control, incident command; or priority (non 2-hour) field response site reconnaissance and clean-up operations.</p> <p>If a “reportable” spill of petroleum products occurs, the District’s Stream Maintenance Implementation Program Manager will be notified and action taken to contact the appropriate safety and cleanup crews. A reportable spill is defined as when:</p> <ul style="list-style-type: none"> ▪ a film or sheen on, or discoloration of, the water surface or adjoining bank/shoreline is observed; or ▪ a sludge or emulsion is deposited beneath the surface of the water or adjoining banks/shorelines (40 Code of Federal Regulations 110); or when ▪ another violation of water quality standards is observed. <p>A written description of the reportable release must be submitted to the appropriate Regional Water Quality Control Board and the California Department of Toxic Substances Control (DTSC). This submittal must contain a description of the release, including the type of material and an estimate of the amount spilled, the date of the release, an explanation of why the spill occurred, and a description of the steps taken to prevent and control future releases.</p> <p>If an appreciable spill has occurred, and results determine that project activities have adversely affected surface water or groundwater quality, a detailed analysis will be performed to the specifications of DTSC to identify the likely cause of contamination. This analysis will include recommendations for reducing or eliminating the source or mechanisms of contamination. Based on this analysis, the District or contractors will select and implement</p>

BMP Number	BMP Title	BMP Description
		measures to control contamination, with a performance standard that surface and groundwater quality will be returned to baseline conditions. These measures will be subject to approval by the District, DTSC, and the Regional Water Quality Control Board.
GEN-27	Existing Hazardous Sites	Upon selection of maintenance project locations, the District will conduct a search for existing known contaminated sites, as part of its annual preparation of the Notice of Proposed Work (NPW), on the State Water Resource Control Board's GeoTracker Web site (http://www.geotracker.waterboards.ca.gov). The Geotracker search will only be performed for the District's ground disturbing activities. For any proposed ground disturbing maintenance sites located within 1,500 feet of any "open" sites where contamination has not been remediated, the District will contact the RWQCB case manager listed in the database. The District will work with the case manager to ensure maintenance activities would not affect cleanup or monitoring activities or threaten the public or environment.
GEN-28	Fire Prevention	<ol style="list-style-type: none"> 1. All earthmoving and portable equipment with internal combustion engines will be equipped with spark arrestors. 2. During the high fire danger period (April 1–December 1), work crews will :-a)- have appropriate fire suppression equipment available at the work site.
GEN-29	Dust Management	<p>The District will implement the Bay Area Air Quality Management District's (BAAQMD) required Dust Control Measures (http://www.baaqmd.gov/~media/Files/Planning%20and%20Research/CEQA/BAAQMD%20CEQA%20Guidelines%20May%202011.ashx?la=en). Current measures stipulated by the BAAQMD Guidelines include the following:</p> <ol style="list-style-type: none"> 1. All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day. 2. All haul trucks transporting soil, sand, or other loose material off-site shall be covered. 3. All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited. 4. Water used to wash the various exposed surfaces (i.e., parking areas, staging areas, soil piles, graded areas, etc.) will not be allowed to enter the water way. 5. All vehicle speeds on unpaved roads shall be limited to 15 mph. 6. All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used. 7. Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points. 8. All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator. 9. Post a publicly visible sign with the telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.

