

## Appendix A

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Rutherford Reach Restoration Maintenance Plan and  
Oakville to Oak Knoll Maintenance Plan





**Final Maintenance Plan for the Napa  
River Rutherford Reach Restoration  
Project**

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# Introduction

The maintenance program for the Rutherford Reach of the Napa River has been developed by the Rutherford Reach Landowner Advisory Committee (LAC) and Napa County Flood Control and Water Conservation District (District) to support the Napa River Rutherford Reach Restoration Project (Rutherford Restoration Project) and to guide implementation of routine maintenance activities within the Rutherford Reach of the Napa River. The maintenance program has been developed to carefully balance the needs of local landowners with protecting and enhancing the natural resources of the Napa River.

As described below, the maintenance program is intended to maintain bank protection and river enhancement features constructed as part of the Rutherford Restoration Project and to prevent new streambank erosion problems from forming in order to protect environmental resources and properties within the Rutherford Reach of the Napa River. The maintenance program is not intended to address catastrophic streambank failure, emergency repairs, or significant streambank erosion in areas not treated by the Rutherford Restoration Project. Such repairs would be implemented by individual landowners in coordination with appropriate agencies. Other non-emergency treatments that fall outside the scope of the maintenance program, because of scale or cost, may be incorporated into the design of future phases of the Rutherford Restoration Project. Additionally, the maintenance program includes activities to control targeted invasive non-native vegetation and Pierce's Disease (PD) host plants within the riparian corridor reachwide.

The purpose of this document is to define the overall maintenance program for the Rutherford Reach and describe key program elements including: maintenance activities; oversight and implementation responsibilities; and measures to avoid or minimize impacts to environmental resources. This document is intended for use by local landowners and vineyard managers, District maintenance staff, and environmental and regulatory agency staff.

## Maintenance Program Overview

### Program Area

The program area is located along a 4.5-mile reach of the Napa River south of the City of Saint Helena, extending from Zinfandel Lane in the north to Oakville Cross Road, in the south (Figure 1). Historic changes in land use and management in the Napa River Watershed have resulted in confinement of the river into a narrow channel, loss of riparian and wetland habitats, accelerated channel incision and bank erosion, and reduction in the quality and quantity of instream habitat for salmonids and other native fish. Additionally, because of this ongoing degradation, properties along the Rutherford Reach have been



**Figure 1**  
**Regional Location**

subject to bank instability and failure leading to the loss of valuable vineyard land, threat to structures, and costly repairs.

## Program Objectives

The objectives of the Maintenance Program are to:

- ❑ Minimize bank erosion through vegetation management, large woody debris (LWD) realignment and/or relocation, debris/large trash removal, and biotechnical stabilization.
- ❑ Maintain the function of constructed instream habitat enhancement structures.
- ❑ Control target non-native invasive and PD host plants, to the extent practicable, within the riparian corridor of the Rutherford Reach.

## Oversight and Coordination

An LAC has been established to oversee implementation of the program and to coordinate maintenance activities with local landowners and vineyard managers. The LAC requested that the District Board adopt a Special Benefit Zone Project, funded through a property tax assessment program under procedures established in the District Act, to conduct maintenance in the Rutherford reach of the Napa River.

The LAC is comprised of landowners and their representatives and is supported by District staff. Participation in the LAC is open to any landowner, or their representative, who have river frontage within the Rutherford Reach. The LAC will select three (3) representatives from the LAC to represent the recommendations of the LAC to the District Board. The three representatives will be designated as the Chair, Co-Chair, and Secretary of the LAC, and will serve for a 2-year period. It is anticipated that the LAC will meet biannually to review, evaluate, and prioritize annual maintenance activities based on the maintenance surveys, landowner maintenance requests, and available funding, and to review and approve the annual maintenance report.

All maintenance activities will be conducted pursuant to regulatory permits issued in conjunction with the Rutherford Restoration Project, with oversight by the District.

## Maintenance Surveys

District staff in coordination with the LAC will conduct routine annual surveys to identify and assess issues of concern relative to the program objectives. Surveys will focus on identifying, mapping, and assessing:

- ❑ Actively eroding streambanks, including effectiveness of prior stabilization measures.

- ❑ Areas of excessive vegetation growth, and/or accumulations of LWD or trash that are contributing to streambank erosion.
- ❑ Storm-related damages to streambank stabilization and aquatic habitat enhancement structures
- ❑ Weed, PD host plant, and invasives eradication and revegetation sites.

The District will work with the LAC to develop standard data sheets for the maintenance survey. Data sheets, aerial photographs, and GPS units will be used to document the nature and extent of the problem, and to identify recommended treatments or remedial actions. Photos will also be taken to document each problem site. The results of the survey will be compiled into a report and presented to the LAC for review. It may also be necessary to conduct interim river surveys shortly after large storm events (< 10-year flood event) to identify areas that may require immediate treatment to prevent additional streambank failure, and protect existing infrastructure and environmental resources.

## **Landowner Maintenance Requests**

In addition to maintenance needs identified through the annual river survey, landowners may submit individual maintenance requests to the LAC for review and evaluation. Maintenance requests should be submitted to the LAC by April 1 each year to be considered for inclusion in that year's work plan. Maintenance requests eligible for funding with assessment funds will be limited to the following problem-types: 1) actively eroding streambanks; 2) debris accumulations; 3) downed trees/LWD; 4) vegetation removal; and 5) storm-related damages to streambank stabilization, aquatic habitat enhancement structures, and revegetation sites. Landowners may also submit requests to the LAC for maintenance work that they would like to fund and execute themselves under District oversight and pursuant to regulatory Project permits. We anticipate that the majority of such requests will be focused on accomplishing additional PD host plant control beyond what is budgeted for using strictly assessment funds. The District and LAC will review landowner work requests and provide field supervision as needed to ensure landowner-sponsored actions are compliant with applicable permit conditions. While maintenance of earthen berms, access roads, and other infrastructure remain exclusively the responsibility of individual landowners and are largely exempt from regulation (located outside of most agencies' jurisdictions but for the County), the LAC and District will track the condition of these project elements and any maintenance required to maintain the original project design.

## **Evaluation and Prioritization of Maintenance Activities**

As described above, the annual river survey report and any individual landowner maintenance requests will be submitted to the LAC for review. The committee

will evaluate and prioritize annual work activities based on the following considerations:

- ☐ Condition of existing bank stabilization and instream habitat enhancement structures.
- ☐ Potential for future significant streambank failure/erosion beyond the riparian corridor and vegetated buffer.
- ☐ Risk to adjacent infrastructure and agriculture (i.e., structures, earthen berms, roads, pumps, utilities, crops).
- ☐ Potential for future significant streambank failure/erosion.
- ☐ Potential for increased flood damage.
- ☐ Available budget.

Based on an evaluation and prioritization of problems identified through the annual river survey and landowner requests, the LAC will prepare a work plan describing the location and scope of maintenance activities proposed to be conducted that year. Following completion of annual maintenance activities, the committee will prepare a supplemental report documenting work completed that year, associated costs, remaining budget, and adequacy of funding to complete required maintenance.

## **Funding and Implementation**

Routine maintenance activities will be funded through property tax assessments collected from local landowners through a Special Benefit Zone Project adopted by the District for the Rutherford Reach. The District has retained an assessment engineer to develop a basis for assessing individual landowners to fund the program based on the benefits derived from the program. This will be presented this fall in an Engineer's Report for landowners to review the method of allocation and total proposed assessment for their individual property. The assessment will be subject to a Proposition 218 vote of the landowners throughout the reach scheduled for late 2008. Table 1 provides an estimate of cost in 2008 dollars to perform the expected annual maintenance activities. In years where maintenance expenditures are less than the total assessment collected by the District, any remaining funds will be retained in an interest-bearing (reserve) account to supplement the budget for maintenance activities conducted in future years. A cap will be placed on reserve funds.

Match funding to supplement property tax assessments may be provided by landowners and/or organizational partners (such as the County, resource agencies, the local RCD, and the California Conservation Corps). Work supported by match funding must be: limited to activities defined in this plan; compliant with any applicable permit restrictions; and, integrated into the annual work plan and year-end report.