BMP Number	BMP Title	BMP Description
GEN-30	Vehicle and Equipment Maintenance	<ol style="list-style-type: none"> 1. All vehicles and equipment will be kept clean. Excessive build-up of oil and grease will be prevented. 2. All equipment used in the creek channel will be inspected for leaks each day prior to initiation of work. Maintenance, repairs, or other necessary actions will be taken to prevent or repair leaks, prior to use. 3. Incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) will be checked for leaking oil and fluids. Vehicles or equipment visibly leaking operational fluids will not be allowed on-site. 4. No heavy equipment will operate in a live stream. This will not apply to activities for which no other option exists, such as sediment removal which cannot be conducted from top of bank, etc. In these cases, dewatering will be conducted as necessary, following the protocols in BMPs GEN-33 or GEN-34. 5. No equipment servicing will be done in the creek channel or immediate floodplain, unless equipment stationed in these locations cannot be readily relocated (i.e., pumps and generators). 6. If emergency repairs are required in the field, only those repairs necessary to move equipment to a more secure location, and that can be performed without releasing any material into the floodway or water, will be conducted in the channel or floodplain. 7. If necessary, all servicing of equipment done at the job site will be conducted in a designated, protected area to reduce threats to water quality from vehicle fluid spills. Designated areas will not directly connect to the ground, surface water, or the storm drain system. The service area will be clearly designated with berms, sandbags, or other barriers. Secondary containment, such as a drain pan, to catch spills or leaks will be used when removing or changing fluids. Fluids will be stored in appropriate containers with covers, and properly recycled or disposed of offsite.
GEN-31	Vehicle Cleaning	<ol style="list-style-type: none"> 1. Equipment will be cleaned of any visible sediment or vegetation clumps before transferring and using in a different watershed to avoid spreading pathogens or exotic/invasive species. 2. Vehicle and equipment washing can occur on-site only as needed to prevent the spread of sediment, pathogens or exotic/invasive species. No runoff from vehicle or equipment washing is allowed to enter water bodies, including creek channels and storm drains, without being subjected to adequate filtration (e.g., vegetated buffers, straw wattles or bales, fiber rolls, and silt screens). The discharge of decant water from any on-site wash area to water bodies or to areas outside of the active project site is prohibited. Additional vehicle/equipment washing will occur at the approved wash area in the District's corporation yard.
GEN-32	Vehicle and Equipment Fueling	<ol style="list-style-type: none"> 1. No fueling will be done in the channel (top-of-bank to top-of-bank) or immediate floodplain unless equipment stationed in these locations cannot be readily relocated (e.g., pumps and generators). 2. All off-site fueling sites (i.e., on access roads above the top-of-bank) will be equipped with secondary containment and avoid a direct connection to soil, surface water, or the storm drainage system. 3. For stationary equipment that must be fueled on-site, secondary containment, such as a drain pan or drop cloth, will be used to prevent accidental spills of fuels from reaching the soil, surface water, or the storm drain system.

BMP Number	BMP Title	BMP Description
Dewatering		
GEN-33	Dewatering for Non-Tidal Sites	<p>When sediment removal and bank stabilization work area includes a flowing stream, the entire streamflow will be diverted around the work area by construction of a temporary dam and/or bypass. Where appropriate, stream flow diversions will occur via gravity driven systems.</p> <p><i>A. Planning to avoid and minimize impacts to water quality and aquatic wildlife:</i></p> <ol style="list-style-type: none"> 1. For construction and monitoring of a stream flow bypass, the <i>Sediment Removal and Bank Stabilization Projects</i> checklist will be completed. 2. Recommendations by a qualified Fisheries Biologist to protect native fisheries and aquatic vertebrates will be incorporated into the bypass design. The recommendations may include but are not limited to: <ol style="list-style-type: none"> i. Screening the stream flow diversion source or pump to prevent entrainment of native fish or amphibian species. The screening dimensions will be appropriate to the species present. ii. Relocation of native aquatic vertebrates. This will include the methods to be used to capture and hold and move the aquatic vertebrates and a description of where the aquatic vertebrates will be relocated. 3. Depending on the channel configurations, sediment removal activities may occur where the flows are not bypassed around the work site as long as a berm is left between the work area and stream flows to minimize water quality impacts during excavation activities. The berm between the work and the live channel will be wide enough to prevent introduction of turbid water from the cell into the live channel. <p><i>B. Construction:</i></p> <ol style="list-style-type: none"> 1. The construction of facilities will be based on the water bypass plan. 2. Cofferdams will be installed both upstream and downstream of the work area to minimize impacts or the distance necessary to accomplish effective passive systems. 3. In streams where water may enter the construction site from downstream (reverse flow) additional coffer dams (downstream) may be necessary. When multiple coffer dams are constructed, the upstream dam will be constructed first. 4. Instream cofferdams will only be built from materials such as sandbags, earth fill, clean gravel, or rubber bladders which will cause little or no siltation or turbidity. 5. Plastic sheeting will be placed over k-rails, timbers, and earth fill to minimize water seepage into and out of the maintenance areas. The plastic sheets will be firmly anchored, using sandbags, to the streambed to minimize water seepage. 6. When pumping is necessary to dewater a work site, a temporary siltation basin and/or use of silt bags may be required to prevent sediment from re-entering the wetted channel. Pump intakes will be screened to prevent harm to aquatic wildlife. 7. If necessary to prevent erosion an energy dissipater will be constructed at the discharge point. 8. Timing of flow diversions will be coordinated with the completion of the dam structure to facilitate not drying up the downstream creek area and to minimize dry back conditions. <p><i>C. Implementation:</i></p> <ol style="list-style-type: none"> 1. Water flows downstream of the project site will be maintained to prevent stranding aquatic vertebrates.