Activities identified in the annual work plan prepared by District staff in coordination with the LAC, will be implemented by District staff, and/or

Table 1 Estimated Costs for Typical Annual Maintenance Activities

Tasks	Estimated Costs	Annual Cost
1 Debris Removal and Relocation of LWD	3days@\$1,700 per crew day = \$5,100; misc supplies and equ	\$6,600
2 Vegetation Management	3 days@\$1,700 per crew day = \$5,100; misc supplies and equipment \$2,500	\$7,600
3 Streambank Erosion Control	<b>Planting:</b> 5 days @ \$1,700 per crew day = \$8,500; <b>Plant and other materials:</b> \$5,000, <b>Irrigation:</b> 5 days (2 persons) @ \$570/day = \$2,850	\$16,350
4 Repair and Maintenance of Floodplain Benches	<b>Planting:</b> 5 days @ \$1,700 per crew day = \$8,500; <b>Plant and other materials:</b> \$5,000, <b>Irrigation:</b> 5 days (2 persons) @ \$570/day = \$2,850	\$16,350
5 Maintenance of Created Vegetation Buffers	<b>Planting:</b> 2 days @ \$1,700 per crew day = \$3,400; <b>Plant materials:</b> \$1,500, <b>Irrigation:</b> 5 days (2 persons) @ \$570/day = \$2,850	\$7,750
6 Repair and Maintenance of Aquatic Habitat Enhancement Structures	<b>Planning:</b> 2 days @ \$50 per hour = \$800. <b>Work:</b> 2 days @ \$1,700 per crew day = \$2,600; <b>Equipment:</b> \$2,000	\$5,400
7 Repair and Maintenance of Streambank Stability Structures	<b>Planning:</b> 2 days @ \$50 per hour = \$800. <b>Work:</b> 2 days @ \$1,700 per crew day = \$3,400; <b>Plant and other materials:</b> \$5,000; <b>Equipment:</b> \$2,000	\$11,200
8 Invasive Plants Removal and Revegetation	<b>Herbicide:</b> 2 days@ \$400 per day (1person) =\$800; <b>Planting:</b> 3 days @ \$1,700 per crew day = \$6,800; <b>Irrigation:</b> 3 days (2 persons) @ \$570 per day = \$1,710	\$9,310
9 Annual surveys, and development of work plans, assessment management.	<b>Surveys:</b> 5 days (2 persons) @ \$1000 per day = \$5000; <b>Reports:</b> 2 days @ \$400 per day = \$800; <b>Develop</b> <b>Priorities:</b> 2 days @ \$400 per day = \$800; <b>Admin:</b> 50 hrs @ \$70 per hour = \$3,500	\$10,100
10 Monitoring		\$7,500
<b>Total</b>		<b>\$98,160</b>

landowner-supplied work crews overseen by District staff, and/or crews supplied by organizational partners including California Conservation Corps or Napa County RCD overseen by District staff. Specific maintenance activities that will be implemented under this program are described in detail below. Depending upon the type and scope of the maintenance activities, work crews may also be required to implement measures to avoid and/or minimize impacts to environmental resources as described below under *Best Management Practices*.

## Maintenance Activities

Certain activities may be implemented proactively within the Rutherford Reach to prevent streambank erosion and failure, and associated impacts to adjacent properties and environmental resources. Preventative maintenance activities identified as part of the maintenance program for the Rutherford Reach are described in detail below.

### Debris Removal

Debris consists of material deposited within the river channel by receding flood flows and includes small (<12 inches in diameter and/or <6 feet long) downed trees and limbs, tires, shopping carts, barrels, trash, and other materials. Debris removal would be required in cases where accumulations of debris within the river channel are blocking or shifting flood flows resulting in localized flooding or streambank erosion.

Methods used to remove debris will vary depending upon the size of material and available access. Whenever feasible, debris removal activities will be conducted by work crews using hand tools. However, removal of larger materials may require use of heavy equipment. Native vegetative debris may be cut-up or chipped on-site, removed and transported to a suitable disposal site, or burned in accordance with state and local permits. Non-native vegetative debris (i.e., giant reed) and non-vegetative debris will be removed and transported to a suitable disposal site, mulched (for materials that do not contain viable seed) in place, or burned in accordance with state and local permits.

### Downed Tree Relocation/Stabilization

Existing mature trees that are toppled during storm events can block or shift flood flows resulting in localized flooding and streambank erosion. This is especially critical when downed logs lodge in bridge openings, near bridge abutments, or at pump intake structures. However, downed trees also provide valuable habitat for native fish. Downed trees determined to pose a flooding or erosion risk may be stabilized in place or relocated to reduce risk and improve local habitat conditions. Downed trees may be cut on-site by work crews using hand tools to facilitate stabilization or relocation. Relocation and/or repositioning of downed trees will likely require heavy equipment working from the top of the adjacent streambank. Relocated/repositioned trees should be



anchored in place using standard methods for anchoring large woody debris structures (e.g., cables and utility pole anchors, cable and boulder anchors) to prevent structures from dislodging in large storm events.

## **Vegetation Management**

### **In-Channel Vegetation**

Within the Rutherford Reach, native vegetation such as willows, generally occur on low floodplain benches and at the toe of the streambank. While these plants provide habitat for native species, they are also effective at trapping sediment leading to the development of substantial in-channel gravel bars that can shift stream flows and cause streambank erosion and failure. Willows and other species (<4 inches in diameter) will be removed in areas where they significantly impede stream flows.

In-channel vegetation will be removed by hand crews using loppers, hand saws, and chain saws. In cases where herbicide use is considered advantageous and is consistent with the landowner's property management regime, trees will be cut off at the base of the trunk and the stump painted with an approved herbicide. Herbicide will be applied according to manufacturer's specifications by licensed applicators in a manner that minimizes drip and drift into the stream channel. Only U.S. Environmental Protection Agency-approved aquatic formulations of glyphosate (e.g., Rodeo, AquaMaster, AquaNeat/Roundup) and imazapyr (e.g., Habitat/Stalker) will be used. Following herbicide applications, dead biomass will be left on site to decompose. In cases where herbicide use is not consistent with the landowner's property management regime, physical removal techniques alone may be employed. If necessary, cuttings may be removed from the channel and stockpiled at top of bank. Debris may be transported to a suitable disposal site, mulched in place, or burned in accordance with state and local permits.

### **Invasive Non-Native and Pierce's Disease Host Vegetation**

A number of invasive non-native and PD host plants occur within the Rutherford Reach. These species reduce the value of habitat for native wildlife by preventing the establishment and growth of desirable native species, and decrease overall plant diversity. Additionally, some of these species act as host plants for the bacterium that causes PD resulting in significant damage to streamside vineyards. Although existing patches of target invasive non-native plants will be treated as part of the Rutherford Restoration Project, success of the restoration effort will rely on ongoing maintenance to control spread of these undesirable species throughout the reach. Key invasive non-native and PD host plants that may be targeted for removal include, but are not limited to:

- ❑ Himalayan blackberry
- ❑ Periwinkle
- ❑ Giant reed

- ❑ Tree-of- heaven
- ❑ Tamarisk
- ❑ Mulefat
- ❑ Mugwort
- ❑ Wild grape (hybrid)
- ❑ Sesbania

Target invasive non-native and PD host plants will be removed by hand crews using weed wrenches, bladed weed eaters, loppers, hand saws, and chain saws. In cases where herbicide use is considered advantageous and is consistent with the landowner's property management regime, control of some species such as Himalayan blackberry may require repeated herbicide applications. Herbicide application will be limited to cutting and painting stumps, or foliar or spot spray using backpack or ATV-mounted sprayers. Herbicide will be applied according to manufacturer's specifications by licensed applicators in a manner that minimizes drip and drift into the stream channel. Only U.S. Environmental Protection Agency-approved aquatic formulations of glyphosate (e.g., Rodeo, AquaMaster, AquaNeat/Roundup) and imazapyr (e.g., Habitat/Stalker) will be used. Following herbicide applications, dead biomass will be left on site to decompose. Where herbicide use is not consistent with the landowner's property management regime, physical eradication and removal techniques (tarping and mechanical removal) and/or non-toxic weed control alternatives may be employed. Where necessary, cuttings may be removed from the channel and stockpiled at top of bank. Plant materials containing viable seed will be immediately bagged to prevent re-establishment. Debris may be transported to a suitable disposal site, mulched (for materials that do not contain viable seed) in place, or burned in accordance with state and local permits.

## Erosion Control

In areas where minor erosion has been identified, biotechnical methods may be used in areas outside of the riparian corridor and vegetated buffer to proactively stabilize eroding banks and prevent streambank failure and large-scale deposition of sediment in the river channel, and protect adjacent property and infrastructure. Typically these treatments will be implemented in combination for effective treatment.

## Planting

Areas subject to minor erosion may be hydroseeded with an appropriate native or sterile seed mix, and/or planted with native riparian species to stabilize eroding banks, and reduce localized flow velocities and erosion potential. A list of native tree and shrub species suitable for streambank revegetation are provided in Table 2. Plants material will be selected based on location-specific (i.e., top-of-bank, lower channel slope) recommendations (Table 2). Plantings may require irrigation for up to 3 years following installation depending upon planting

location. Because of the potential for storm-related damages to a fixed irrigation system, plants installed below top of bank will be hand watered using nearby water sources provided by the landowners.

## **Other Erosion Control Treatments**

Implementation of the treatments described above or treatment of other minor streambank erosion sites may require installation of erosion control blankets and/or coir logs. Erosion control blankets will consist of coconut fiber or other 100% biodegradable materials. Blankets will be installed in vertical strips and anchored with wooden stakes or starch staples. Blankets will be overlapped to facilitate anchoring. Coir logs will be 100% coconut fiber and will be installed using wooden stakes.