BMP Number	BMP Title	BMP Description
		<ol style="list-style-type: none"> 2. Water diverted around work sites and water detained by coffer dams will be protected from maintenance activity-related pollutants, such as soils, equipment lubricants or fuels. 3. The <i>Fish Relocation Guidelines</i> (Attachment B) will be implemented to ensure that fish and other aquatic vertebrates are not stranded during construction and implementation of channel dewatering. <ol style="list-style-type: none"> a) Native aquatic vertebrates shall be captured in the work area and transferred to another reach as determined by a qualified biologist. Timing of work in streams that supports a significant number of amphibians will be delayed until metamorphosis occurs to minimize impacts to the resource. Capture and relocation of aquatic native vertebrates is not required at individual work sites when site conditions preclude reasonably effective operation of capture gear and equipment. b) Aquatic invertebrates will not be transferred (other than incidental catches) because of their anticipated abundance and colonization after completion of the repair work. 4. Filtration devices (silt bags attached to the end of discharge hoses and pipes to remove sediment from discharged water) or settling basins will be provided as necessary at discharge sites to ensure that the turbidity of discharged water is not visibly more turbid than the water in the channel upstream of the maintenance site. If increases in turbidity are observed, additional measures will be implemented such as a larger settling basin or additional filtration. If increases in turbidity persist, the District’s Stream Maintenance Program Implementation Project Manager will be alerted since turbidity measurements may be required. 5. Water remaining in the work area will be removed by evaporation, seepage, or pumping. When pumping is required to dewater a site, the decanted water will be discharged with water bypassed around the site or in a separate erosion control – energy dissipation area/vegetated swale. The turbidity of discharged water will not be visibly more turbid than the receiving water. <p><i>Deconstruction:</i></p> <ol style="list-style-type: none"> 1. When maintenance is completed, the flow diversion structure will be removed as soon as possible. Impounded water will be released at a reduced velocity to minimize erosion, turbidity, or harm to downstream habitat. 2. Removal will normally proceed from downstream in an upstream direction. 3. When diversion structures are removed, the ponded water will be directed back into the low-flow channel in a phased manner to minimize erosion and downstream water quality impacts. Normal flows will be restored. 4. The area disturbed by flow bypass mechanisms will be restored to the pre-project condition at the completion of the project (to the extent practical). This may include, but is not limited to, recontouring the area and planting of riparian vegetation.

BMP Number	BMP Title	BMP Description
GEN-34	Dewatering in Tidal Work Areas	<p>For tidal areas, a downstream cofferdam will be constructed to prevent the work area from being inundated by tidal flows.</p> <ol style="list-style-type: none"> 1. Installation of cofferdams and fish exclusion measures will be installed at low tide when the channel and project site are at their driest. 2. It is preferable to not use any bypass pipes when work is being conducted on one side of the channel, if isolated by the cofferdam, and flows can continue on the other side of the creek channel without entering the project area. 3. If downstream flows cannot be diverted around the project site, the creek waters will be transmitted around the site through cofferdam bypass pipes. Waters discharged through tidal cofferdam bypass pipes will not exceed 50 NTUs over the background levels of the tidal waters into which they are discharged. 4. Cofferdams in tidal areas may be made from earthen or gravel material. If earth is used, the downstream and upstream faces will be covered by a protected covering (e.g., plastic or fabric) if needed to minimize erosion. A protected covering or sheeting will be placed on the water side of an earthen coffer dam to protect water quality. 5. When maintenance is completed, the cofferdams and bypass pipes will be removed as soon as possible but no more than 72 hours after work is completed. Flows will be restored at a reduced velocity to minimize erosion, turbidity, or harm to downstream habitat.
GEN-35	Pump/Generator Operations and Maintenance	<p>When needed to assist in channel dewatering, pumps and generators will be maintained and operated in a manner that minimizes impacts to water quality and aquatic species.</p> <ol style="list-style-type: none"> 1. Pumps and generators will be maintained according to manufacturers' specifications to regulate flows to prevent dryback or washout conditions. 2. Pumps will be operated and monitored to prevent low water conditions, which could pump muddy bottom water, or high water conditions, which creates ponding. 3. All pump intakes will be screened. Pumps in steelhead creeks will be screened according to NMFS criteria (http://www.swr.noaa.gov/sr/fishscrn.pdf) to prevent entrainment of steelhead.
Public Safety		
GEN-36	Public Outreach	<p>The public will be informed of stream maintenance work prior to the start of work as part of the preparation of the NPW for all projects in the NPW:</p> <ol style="list-style-type: none"> 1. Each spring, a newspaper notice will be published with information on the NPW work sites, approximate work dates, and contact information. 2. Neighborhood Work Notices will be distributed as part of the NPW preparation prior to the start of work. 3. Local governments (cities and County) will be notified of scheduled maintenance work. The NPW will be submitted to the public works departments, local fire districts, and the District's Flood Protection and Watershed Advisory Committees. 4. The District will post specific information on individual maintenance projects on the Stream Maintenance Web site: (http://valleywater.org/EkContent.aspx?id=379&terms=stream+maintenance) 5. For high profile projects, at the District's discretion, signs will be posted in the neighborhood to notify the public at least one week in advance of maintenance schedules, trail closures, and road/lane closures as necessary and as possible. Signage used at work sites will include contact information for lodging comments and/or complaints regarding the maintenance activities.
GEN-37	Implement Public Safety Measures	<p>The District will implement public safety measures during maintenance as follows:</p> <ol style="list-style-type: none"> 1. Construction signs will be posted at job sites warning the public of construction work and to exercise caution,

BMP Number	BMP Title	BMP Description
		<p>as appropriate to public accessed areas.</p> <ol style="list-style-type: none"> 2. Where work is proposed adjacent to a recreational trail, warning signs will be posted several feet beyond the limits of work. Signs will also be posted if trails will be temporarily closed. 3. If needed, a lane will be temporarily closed to allow for trucks to pull into and out of access points to the work site. 4. Temporary fencing, either the orange safety type or chain link, will be installed above repair sites on bank stabilization projects. 5. When necessary, District or contracted staff will provide traffic control and site security.
GEN-38	Minimize Noise Disturbances to Residential Areas	<p>The District will implement maintenance practices that minimize disturbances to residential areas surrounding work sites.</p> <ol style="list-style-type: none"> 1. With the exception of emergencies, work will be conducted during normal working hours. Maintenance activities in residential areas will not occur on Saturdays, Sundays, or District observed holidays except during emergencies, or with approval by the local jurisdiction and advance notification of surrounding residents. 2. Vehicles, generators and heavy equipment will be equipped with adequate mufflers. 3. Idling of vehicles will be prohibited beyond 5 minutes unless operation of the engine is required to operate a necessary system such as a power take-off (PTO).
GEN-39	Planning for Pedestrians, Traffic Flow, and Safety Measures	<ol style="list-style-type: none"> 1. Work will be staged and conducted in a manner that maintains two-way traffic flow on public roadways in the vicinity of the work site. If temporary lane closures are necessary, they will be coordinated with the appropriate jurisdictional agency and scheduled to occur outside of peak traffic hours (7:00 – 10:00 a.m. and 3:00 – 6:00 p.m.) to the maximum extent practicable. Any lane closures will include advance warning signage, a detour route and flaggers in both directions. When work is conducted on public roads and may have the potential to affect traffic flow, work will be coordinated with local emergency service providers as necessary to ensure that emergency vehicle access and response is not impeded. 2. Bicycle and pedestrian facility closures will be scheduled outside of peak traffic hours (7:00 – 10:00 a.m. and 3:00 – 6:00 p.m.) to the maximum extent practicable. 3. Public transit access and routes will be maintained in the vicinity of the work site. If public transit will be affected by temporary road closures and require detours, affected transit authorities will be consulted and kept informed of project activities. 4. Adequate parking will be provided or designated public parking areas will be used for maintenance-related vehicles not in use through the maintenance period. 5. Access to driveways and private roads will be maintained. If brief periods of maintenance would temporarily block access, property owners will be notified prior to maintenance activities.