## **Maintenance of Constructed Features**

Several streambank and channel improvements will be constructed by the Rutherford Reach Restoration Project to provide ecological benefits within this reach of the Napa River. Following the County's notice of completion of post construction maintenance and acceptance of the project-constructed features, maintenance of the features constructed as part of the Rutherford Reach Restoration Project will be incorporated into the Rutherford Reach maintenance program under LAC oversight. Maintenance activities for these features are described in detail below.

## **Floodplain Benches**

As part of the Rutherford Restoration Project, streambanks in selected areas will be graded to create inset floodplain benches at approximately the 1.5-year flood elevation (typically about 10 - 15 feet above the existing low-flow channel invert) to widen the floodway and reduce localized flow velocities, and provide opportunities for planting riparian vegetation. Bench width and slope angle vary depending on overall channel width, adjacent land uses, and other factors. However, in general, benches are expected to range from 10 to 30 feet wide and will slope very gently away from the river, with an approximate difference of 1 foot in elevation between the outer and inner terrace edges. Floodplain slopes will be graded to a stable angle (3:1 or 2:1).

Maintenance of these areas will be conducted by work crews using hand tools and will typically include: controlling weeds and other non-native invasive plants; replanting native species; irrigation and/or hand watering; and installation of erosion control fabric and coir logs (if necessary). In some cases minor grading using hand tools or heavy equipment may be required to repair damage caused by large storm events.

## **Vegetated Buffers**

In selected areas of the Rutherford Reach, vegetated buffers will be created between the edges of the existing riparian corridor and newly constructed earthen berms or access roads. The primary purpose of the vegetated buffer is to provide space between the river and adjacent land uses to allow the channel to widen naturally and to avoid the need for landowners to implement measures to protect adjacent property/land uses. These buffers will be planted with suitable native tree and shrub species as identified in Table 2.

Maintenance of these areas will be conducted by work crews using hand tools and will include: controlling weeds and other non-native invasive plants; replanting native species; irrigation system maintenance; and irrigation/hand watering.

## **Aquatic Habitat Enhancement Structures**

Several types of large woody debris and rock structures are proposed to be installed in the river channel to enhance existing aquatic habitat for native fish. These structures include: rock weirs, grade-control riffles, off-bench branch cover, branch bundles, and spider log structures. Maintenance of these structures will be accomplished by work crews using hand tools and heavy equipment and may include: replacing logs and boulders; installing new utility or boulder and cable anchors; and installing native plants. Equipment such as excavators, front-end loaders, power augers, and dump trucks will be used to transport and place logs and boulders.

## **Streambank Stabilization Structures**

Several types of wood and rock structures are proposed to be installed in the river channel to stabilize the toes of actively eroding banks. Maintenance of these structures will be accomplished by work crews using hand tools and heavy equipment and may include: replacing logs and boulders; installing new utility or boulder and cable anchors; and installing native plants. Equipment such as excavators, front-end loaders, power augers, and dump trucks will be used to transport and place logs and boulders.

## **Best Management Practices**

The following section describes best management practices (BMPs) that will be implemented in conjunction with maintenance activities to avoid and/or minimize effects on environmental resources.

**Table 2.** Proposed Restoration Planting Palette, by Planting Zone

Planting Zone	Inundation Frequency	Groundwater Depth	Substrate	Planting Palette
Bank toe/bar	<1.5 year	<5 feet	Rock, gravel, sand	<i>Alnus rhombifolia</i> White alder <i>Salix laevigata</i> Red willow <i>Salix lasiolepis</i> Arroyo willow <i>Salix lutea</i> Yellow willow
Floodplain bench	1.5 year	10–15 feet	Silty clay loam	<i>Alnus rhombifolia</i> White alder <i>Carex barbarae</i> Santa Barbara sedge <i>Cornus glabrata</i> Brown dogwood <i>Fraxinus latifolia</i> Oregon ash <i>Leymus triticoides</i> Creeping wildrye <i>Populus fremontii</i> Fremont cottonwood <i>Salix laevigata</i> Red willow <i>Salix lasiolepis</i> Arroyo willow
Lower floodplain slope	1.5–5 years	15–22 feet	Silty clay loam	<i>Aesculus californica</i> California buckeye <i>Aristolochia californica</i> Pipevine <i>Calycanthus occidentalis</i> Western spicebush <i>Carex barbarae</i> Santa Barbara sedge <i>Heteromeles arbutifolia</i> Toyon <i>Leymus triticoides</i> Creeping wildrye <i>Populus fremontii</i> Fremont cottonwood <i>Rosa californica</i> California wild rose <i>Salix laevigata</i> Red willow <i>Symphoricarpos albus</i> Snowberry

Planting Zone	Inundation Frequency	Groundwater Depth	Substrate	Planting Palette
Upper floodplain slope	5–10 years	22–24 feet	Silty clay loam	<i>Aesculus californica</i> California buckeye <i>Aristolochia californica</i> Pipevine <i>Calycanthus occidentalis</i> Western spicebush <i>Carex barbarae</i> Santa Barbara sedge <i>Heteromeles arbutifolia</i> Toyon <i>Leymus triticoides</i> Creeping wildrye <i>Lonicerna hispidula</i> Honeysuckle <i>Quercus agrifolia</i> Coast live oak <i>Umbellularia californica</i> California bay
Floodplain terrace	>10 years	>24 feet	Consolidated silty clay loam, artificial fill	<i>Aesculus californica</i> California buckeye <i>Aristolochia californica</i> Pipevine <i>Bromus carinatus</i> California brome <i>Calycanthus occidentalis</i> Western spicebush <i>Carex barbarae</i> Santa Barbara sedge <i>Heteromeles arbutifolia</i> Toyon <i>Hordeum brachyantherum</i> Meadow barley <i>Leymus triticoides</i> Creeping wildrye <i>Lonicerna hispidula</i> Honeysuckle <i>Melica californica</i> California melic <i>Quercus agrifolia</i> Coast live oak <i>Quercus lobata</i> Valley oak <i>Rosa californica</i> California wild rose <i>Symphoricarpos albus</i> Snowberry <i>Umbellularia californica</i> California bay <i>Vulpia microstachys</i> Small fescue

## Access and Staging

Whenever feasible, equipment staging and access will occur on the access road adjacent to the work site. If it is not possible to access the work site from an existing road, site access and staging will be accomplished in a way that minimizes damages to surrounding native vegetation. Staging, storage of equipment, materials, fuels lubricants, and other possible contaminants will be located at least 100 feet away from the top of the streambank. Additionally, vehicles and power equipment will be refueled at least 100 feet away from the top of the streambank.

## Site Housekeeping

To minimize the effects of maintenance activities on neighboring homes and businesses, the following site “housekeeping” measures will be implemented.

- ❑ Maintenance sites will be maintained in a neat and orderly condition, and the site will be left free of any garbage or debris.
- ❑ For activities that last more than one day, materials, equipment, or stockpiled debris left on the site overnight will be stored in a manner that does not block access roads.
- ❑ Landowners will be notified at least 48 hours prior to any maintenance activities occurring on their property.

## Noise Control

To minimize the effects of maintenance activities on neighboring homes and businesses, the following noise control measures will be implemented.

- ❑ Work will be limited to normal business hours (8:00 a.m.–5:00 p.m.), Monday through Friday. No activities will occur on Saturdays, Sundays, or recognized holidays.
- ❑ All power equipment will be equipped with sound-control devices no less effective than those provided as original equipment. All equipment will be operated and maintained to meet the applicable District standards for construction noise generation. No equipment will be operated with an unmuffled exhaust.

## Erosion and Sediment Control

Any maintenance work involving modifications to the stream channel and banks will be restricted to the minimum necessary to address the problem. Inchannel work will be limited to the dry season (April 15–October 15). Work requiring stream dewatering, stream crossings, or work within the live stream will not begin before June 1.

To the extent feasible all inchannel work will be conducted by equipment operating from dry areas outside the low-flow channel. To the extent feasible, erosion control measures such as installing silt fencing, fiber rolls, or erosion control blankets will be implemented to minimize sediment input to the active channel.

## **Biological Resources Protection**

### **Migratory Birds**

In order to avoid adverse effects related to disturbance of migratory birds (protected under the federal Migratory Bird Treaty Act, the California Fish and Game Code, and CEQA), a qualified biologist will conduct preconstruction surveys for migratory birds and their nests at each work site no more than 1 week prior to the initiation of any construction activity planned to occur during the migratory bird nesting season (February 15–August 1). If preconstruction surveys identify active nests belonging to common migratory bird species, an exclusion zone will be established around each nest to minimize disturbance-related impacts on nesting birds. If active nests belonging to special-status migratory birds are identified, a no-activity buffer zone will be established around each nest. The radius of the exclusion zone/no-activity zone and the duration of exclusion will be determined in consultation with the U.S. Fish and Wildlife Service and the California Department of Fish and Game.