BMP Number	BMP Title	BMP Description
Cultural Resources		
GEN-40	Discovery of Cultural Remains or Historic or Paleontological Artifacts	<p>Work in areas where remains or artifacts are found will be restricted or stopped until proper protocols are met.</p> <ol style="list-style-type: none"> 1. Work at the location of the find will halt immediately within 50 feet of the find. A “no work” zone shall be established utilizing appropriate flagging to delineate the boundary of this zone, which shall measure at least 50 feet in all directions from the find. 2. The District shall retain the services of a Consulting Archaeologist or Paleontologist, who shall visit the discovery site as soon as practicable, and perform minor hand-excavation to describe the archaeological or paleontological resources present and assess the amount of disturbance. 3. The Consulting Archaeologist shall provide to the District and the Corps, at a minimum, written and digital-photographic documentation of all observed materials, utilizing the guidelines for evaluating archaeological resources for the California Register of Historic Places (CRHP) and National Register of Historic Places (NRHP). Based on the assessment, the District and Corps shall identify the CEQA and Section 106 cultural-resources compliance procedure to be implemented. 4. If the find appears to not meet the CRHP or NRHP criteria of significance, and the Corps archaeologist concurs with the Consulting Archaeologist’s conclusions, construction shall continue while monitored by the Consulting Archaeologist. The authorized maintenance work shall resume at the discovery site only after the District has retained a Consulting Archaeologist to monitor and the Watershed Manager has received notification from the Corps to continue work. 5. If the find appears significant, avoidance of additional impacts is the preferred alternative. The Consulting Archaeologist shall determine if adverse impacts to the resources can be avoided. 6. When avoidance is not practical (e.g., maintenance activities cannot be deferred or they must be completed to satisfy the SMP objective), the District shall develop an Action Plan and submit it to the Corps within 48 hours of Consulting Archaeologist’s evaluation of the discovery. The action Plan may be submitted via e-mail to {rstradford@spd.usace.army.mil}. The Action Plan is synonymous with a data-recovery plan. It shall be prepared in accordance with the current professional standards and State guidelines for reporting the results of the work, and shall describe the services of a Native American Consultant and a proposal for curation of cultural materials recovered from a non-grave context. 7. The recovery effort will be detailed in a report prepared by the archaeologist in accordance with current archaeological standards. Any non-grave artifacts will be placed with an appropriate repository. 8. The Consulting Paleontologist will meet the Society for Vertebrate Paleontology’s criteria for a “qualified professional paleontologist” (Society of Vertebrate Paleontology Conformable Impact Mitigation Guidelines Committee 1995). 9. The paleontologist will follow the Society for Vertebrate Paleontology’s guidelines for treatment of the artifact. Treatment may include preparation and recovery of fossil materials for an appropriate museum or university collection, and may include preparation of a report describing the finds. The District will be responsible for ensuring that paleontologist’s recommendations are implemented. 10. In the event of discovery of human remains (or the find consists of bones suspected to be human), the field crew supervisor shall take immediate steps to secure and protect such remains from vandalism during periods when work crews are absent.) 11. Immediately notify the Santa Clara County Coroner and provide any information that identify the remains as Native American. If the remains are determined to be from a prehistoric Native American, or determined to be a Native American from the ethnographic period, the Coroner shall contact the Native American Heritage

BMP Number	BMP Title	BMP Description
		<p>Commission (NAHC) within 24 hours of being notified of the remains. The NAHC then designates and notifies within 24 hours a Most Likely Descendant (MLD). The MLD has 24 hours to consult and provide recommendations for the treatment or disposition, with proper dignity, of the human remains and grave goods.</p> <p>12. Preservation in situ is the preferred option. Human remains shall be preserved in situ if continuation of the maintenance work, as determined by the Consulting Archaeologist and MLD, will not cause further damage to the remains. The remains and artifacts shall be documented and the find location carefully backfilled (with protective geo-fabric if desirable) and recorded in District project files.</p> <p>13. Human remains or cultural items exposed during maintenance that cannot be protected from further damage shall be exhumed by the Consulting Archaeologist at the discretion of the MLD and reburied with the concurrence of the MLD in a place mutually agreed upon by all parties.</p>
GEN-41	Review of Projects with Native Soil	<p>A cultural resources specialist will conduct a review and evaluation of those sites that would involve disturbance / excavation of native soil previously undisturbed by contemporary human activities to determine their potential for affecting significant cultural resources. The evaluation of the potential to disturb cultural resources will be based on an initial review of archival information provided by the California Historical Resources System/Northwest Information Center (CHRIS/NWIC) in regard to the project area based on a 0.25 mile search radius. It is recommended that this initial archival review be completed by a professional archaeologist who will be able to view confidential site location data and literature to arrive at a preliminary sensitivity determination. If necessary, a further archival record search and literature review (including a review of the Sacred Lands Inventory of the Native American Heritage Commission); and a field inventory of the project area will be conducted to determine the presence/absence of surface cultural materials associated with either prehistoric or historic occupation. The results along with any mitigation and/or management recommendations would be presented in an appropriate report format and include any necessary maps, figures, and correspondence with interested parties. A summary table indicating appropriate management actions (e.g., monitoring during construction, presence/absence testing for subsurface resources; data recovery, etc.) will be developed for each project site reviewed. The management actions will be implemented on site to avoid significant effects to cultural resources.</p>