### **Fish**

To reduce the likelihood of adverse impacts on salmonids that use the Napa River corridor, any work activities below the top-of-streambank will be limited to the dry season (April 15–October 15), with the condition that construction requiring stream dewatering, stream crossings, or work in the live stream may not commence before June 1.

Prior to activities disturbing the bed or banks of the active low-flow channel, coffer dams or culverts will be installed to divert flow around the work area. Stream flow downstream of the work area will be maintained. Any native fish present in the work area will be relocated to a suitable location by a qualified biologist. If it is necessary to pump the work area to remove seepage and maintain a dry condition, pumps will be placed in flat areas well away from the channel and secured by anchoring to a tree or stake. Pumps will be refueled at least 100 feet away from the top of the streambank. Wastewater will be discharged to an upland location where it will not drain back into the channel.

### **California Freshwater Shrimp**

Prior to activities disturbing the bed or banks of the active low-flow channel, the District will retain a qualified biologist to conduct preconstruction dipnet surveys for California freshwater shrimp at each inchannel work site. If the species are



determined to be present, the biologist will capture and relocate them to a suitable site downstream of the work area.

### **Northwestern Pond Turtle**

Prior to activities disturbing the bed or banks of the active low-flow channel, the District will retain a qualified biologist to conduct preconstruction surveys for northwestern pond turtle at each inchannel work site. Surveys will take place no more than 72 hours prior to the onset of maintenance activities (including site preparation) with the potential to disturb turtles or their habitat. If the species is determined to be present, the biologist will capture and relocate them to a suitable site downstream of the construction area. If preconstruction surveys identify active nests, the biologist will establish no-disturbance buffer zones around each nest using temporary orange construction fencing. The radius of the buffer zone and the duration of exclusion will be determined in consultation with the U.S. Fish and Wildlife Service and the California Department of Fish and Game. The buffer zones and fencing will remain in place until the young have left the nest, as determined by a qualified biologist.

## **Cultural Resources**

Several known cultural resources sites have been identified within the program area, and it is possible that other unknown sites may be disturbed or damaged by some maintenance activities (e.g., minor grading). If buried cultural resources, such as chipped or ground stone, historic debris, building foundations, or human bone are discovered inadvertently during ground-disturbing activities, work will stop in that area and within 100 feet of the find until a qualified professional archaeologist can assess the significance of the find and develop appropriate treatment measures in consultation with the District, and other appropriate authority.

Additionally, if human remains are discovered, there is to be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent human remains until the Napa County Coroner has been informed and has determined that no investigation of the cause of death is required. If the remains are of Native American origin, ground-disturbing activities may not resume until the descendants of the deceased Native American(s) have made a recommendation regarding means of treating or disposing of, with appropriate dignity, the human remains and any associated grave goods as provided in California Public Resources Code Section 5097.98. If NAHC is unable to identify a descendent or the descendent fails to make a recommendation within 24 hours after being notified by the NAHC, work may then resume.

## Maintenance Responsibilities

As described above, it will be the responsibility of the District and local landowners to oversee and implement the Rutherford Reach maintenance program. Both District staff and local landowner representatives will serve on the LAC and will review, evaluate, and prioritize annual maintenance activities. Additionally, District staff will be responsible for supervising maintenance work crews. Work crews may be comprised of California Conservation Corps members, local RCD or NRCS staff, vineyard employees, and/or contract labor.

## Regulatory Compliance

Implementation of the maintenance program will require compliance with federal and state environmental regulations including Section 1600 of the California Department of Fish and Game Code, Sections 401 and 404 of the Clean Water Act, state and federal endangered species acts, and the California Environmental Quality Act. All maintenance of constructed features will be limited to maintaining the original design approved by relevant regulatory agencies. Ongoing compliance with these regulations will be addressed through environmental and regulatory compliance documentation in process for the Rutherford Reach Restoration Project. As part of the compliance process additional BMPs and permit conditions relevant to the maintenance activities described above may be identified. Additionally, following completion of annual maintenance activities, District staff will submit a report to the LAC, regulatory agencies, the Flood District Board, and all project landowners documenting activities completed that year.

## 1.1 Napa River Restoration Oakville to Oak Knoll Maintenance Program

The Napa County Flood Control and Water Conservation District's (District) river restoration maintenance program for the Oakville to Oak Knoll Reach relies on recognizing fundamental hydrological, geomorphic, and biologic processes that affect a given stream reach and adaptively managing and maintaining streams and restoration projects based on the underlying processes. Restoration project maintenance depends on a collaborative working relationship between the District and private landowners who agree to participate in the river restoration project and fund annual maintenance and monitoring of the project reach. The District's monitoring and maintenance approach is designed to place reach scale restoration activities within a watershed context.

- 1.1 **Napa River Restoration Project Maintenance Program**
- 1.2 Annual Maintenance Planning
- 1.3 Maintenance Activities
- 1.4 Managed Streambank Retreat
- 1.5 Restoration Project Monitoring and Adaptive Management
- 1.6 Regulatory Compliance
- 1.7 Community Facilities District Funding Approach
- 1.8 Construction Schedule

*Program area*

The proposed Napa River Restoration: Oakville to Oak Knoll Project (Project) includes 4.8 miles of active channel restoration activities along nine miles of the mainstem Napa River between the Oakville Cross Road Bridge and the Oak Knoll Avenue Bridge (**Figure 1**). The Project is immediately downstream of the Rutherford Project, which is a 4.5-mile stretch of the Napa River south of the City of Saint Helena, extending from Zinfandel Lane in the north to Oakville Cross Road. Historic changes in land use and management in the Napa River Watershed have resulted in confinement of the river into a narrow channel, loss of riparian and wetland habitats, accelerated channel incision and bank erosion, and reduction in the quality and quantity of instream habitat for salmonids and other native fish. The purpose of the Project is to restore and enhance long-term river and floodplain function, enhance native riparian plant communities, improve the quality and resilience of aquatic and terrestrial riparian habitat, and reduce property damage and sediment delivery associated with ongoing bank erosion processes.

## Overview

Within the Project reach, preventative and routine maintenance of the river and restoration features will be funded through property tax assessments collected from local landowners through a Community Facilities District (CFD) and adopted by the District. A core group of landowners with restoration projects on their parcels will form the CFD and other landowners may annex in if they wish to receive services. The core group of landowners will form a Landowner Advisor Committee (LAC) to guide and review annual maintenance and monitoring activities. The CFD will fund annual maintenance and

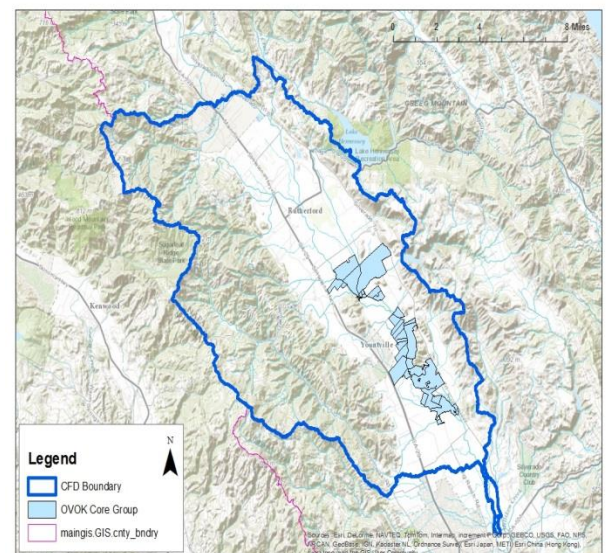


Figure 1: OVOK CFD Boundary and Core parcels.

monitoring activities, including annual surveys, vegetation management, downed tree and debris management, and biotechnical bank stabilization projects along the river on participating landowner parcels. Annual maintenance needs will vary from year to year depending on the magnitude of winter storm events and landowner requests. The District's objective is to work with landowners to ensure the long-term success of the Project and to enhance physical processes and biological resources through the entire restoration reach.

### ***Maintenance Program Objectives***

The objectives of the Restoration Project Maintenance Program are to:

1. Minimize bank erosion through vegetation management, large woody debris (LWD) realignment and/or relocation, debris/large trash removal, and biotechnical stabilization.
2. Maintain the function of constructed instream habitat enhancement structures.
3. Control target non-native invasive and Pierce's disease host plants, to the extent practicable, within the riparian corridor of the reach.

### ***Oversight and Coordination***

The core group of landowners has been invited to form the LAC to oversee implementation of the program and to coordinate maintenance activities with local landowners and vineyard managers. The LAC requested that the District Board adopt a CFD, funded through a property tax assessment program under procedures established in the District Act, to conduct maintenance in the restoration reach of the Napa River.