Utilities

GEN-42	Investigation of Utility Line Locations	<p>An evaluation of the locations of utility lines that could be affected by maintenance activities will be conducted annually as part of the preparation of the Notice of Proposed Work (NPW). Utilities will be avoided as much as possible. For maintenance areas with the potential for adverse effects on utility services, the following measures shall be implemented:</p> <ol style="list-style-type: none"> 1. Utility excavation or encroachment permits shall be required from the appropriate agencies. These permits include measures to minimize utility disruption. The District and its contractors shall comply with permit conditions. Such conditions shall be included in construction contract specifications. 2. Utility locations shall be verified through a field survey (potholing) and use of the Underground Service Alert services. 3. Detailed specifications shall be prepared as part of the design plans to include procedures for the excavation, support, and/or fill of areas around utility cables and pipelines. All affected utility services shall be notified of the District's maintenance plans and schedule. Arrangements shall be made with these entities regarding protection, relocation, or temporary disconnection of services. 4. Residents and businesses in the project area shall be notified of planned utility service disruption 2 to 4 days in advance, in conformance with state standards. 5. Disconnected cables and lines shall be reconnected promptly.
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B. SECTION B – Sediment Removal BMPs

This group of BMPs is intended to be implemented specifically during sediment removal activities to avoid potential impacts on biological resources.

BMP Number	BMP Title	BMP Description
SED-1	Groundwater Management	If high levels of groundwater (i.e., visible water) are encountered during excavations in a work area, the water will be pumped out of the work site or left within the work area if the work activity is not causing water quality degradation in a live stream. Water Quality monitoring would need to occur. If necessary to protect water quality, the extracted water will be discharged into specifically constructed infiltration basins, holding ponds, or areas with vegetation to remove sediment prior to the water re-entering a creek. Water discharged into vegetated areas or swales will be pumped in a manner that will not create erosion around vegetation.
SED-2	Prevent Scour Downstream of Sediment Removal	Sediment removal sites in the transport zone on alluvial fans may cause increased scour downstream if they experience scouring flows or rapid sediment accumulation after maintenance. After sediment removal, the channel will be graded so that the transition between the existing channel both upstream and downstream of the maintenance area is smooth and continuous between the maintained and non-maintained areas and does not present a sudden vertical transition (wall of sediment) or other blockage that could erode once flows are restored to the channel.
SED-3	Restore Channel Features	Low-flow channels within non-tidal streams will be contoured to facilitate fish passage and will emulate the pre-construction conditions as closely as possible, within the finished channel topography.
SED-4	Berm Bypass	Where sediment removal is accomplished without a bypass by removing alternating cells, the berm between the work and the live channel will be wide enough to prevent introduction of turbid water from the cell into the live channel.
SED-5	Sediment Characterization	Projects involving sediment removal at stream gauges, outfalls, culverts, flap gates, tide gates, grade control structures, bridges, fish ladders, and fish screens in excess of 25 cubic yards shall be characterized in accordance with the SCVWD's Sediment Characterization Plans for SMP-2. These projects shall be reported in the annual summary report. Sediment removed will not be reused without pre-approval from appropriate regulatory agencies. See section 5.4 for information on the waiver process.

C. SECTION C – Vegetation Management BMPs

These BMPs provide specific and detailed guidance on the variety of vegetation management procedures implemented by the District. BMPs for the following maintenance techniques are included: tree pruning, tree removal, plant removal, woody debris management, herbicide application, mowing, discing, flaming, and grazing. Practices will be implemented by fully trained and qualified field crews.

BMP Number	BMP Title	BMP Description
VEG-1	Minimize Local Erosion Increase from In-channel Vegetation Removal	To minimize the potential effect of localized erosion, the toe of the bank will be protected by leaving vegetation to the maximum extent possible and consistent with the maintenance guidelines or original design requirements.
VEG-2	Non-native Invasive Plant Removal	Invasive species (e.g. cape ivy [<i>Delairea odorata</i> / <i>Senecio mikanooides</i>], arundo [<i>Arundo donax</i>]) will be disposed of in a manner that will not contribute to the further spread of the species. Cape ivy removed during a project shall be bagged and disposed of in a landfill. Arundo canes will be prevented from floating downstream or otherwise entering the creek or waterway.
VEG-3	Use Appropriate Equipment for Instream Removal	When using heavy equipment to cut or remove instream vegetation, low ground pressure equipment, such as tracked wheels will be utilized to reduce impacts to the streambed.
VEG-4	Use Flamers with Caution	<ol style="list-style-type: none"> 1. A fire extinguisher, water supply and other appropriate fire suppression equipment will always be kept close to the work site in case of an emergency. 2. Propane tanks will be checked for leaks and proper functioning prior to and proceeding use of flaming equipment. The propane tank will be treated as a hazardous material.
VEG-5	Conduct Flaming During Appropriate Weather and Seasonal Conditions	Flamers will not be used during periods of high fire danger or in areas where fuel or climate conditions could accidentally ignite a fire.
VEG-6	Standard Grazing Procedures	<ol style="list-style-type: none"> 1. Vegetation and areas to be preserved will be fenced off to exclude grazing animals. 2. Grazing animals will be excluded from stream channels, using fencing or other barriers.

D. SECTION D – Bank Stabilization BMPs

These BMPs provide additional guidance during implementation of bank stabilization projects to avoid impacts on biological and cultural resources. Review of the Post-Project Restoration BMPs in Section F is recommended because those measures will be implemented after bank stabilization projects are complete. The BMPs included in this section are implemented by the field crew and site manager.

BMP Number	BMP Title	BMP Description
BANK-1	Bank Stabilization Design to Prevent Erosion Downstream	To further prevent potential downstream erosion impacts due to bank stabilization, the site design will be adjusted to provide proactive protection of vulnerable areas within the reach of the worksite. Such measures include, but are not limited to, appropriately keyed-in coir logs, riparian planting, strategic placement of rock, and flow deflectors. Bank stabilization will include appropriate transition designs upstream and downstream of the work site to prevent potential erosion impacts.
BANK-2	Concrete Use Near Waterways	Concrete that has not been cured is alkaline and can increase the pH of the water. Fresh concrete will be isolated until it no longer poses a threat to water quality using the following appropriate measures: <ol style="list-style-type: none"> 1. Wet sacked concrete will be excluded from the wetted channel for a period of 30 days after installation. During that time, the wet sacked concrete will be kept moist (such as covering with wet carpet) and runoff from the wet

BMP Number	BMP Title	BMP Description
		<p>sacked concrete will not be allowed to enter a live stream.</p> <p>2. Poured concrete will be excluded from the wetted channel for a period of 30 days after it is poured. During that time, the poured concrete will be kept moist, and runoff from the wet concrete will not be allowed to enter a live stream. Commercial sealants (e.g., Deep Seal, Elasto-Deck Reservoir Grade) may be applied to the poured concrete surface where difficulty in excluding water flow for a long period may occur. If a sealant is used, water will be excluded from the site until the sealant is dry.</p> <p>3. Dry sacked concrete will not be used in any channel.</p> <p>4. An area outside of the channel and floodplain will be designated to clean out concrete transit vehicles.</p>
BANK-3	Bank Stabilization Post-Construction Maintenance	<p>The District may maintain or repair bank stabilization projects that are less than 2 years old that are damaged by winter flows.</p> <p>The District will notify the regulatory agencies 24 hours prior to beginning the work and the work will be reported as part of the Post-Construction Report submitted by January 15 of each year or if necessary, the subsequent year.</p> <p>Appropriate BMPs will be applied during maintenance repairs.</p>

E. SECTION E – Post-Project Restoration BMPs

These BMPs will be implemented, as appropriate, on all sites that involve ground disturbance.

BMP Number	BMP Title	BMP Description
REVEG-1	Seeding	<p>Sites where maintenance activities result in exposed soil will be stabilized to prevent erosion. Disturbed areas shall be seeded with native seed as soon as is appropriate after maintenance activities are complete. An erosion control seed mix may be applied to exposed soils, and down to the ordinary high water mark (OHWM).</p> <p>1. The seed mix should consist of California native grasses (e.g., <i>Hordeum brachyantherum</i>, <i>Elymus glaucus</i>, and <i>Vulpia microstachydes</i>) or annual, sterile seed mix.</p> <p>2. Temporary earthen access roads may be seeded when site and horticultural conditions are suitable, or have other appropriate erosion control measures in place (GEN-20).</p>
REVEG-2	Planting Material	<p>Revegetation and replacement plantings will consist of locally collected native species. Species selection will be based on surveys of natural areas on the same creek that have a similar ecological setting and/or as appropriate for the site location.</p>

F. SECTION F – Management of Animal Conflict BMPs

Methods of animal management included in the SMP are avoidance, biological controls, physical alterations, habitat alterations, and lethal controls. Of all these methods, implementation of lethal controls has the highest potential for environmental and biological impacts. Therefore, the animal management BMPs provided in this section focus on lethal controls. The application area for lethal controls will be identified during the annual planning process (see the Biological Resource Planning BMPs) and guided as directed by wildlife biologists. Species habitat areas are defined by the District’s GIS species mapping, updated CNDDDB and known local biological information and are included in the SMP Update Subsequent EIR.