The LAC is comprised of landowners and their representatives and is supported by District staff. Participation in the LAC is open to any participating landowner, or their representative, who have river frontage within the restoration area or CFD boundary. It is anticipated that the LAC will meet biannually to review, evaluate, and prioritize annual maintenance activities based on the maintenance surveys, landowner maintenance requests and available funding, and to review and approve the annual maintenance report.

All maintenance activities will be conducted under regulatory permits issued in conjunction with the Project with oversight by the District.

## **1.2 Annual Maintenance Planning**

### ***Annual Maintenance Survey***

District staff will conduct routine (at least once a year) surveys to identify and assess issues of concern relative to the Project objectives. Surveys will focus on identifying, mapping, and assessing:

- Actively eroding streambanks, managed streambank retreat areas, including effectiveness of prior stabilization measures.
- Areas of excessive vegetation growth and/or accumulations of LWD or trash that are contributing to streambank erosion.

- Storm-related damages to streambank stabilization and aquatic habitat enhancement structures.
- Weed eradication, Pierce's disease host plant status, and revegetation sites.
- River conditions and biological monitoring.

The District will use its standard stream maintenance survey data sheets. Data sheets, aerial photographs, and GPS units will be used to document the nature and extent of issues encountered during surveys and to identify recommended treatments or remedial actions. Photos will also be taken to document each problem site. The results of the surveys will be compiled into a report and presented to the landowners and permitting agencies for review. It may also be necessary to conduct interim river surveys shortly after large storm events (> 10-year flood event) to identify areas that may require immediate treatment to prevent additional streambank failure and protect existing infrastructure and environmental resources.



Photo 1: Annual river maintenance survey.

### ***Landowner Maintenance Requests***

In addition to maintenance needs identified through the annual river survey, landowners will be able to submit individual maintenance requests to the District for review and evaluation. Maintenance requests will be limited to the following problem types: actively eroding streambanks; debris accumulations; downed trees/LWD; vegetation management; and storm-related damages to streambank stabilization and aquatic habitat enhancement structures and revegetation sites.

Maintenance requests would be submitted to the District by April 1 of each year to be considered for inclusion in that year's stream maintenance work plan. Maintenance of earthen berms, access roads, and other infrastructure is not included in the maintenance program and will be the responsibility of individual landowners.

### ***Evaluation and Triggers for Maintenance Activities***

As described above, the annual river survey report and any individual landowner maintenance requests will be considered by the District annually. The District will evaluate and prioritize annual work activities based on the following considerations:

- Condition of existing bank stabilization and instream habitat enhancement structures.
- Potential for future significant streambank failure/erosion beyond the riparian corridor and vegetated buffer.
- Risk to adjacent infrastructure and agriculture (i.e., structures, earthen berms, roads, pumps, utilities, crops).
- Potential for future significant streambank failure/erosion.

- Potential for increased flood risk.
- Potential to enhance or expand riparian corridor.
- Available budget.

Based on an evaluation and prioritization of problems identified through the annual river survey and landowner requests, the District will prepare a work plan describing the location and scope of maintenance activities proposed to be conducted that year. The work plan will not be implemented until landowner approval is received. Following completion of annual maintenance activities, the District will prepare a supplemental report documenting work completed that year, associated costs, remaining budget, and adequacy of funding to complete required maintenance.

### 1.3 Maintenance Activities

The District takes an integrated stream maintenance approach that involves protecting and enhancing existing instream resources while ensuring that the restoration features are functioning as intended. As described above, the maintenance program is intended to proactively address streambank erosion and failure in order to protect environmental resources and properties within the Project reach and maintain features constructed as part of the Project. It also includes activities to control target invasive non-native and Pierce's disease host plants within the riparian corridor. The maintenance program is not intended to address catastrophic streambank failure, emergency repairs, or large streambank erosion issues that would require Project- specific permits. Such repairs would be implemented by individual landowners in coordination with the appropriate agencies or a landowner may choose to participate in the optional services through the CFD, which are outlined in Section 1.7.

The following sections describe the specific types of activities included in the maintenance program. Each year, the activities identified in the annual work plan will be implemented by District staff, crews supplied by the District, or by landowner-supplied work crews overseen by District staff. For some activities (depending on the nature and scope of the work they entail), maintenance crews will also be required to implement measures to avoid and/or minimize environmental impacts; this is described further in the Best Management Practices (**Appendix A**).

#### ***Maintenance of Constructed Features***

Constructed features, such as biotechnical stabilization areas and habitat enhancement structures, will need to be monitored to ensure that they are performing correctly and to identify any areas of damage or failure. Depending on their performance, some features may require repair or maintenance.

During the first three years following restoration, the contractor(s) selected by the County to implement the restoration project will be responsible for monitoring and maintenance of all constructed features. Maintenance and monitoring during this three year period will be funded by grants and Measure A. Once



Photo 2: Erosion issue at restoration site.



the initial post-construction monitoring and maintenance period has elapsed and the County has accepted the Project as successfully completed, all Project features will transition to the Oakville to Oak Knoll maintenance program under the oversight of the District.

Maintenance activities for constructed features are expected to include the following:

- Controlling weeds and other non-native invasive plants.
- Minor vegetation pruning.
- Replanting native species.
- Hand watering.
- Installation and repair of erosion control fabric and coir logs.
- Minor grading.
- Installation and repair of biotechnical bank stabilization elements.
- Replacing logs and boulders.
- Installing new utility or boulder and cable anchors.

### ***Preventative Maintenance Activities***

The District's maintenance activities will be implemented to enhance or develop instream complexity features, improve bank conditions, and expand native riparian plant communities. Certain activities may be implemented proactively within the Project reach to prevent streambank erosion and failure and associated impacts to adjacent properties and environmental resources.

### ***Downed Tree Management***

In alignment with the Sediment Total Maximum Daily Load (TMDL) for the Napa River watershed, the District seeks to promote recruitment of woody debris in channels to benefit instream habitat. The District may leave downed trees in place or modify downed trees to encourage formation of channel features, such as scour pools and slack water areas, which are used by juvenile salmonids and increase stream channel complexity. However, if the tree threatens flood conveyance capacity or channel stability (i.e., stream banks destabilization), the District may modify the downed tree by trimming off branches or cutting it into smaller pieces. If further action is needed to minimize the potential for flow obstruction, the District may reposition the tree in the channel, such as move it from perpendicular to parallel to stream flow, or remove the tree entirely. Downed tree management is generally conducted during the dry season but can occur year-round to prevent flooding or erosion.

### ***Debris Removal***

Removal of debris, such as tires, shopping carts, barrels, and other trash that deposits within the Project, will be removed from the channel and disposed of at appropriate disposal sites. Debris removal may include



Photo 3: Debris jam along Napa River.

clearing of vegetation debris that racks up on restoration features, on downed trees, or on other channel vegetation. Debris jams will be disassembled if they are significantly blocking the channel, redirecting flows and causing erosion issues, or degrading the function of a restoration feature. Methods used to remove debris will vary depending upon the size of material and available access. When feasible, debris removal activities will be conducted by work crews using hand tools. However, removal of larger materials may require the use of heavy equipment. Native vegetative debris may be cut up or chipped on-site, removed and transported to a suitable disposal site, or burned in accordance with State and local permits. Non-native vegetative debris (i.e., giant reed) will be removed and transported to a suitable disposal site, mulched (for materials that do not contain viable seed) in place, or burned in accordance with State and local permits.

### ***Vegetation Management***

Vegetation management refers to the trimming, pruning, mowing, and removal of vegetation. Vegetation management may be necessary to control weeds to support the establishment of restoration plantings. In some cases, vegetation may cause flow constrictions or increase erosion, in which case minor pruning may be necessary. Vegetation management also includes the removal of non-native invasive species and Pierce's host vegetation as described below.

***In-Channel Vegetation:*** Within the Project, native vegetation, such as willows, generally occur on low floodplain benches and at the toe of the streambank. While these plants provide habitat for native species, they are also effective at trapping sediment leading to the development of substantial in-channel gravel bars that shift stream flows and cause streambank erosion and failure. Willows and other species (<4 inches in diameter) may be pruned or removed in areas where they significantly impede stream flow or are causing bank erosion issues.

In-channel vegetation will be removed by hand crews using loppers, hand saws, and chain saws. In cases where herbicide use is considered advantageous and it's consistent with the landowner's property management regime, trees may be cut off at the base of the trunk and the stump painted with an approved herbicide. Herbicide will be applied according to manufacturer's specifications by licensed applicators in a manner that minimizes drip and drift into the stream channel. Only U.S. Environmental Protection Agency-approved aquatic formulations of glyphosate (e.g., Aquamaster, Aqua Neat/Roundup, Rodeo) and imazapyr (e.g., Habitat/Stalker) will be used. In cases where herbicide use is not consistent with the landowner's property management regime, physical removal techniques alone may be employed. If necessary, cuttings may be removed from the channel and stockpiled at top of bank. Debris may be transported to a suitable disposal site or mulched in place.

***Invasive Non-Native and Pierce's Diseases Host Vegetation:*** A number of invasive non-native and Pierce's disease host plants occur within the Project. These species reduce the value of habitat for native wildlife by preventing the establishment and growth of desirable native species and decreases overall plant diversity. Additionally, some of these species act as host plants for the bacterium that causes Pierce's disease, resulting in significant damage to streamside vineyards.



Photo 4: CCC crews removing Arundo .



Although existing patches of target invasive non-native plants will be treated as part of the Project, success of the restoration effort will rely on ongoing maintenance to control spread of these undesirable species throughout the reach. Key invasive non-native and Pierce's disease host plants that may be targeted for removal include, but are not limited to:

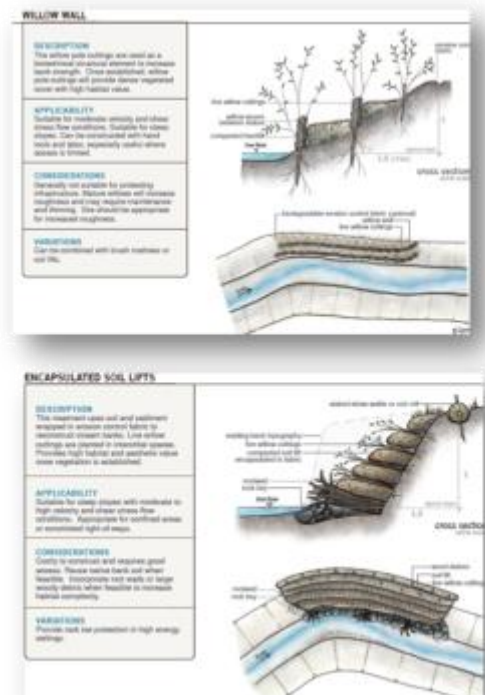
- Himalayan blackberry (*Rubus discolor*);
- Periwinkle (*Vinca major*);
- Giant reed (*Arundo donax*);
- Tree of heaven (*Ailanthus altissima*);
- Sesbania (*Sesbania punicea*); and
- Wild grape (hybrid) (*Vitis* spp).

Target invasive non-native and Pierce's disease host plants will be removed by hand crews using weed wrenches, bladed weed eaters, loppers, hand saws, chain saws, and at times, a rubber-tracked skid steer with flail mower may be used outside of the wetted channel. Herbicide application will be limited to cutting and painting stumps or foliar spot spray using backpack, ATV, or truck-mounted sprayers. Herbicide will be applied according to manufacturer's specifications by licensed applicators in a manner that minimizes drip and drift into the stream channel. Only U.S. Environmental Protection Agency-approved aquatic formulations of glyphosate (e.g., Aquamaster, Aqua Neat/Roundup, Rodeo) and imazapyr (e.g., Habitat/Stalker) will be used.

### ***Erosion Control/Bank Stabilization***

The repair and stabilization of stream banks is undertaken when a bank is weakened, unstable, or failing. In areas where minor erosion has been identified, biotechnical methods may be used, which incorporate live vegetation with other natural elements (e.g., wood, biodegradable erosion control products, rock) to provide structural stability to streambanks.

Biotechnical bank stabilization approaches include erosion control fabric with coir logs, brush mattresses, willow walls, encapsulated soil lifts, and crib walls. Typically, these treatments will be implemented in combination with riparian planting projects to stabilize eroding streambanks and enhance native riparian plant communities. Erosion control and biotechnical bank stabilization elements will be installed using hand tools. However, some projects may require the use of a small excavator staged along the top of bank to perform minor grading or to place material. Hardscape rock materials may be used only at the toe of streambanks in combination with these measures if no effective alternative is feasible due to the magnitude of hydraulic forces involved, the need to protect infrastructure, or an adjacent land use constraint. In the event that the erosion or bank failure is catastrophic or exceeds the maximum linear footage of biotechnical bank stabilization projects allowed under the Project's



regulatory permits, the landowner will be responsible for the repair and can choose to collaborate with the District to implement a larger project consistent with the Project objectives and the optional services outlined in program funding methodology.

### ***Riparian Planting***

Areas subject to minor erosion may be hydroseeded with an appropriate native or sterile seed mix, and/or planted with native riparian species to stabilize eroding banks and reduce localized flow velocities and erosion potential. The goal of riparian planting is to enhance habitat for fish, birds, amphibians, and other wildlife using terrestrial riparian areas while providing shading, sources of organic matter and coarse woody debris, and water quality benefits to aquatic species. The planting palette will be consistent with the Project; the list of species will evolve to mimic the successional development of the riparian forest. Opportunities for riparian planting and restoration will be evaluated on a case-by-case basis at all maintenance locations within the Project.



Photo 5: CCC during riparian planting.

### ***Culvert Erosion Repair***

Existing drainage culverts and drop inlets within the Project that are blocked or in need of repair may contribute to overtopping flows (due to poor drainage), which can increase the opportunity for bank erosion or bank failure due to saturated soils. The clearing and repair of these structures will be coordinated with individual landowners. The goal of culvert inspection and repair is to ensure that existing infrastructure does not adversely impact the restoration projects or degraded bank conditions and aquatic resources. The District will implement minor erosion control or a bank stabilization project as a preventative measure if a drainage structure is contributing to bank erosion. In the event the structure needs to be replaced, the landowner will be responsible for the cost of replacing the structure, but the District will provide technical oversight to ensure the replacement is done in a manner that minimizes or avoids potential impacts. In some cases, a small amount of hardscape may be necessary at the toe-of-slope to provide added erosion protection for the bank. Repairs may require the use of erosion control materials, such as coir logs, coir blankets, brush mattresses, or soil lifts. In some cases, larger equipment, such as a mini-excavator, may be staged along the top of bank to facilitate minor grading actions or to place material. For replacement of existing infrastructure, landowners may be required to get additional permits before implementing replacement projects.

The following impact avoidance guidance applies to the District's maintenance of drop-inlet culverts:

- Repair of an existing culvert will occur within the same footprint as the original culvert.
- The culvert outfall path, from the culvert edge down to toe-of-slope, will be protected with erosion control material as needed to dissipate energy and reduce the erosion potential.

- The culvert repair will be installed to minimize outfall velocity and reduce the potential for future bank erosion and scour from outfall. Energy dissipation approaches will be used as needed.

## 1.4 Managed Streambank Retreat

The goal of managed streambank retreat is to create a more expansive riparian corridor for terrestrial species and a wider channel cross section that supports long-term habitat sustainability. It is a passive restoration technique that allows landowners to participate in riparian restoration as part of the CFD. In a managed streambank retreat zone, a landowner may choose to remove vineyards to install an alternative agricultural crop consistent with an Agroforestry model of a riparian buffer zone or restore the area with native riparian and upland plant species. Within the managed streambank retreat zone, landowners are agreeing to allow the river to naturally expand with the understanding that a maintenance action will take place to stabilize the stream bank before it reaches the defined managed retreat line. Typical maintenance actions will include the planting of native riparian and upland species, invasive and Pierce's disease plant management, biotechnical bank stabilization, laying the bank back to a stable slope, and erosion control measures. The District will collaborate with landowners to manage these areas in a manner that meets the Project objectives and is consistent with the landowner's land management regime.

Specific maintenance actions within managed streambank retreat zones are highly dependent upon site-specific conditions and will vary depending on the landowner's level of participation. The District will implement the above maintenance actions within these zones using a variety of methods using hand tools, power tools and small equipment, such as a skid steer or small excavator. In the event that a site experiences large scale retreat or erosion the District will collaborate with the landowner to identify a solution. Landowners may choose to pay for additional services to support the design, permitting and implementation of larger biotechnical streambank stabilization projects that are beyond the scope of the maintenance program.