BMP Number	BMP Title	BMP Description
ANI-1	Avoid Redistribution of Rodenticides	<p>Carcass surveys will be conducted periodically when acute poisons and first generation anticoagulants are used. The frequency of the carcass surveys will be specific to the type of rodenticide used, to minimize secondary poisoning impacts:</p> <ul style="list-style-type: none"> • Acute toxins – Daily carcass surveys, beginning the first day after application until the end of the baiting period for acute toxins used above-ground. • Anticoagulants - Within 7 days of installation of first generation anticoagulant bait, and weekly thereafter. Anytime a carcass is found, daily carcass surveys will begin for as long as carcasses are found until no carcasses are found during a daily survey. Once no carcasses are found, carcass surveys will return to the weekly carcass survey timeline maximum from the date of initial installation of an anticoagulant bait station. <p>To verify that the frequency of carcass surveys is adequate, a biologist will conduct daily carcass surveys 2 times per year over one baiting cycle. Based on the results of these surveys, the timing of carcass surveys will be adjusted if necessary.</p> <p>Any spilled bait will be cleaned up immediately.</p>
ANI-2	Prevent Harm to the Salt Marsh Harvest Mouse and California Clapper Rail	<ol style="list-style-type: none"> 1. No rodenticides or fumigants will be used within the range of the SMHM or CCR as identified on District range maps. 2. Methods of rodent control within SMHM or CCR habitat will be limited to live trapping. All live traps shall have openings measuring no smaller than 2 inches by 1 inch to allow any SMHM that inadvertently enter the trap to easily escape. All traps will be placed outside of pickleweed areas and above the high tide line.
ANI-3	Burrowing Owl, Bald Eagle and Golden Eagle Buffer Zone	<p>Per the California Department of Fish and Wildlife’s 2008 <i>Guidance for Burrowing Owl Conservation</i>, a 656-yard buffer will be established around known burrowing owl locations where no rodenticides or fumigants (including smoke bombs) will be used. A 0.5-mile buffer will be established around known bald eagle and golden eagle nesting locations where no rodenticides will be used.</p>
ANI-4	Animal Control in Sensitive Amphibian Habitat	<ol style="list-style-type: none"> 1. Fumigants will not be used within the habitat areas of special status amphibians. 2. The use of bait stations within the potential habitat areas of California red-legged frog, California tiger salamander, or foothill yellow-legged frog will be limited to bait stations specifically designed to prevent entry by these species. 3. Any live traps will allow California red-legged frogs, California tiger salamanders, or foothill yellow-legged frogs to safely exit (e.g., by having openings measuring no smaller than 2 inches by 1 inch).
ANI-5	Slurry Mixture near Waterways	<p>All slurry type mixes used to fill rodent burrows will be prevented from entering any waterway by using appropriate erosion control methods and according to the manufacturer’s specifications. If the creek bed is dry or has been dewatered, any material that has entered the channel will be removed.</p>
ANI-6	Species requiring depredation permit	<p>Animal Conflict Management will not include lethal control of species listed in California F&G Code Section 4181 including beaver and gray squirrel without first obtaining a depredation permit.</p>

G. SECTION G – Use of Pesticides

Pesticides may be used for vegetation management or control of animal damage.

BMP Number	BMP Title	BMP Description
HM-4	Posting and Notification for Pesticide Use	<p>Posting of areas where pesticides are used will be performed in compliance with District Policy Ad-8.2 Pesticide Use as follows:</p> <ol style="list-style-type: none"> 1. Posting will be performed in compliance with the label requirements of the product being applied. 2. In addition, posting will be provided for any products applied in areas used by the public for recreational purposes, or those areas readily accessible to the public, regardless of whether the label requires such notification. In doing this, the District ensures that exposure risk is minimized further by adopting practices that go beyond the product label requirements. (The posting method may be modified to avoid destruction of bait stations or scattering of rodenticide.) 3. These postings will notify staff and the general public of the date and time of application, the product's active ingredients, and common name, and the time of allowable re-entry into the treated area. 4. Signs will not be removed until after the end of the specified re-entry interval. 5. Right-to-know literature on the product will be made available to anyone in the area during the re-entry period. 6. A District staff contact phone number will be posted on the sign, including a cellular phone number. 7. Notification of pesticide activities will be made as required by law. Also, the District will maintain records of neighbors with specific needs relative to notification before treatment of an adjacent area so that such needs are met.

Source: Data compiled by Horizon Water and Environment in 2011

APPENDIX E

Environmental Permits

(to be included when received)

APPENDIX F

Owner Manual(s) of other channel features

(to be included when received)