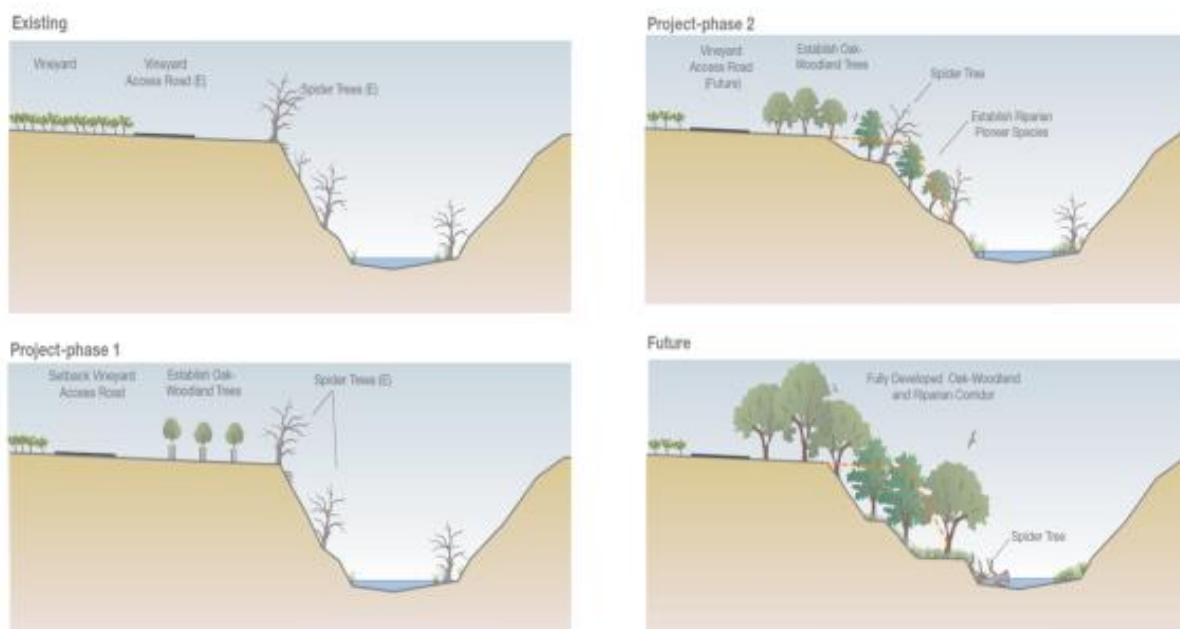


Figure 2: Theoretical example of managed retreat concept.

## 1.5 Restoration Project Monitoring and Adaptive Management

### *Restoration Project Objectives*

For the purposes of monitoring Project success, the goals and objectives of the Project include:

- Streambank Stability-minimizing the need for ongoing channel stabilization and repair work by establishing a more self-sustaining channel design that reduces maintenance needs;
- Physical Processes-enhancing geomorphic channel forms and processes to support a more diverse and complex instream condition;
- Floodplain Connectivity-increasing river and floodplain interactions where possible;
- Habitat-increasing and enhancing riverine, riparian, and floodplain habitat functions, with a focus to improve habitat for fish and wildlife;
- Riparian Plant Communities-removing invasive non-native vegetation and replanting with native vegetation that will not promote Pierce's disease in vineyards;
- Sediment TMDL-supporting the sediment reduction and habitat enhancement goals of the Napa River Sediment TMDL; and
- Stakeholder Participation-coordinating with landowners to address their interests with regard to river-adjacent farmland and property.

### *Monitoring and Adaptive Management Approach*

Restored Project areas will be monitored following construction to ensure that each restoration area performs as designed and meets Project objectives. It is likely that the grant funding agencies and permitting agencies for the Project will require monitoring to demonstrate that specific requirements have been achieved. For example, a common Project permit monitoring requirement is to evaluate post-Project planting to evaluate the success of new plantings, or a description of how instream features have performed over time. Additionally, grant funding agencies often require that the Project site be maintained for 10-20 years to ensure that the Project is successful and meeting the intended function.

The Project will include adaptive management strategies in the event that post-project conditions are not meeting original Project designs or objectives. Examples of adaptive management actions are described below.

The adaptive management framework links Project objectives to proposed monitoring elements based on the understanding of process-based relationships between existing conditions and restoration techniques aimed at achieving desired outcomes. The monitoring program provides a basis for evaluating the function of specific restoration features and informs annual maintenance activities. The monitoring program will entail an Annual Survey of the entire restoration reach, which uses a function-based stream assessment framework that may be event based and channel maintenance needs using rapid assessment formats. Monitoring activities could consist of activities such as vegetation

surveys, channel morphology survey, fisheries survey, wildlife surveys, and photo documentation of structures.

The monitoring program is designed to evaluate the success of the Project at meeting the objectives of reducing excessive channel bank and bed erosion, enhancing aquatic and riparian habitat, and protecting property. The monitoring program is organized around the Project objectives and is designed to address progress towards meeting stated Project goals and informing maintenance needs. **Table 2** provides the restoration actions, monitoring parameters, maintenance triggers, and maintenance actions to be implemented for the Project.

The adaptive management strategy consists of assessing annual monitoring data to determine if restoration elements are functioning as intended. In the event that a restoration element is not meeting its intended purpose, the restoration team will review the issue and prescribe a maintenance action that can be implemented to restore the intended function. Alternatively, the District may continue monitoring the restoration feature over multiple years to see if it develops the intended function over time. The adaptive management strategy is based on the understanding that rivers are dynamic systems and allows for the District to make professional judgments in prescribing or not prescribing maintenance actions. In the event that a restoration element fails, the District will evaluate the site to determine if it is providing an unintended function that is valuable to the Project. In the event that it is determined that the restoration element is not providing a valuable function to the Project, a maintenance action or larger design solution may be implemented.



Photo 6: After Construction of Restoration Project



Photo 7: During High Flow Monitoring



## Monitoring Framework

Table 1: River Monitoring Guidelines

<b>Goals/ Objective</b>	<b>Performance Indicator</b>	<b>Frequency</b>	<b>Performance Standards</b>	<b>Monitoring Method</b>
Streambank Stability	Eroding Streambank Survey	Bi-Annually	-Positive trends in reduction of bank erosion	-Eroding Streambank Survey -ITAS Assessment
Riparian Plant Communities	-Area successfully treated -Plant survival	Annual Survey For Five Years	-80% survival of native plants -Evidence of successful natural recruitment by year 5 at revegetation sites	-Vegetation Monitoring -Direct Count Plant Survival
Aquatic & Terrestrial Habitat	-LWD Structure Persistence (# years, % persistence) -Riffle length & Frequency -High flow refugia in constructed alcoves & velocities	Bi-Annually	-Increase in seasonal and high flow refugia, -Increase in riffle frequency, -Persistence of installed habitat enhancement structures	-LWD Survey -Channel Morphology Survey -Salmon Habitat Velocity Survey
Sediment TMDL & Channel Morphology	-ITAS Assessment -Length & Area of Actively Eroding Streambanks -Longitudinal Thalweg Survey	ITAS-Annual Survey Thalweg survey-pre and post project	-Reduction in length, or surface area of actively eroding streambanks	-Eroding Streambank Survey -Longitudinal Thalweg Survey
Stakeholder Participation	Landowner Advisory Task Force Participation	Two Meetings Annually	-Landowner Participation in Restoration Project -Landowner Advisory Committee Participation -Ongoing Collaboration Between District and Landowners	-Records of Landowner Maintenance Requests -Landowner Advisory Committee Meetings Attendance Records -Records of Landowner Access Agreements



Photo 8: Looking Downstream During Construction of the Rutherford Project



Photo 9: Looking Upstream After Construction



Photo 10: Looking Downstream During High flow Monitoring

Table 2: Monitoring Program and Maintenance Implementation Guidelines

Restoration Action	Monitoring Parameter	Maintenance Triggers	Maintenance Actions
Stabilize actively eroding banks with biotechnical methods	<ul style="list-style-type: none"> <li>▪ Eroding stream bank survey</li> <li>▪ Napa RCD fisheries studies</li> </ul>	<ul style="list-style-type: none"> <li>▪ Bank erosion advances significantly from previous monitoring period</li> <li>▪ Biotechnical stabilization feature fails or is experiencing erosion</li> </ul>	<ul style="list-style-type: none"> <li>▪ Continue Monitoring</li> <li>▪ Erosion control</li> <li>▪ Environmental Commitment</li> <li>▪ Biotechnical bank stabilization improvement</li> <li>▪ Minor grading</li> <li>▪ Riparian Planting</li> </ul>
Widen selected reaches to create inset floodplains benches and secondary channels	<ul style="list-style-type: none"> <li>▪ Channel morphology survey</li> </ul>	<ul style="list-style-type: none"> <li>▪ Sediment deposition degrades the function of restoration feature</li> <li>▪ Erosion degrades the function of restoration feature</li> </ul>	<ul style="list-style-type: none"> <li>▪ Continue Monitoring</li> <li>▪ Vegetation maintenance</li> <li>▪ Erosion control</li> <li>▪ Environmental Commitment</li> <li>▪ Biotechnical bank stabilization</li> <li>▪ Riparian planting</li> </ul>
Add in-channel large wood & roughness boulders	<ul style="list-style-type: none"> <li>▪ Large woody debris survey</li> <li>▪ Survey of California fresh water shrimp habitat structures</li> <li>▪ Napa RCD fisheries studies</li> </ul>	<ul style="list-style-type: none"> <li>▪ Restoration feature fails or the function is degraded</li> <li>▪ Sediment aggrades and buries a structure</li> <li>▪ Erosion threatens the stability of the structure</li> <li>▪ Debris jam or blockage degrades the function</li> </ul>	<ul style="list-style-type: none"> <li>▪ Continue monitoring</li> <li>▪ Debris management</li> <li>▪ Biotechnical bank stabilization</li> <li>▪ Replace LWD structure or boulders</li> <li>▪ Install new utility, log pin or boulder and cable anchor</li> </ul>
Augment channel with gravel	<ul style="list-style-type: none"> <li>▪ Channel Geomorphology survey</li> <li>▪ Erosion/deposition pins</li> </ul>	<ul style="list-style-type: none"> <li>▪ Gravel mobilizes downstream</li> <li>▪ Gravel augmentation areas become heavily vegetated and begins aggrading</li> <li>▪ The designed function is degraded</li> </ul>	<ul style="list-style-type: none"> <li>▪ Continue monitoring</li> <li>▪ Vegetation maintenance</li> <li>▪ Augment channel with gravel at site or upstream</li> </ul>
Floodplain Restoration	<ul style="list-style-type: none"> <li>▪ Channel Geomorphology survey</li> <li>▪ Erosion/deposition pins</li> <li>▪ Vegetation survey</li> </ul>	<ul style="list-style-type: none"> <li>▪ Abundant nonnative invasive vegetation growth</li> <li>▪ Sediment deposition degrades intended function</li> <li>▪ Significant Erosion of restoration feature or bank</li> </ul>	<ul style="list-style-type: none"> <li>▪ Continue monitoring</li> <li>▪ Vegetation maintenance</li> <li>▪ Riparian planting</li> <li>▪ Biotechnical bank stabilization</li> </ul>
Expand Riparian Forest	<ul style="list-style-type: none"> <li>▪ Vegetation survey</li> </ul>	<ul style="list-style-type: none"> <li>▪ Abundant nonnative invasive vegetation growth</li> <li>▪ Riparian restoration plant mortality exceeds 20% of installed plants within the first three years</li> <li>▪ Erosion of restoration feature</li> </ul>	<ul style="list-style-type: none"> <li>▪ Continue monitoring</li> <li>▪ Vegetation maintenance</li> <li>▪ Riparian Planting</li> <li>▪ Hand watering</li> <li>▪ Erosion control</li> <li>▪ Environmental Commitment</li> </ul>

## 1.6 Regulatory Compliance

The California Environmental Quality Act (CEQA) review will be completed for the Project in 2014. The Project Initial Study/Mitigated Negative Notice of Determination is on file (State Clearing House).

The regulatory permits acquired for the entire Project reach include:

- USACE CWA 404 Permit (No. 2008-00366N), with construction phase reviews for updated wetland delineations and cultural resources;
- Project Biological Assessment: NMFS and USFWS biological opinions;
- California Natural Diversity Database Record Search; and
- County Grading and Floodplain Management permit: the Project has been determined to be in compliance with County grading and floodplain management ordinances through completion and submittal to FEMA of a Conditional Letter of Map Revision (CLOMR) in 2008.

The regulatory permits which are issued by restoration implementation (construction) phase include:

- RWQCB 401 Water Quality Certifications;
- CDFW 1602 Streambed Alteration Permits; and
- CDFW Section 2081 of California Endangered Species Act-Incidental Take Permit.

The regulatory permits which are issued for routine and preventative maintenance include:

- CDFW 1602 Streambed Alteration Permits; and
- RWQCB 401 Water Quality Certification and 404 Waste Discharge Requirement.
- USACE CWA 404 Permit may be needed for bank stabilization depending on the site and design solution.

## 1.7 Community Facilities District Funding Approach

The CFD funding approach provides a mechanism for the District to collaborate with landowner's on the long-term maintenance of the OVOK restoration project. The CFD approach is flexible which allows for additional landowners to opt into the program, allows all participating landowners to receive a base level of services and allows for landowners to request additional services if interested. A general description of the CFD process is described below.

### **What is a CFD special tax?**

A CFD special tax is levied on taxable property within a district area that is used to finance the annual maintenance of the Restoration Project Maintenance Program.

### **How does a CFD special tax work?**

Special taxes for a CFD are levied annually and are levied on the property tax bill.



**How is the Special Tax calculated?**

Each parcel's special tax is calculated based on each parcel's linear frontage and/or its restoration linear frontage.

**Does the CFD special tax have a maximum amount?**

Yes, the CFD has a maximum special tax amount which cannot be exceeded, subject to an annual inflation index. The amount of special tax levied may fluctuate from year to year; however, it may not exceed its annual maximum amount.

**Does a CFD special tax decrease?**

Property owners may be charged less than the maximum special tax or less than the prior year's special tax depending on the revenue needs of the District.

**When does the CFD special tax expire?**

The Oak Knoll CFD will have a sunset clause not to exceed 20 years, a term consistent with many grant funding requirements.

**Is a parcel subject to the special tax if it does not receive any of the restoration improvements?**

No, only those parcels that have received any of the restoration maintenance program are subject to the special tax.

**Once a parcel is charged the special tax, can it be removed from the taxed thereafter?**

No, once a parcel is subject to the special tax, it will receive the annual special tax subject to the 20 year sunset.

**If my parcel is not included in the original formation of the CFD, may I chose to annex my parcel into the CFD?**

Yes, every year a parcel owner may sign an annexation form with the District and then be subject to the special tax.

**When and how are the CFD special taxes collected?**

The special tax is usually collected by the County Tax Collector as part of your property tax bill. Under certain circumstances, the District can elect to bill the property owners directly

***CFD Rate Description***

Each participating parcel will be subject to the Channel Maintenance and Monitoring Costs described in **Table 3** and charged the given rate for these services. Any parcel with a restoration project on it will also be charged for the Maintenance of Restoration Features. An estimate budget for the CFD appears in **Table 4** below and outlines how the funds would be spent on any given year.

Table 3: CFD Rate Description

Budget Item	Unit	Rate	Estimated Annual Budget
Monitoring	Linear Feet	\$0.24	\$14,480
Channel Maintenance	Linear Feet	\$0.88	\$59,500
Maintenance of Restoration Features	Linear Feet of Restoration Site	\$1.17	\$34,140

Table 4: Estimated Annual Maintenance and Monitoring Budget

	Budget Item	Cost Breakdown	Percentage of Total Budget	Estimated Total Budget
<b>Routine Channel Maintenance Activities</b>				
1	Downed Tree Management	Work: 5 days @ \$2,340 per crew day = \$11,700	11	11,700
2	Debris Management	Work: 5 days @ \$2,140 per crew day = \$10,700	10	10,700
3	Vegetation Management	Work: 10 days @ \$2,140 per crew day = \$21,400	20	21,400
4	Streambank Erosion Control	Erosion/biotechnical: 5 days @ \$2,340 per crew day = \$11,700; mis. supplies and equipment \$4,000	15	15,700
<b>Restoration Site Maintenance</b>				
5	Repair and maintenance of Floodplain Benches	Repair and maintenance work: 2 days @ \$2,340 per crew day = \$4,680; mis. supplies and equipment \$500	5	5,180
6	Maintenance of Created Vegetation Buffers	Plantings: 4 days @ \$1,840 per crew day = \$7,360	7	7,360
7	Repair and Maintenance of Aquatic Habitat Enhancement Structures	Work: 2 days @ \$2,340 per crew day = \$4,680	4	4,680
8	Repair and maintenance of Streambank Stability Structures	Work: 2 days @ \$2,340 per crew day = \$4,680	4	4,680
9	Invasive Plants Removal, PD Management and Revegetation	Herbicide: 4 days @ \$2,140 per day = \$8,560; Planting: 2 days @ \$1,840 per crew day = \$3,680	11	12,240
<b>Monitoring</b>				
10	Annual Surveys, Development of Work Plans, Assessment Management	Surveys: 3 days (3 persons) @ \$1,920 per day = \$5,760; Reports: 3 days @ 640 per day = \$1,920; Planning/Permitting: 3 days @ \$640 per day = \$1,920; mis supplies \$400	9	10,000
11	Monitoring	Surveys: 2 days (2 persons) @ \$1,280 per day = \$2,560; Monitoring Report: 3 days @ 640 per day = 1,920	4	4,480
<b>Total</b>			<b>100</b>	<b>108,120</b>

## ***Description of Optional Services***

There are optional services built into the CFD funding methodology to help landowners cover the costs of larger scale managed retreat projects. These optional services require a landowner to identify a project and sign up for the additional assessment. The costs outlined below will not be charged to the landowner unless they initiate one or more of the below projects in coordination with the District. This is also meant to be a tool to assist other landowner within the CFD boundary with raising funds to support future restoration projects or used as matching funds to apply for grants.

Table 5: Optional services

<b>Optional Services</b>			
Activities	Unit	Trigger Events	Maximum Cost Per Linear Ft.
Managed Retreat-Back Planting	Linear Feet	Landowner Initiated	\$75
Managed Retreat-Biotechnical Streambank Stabilization	Linear Feet	Landowner Initiated & Bank Erosion	\$200
Planning, Design, Permitting of a Restoration Project	Linear Feet	Landowner Initiated	\$250
Implementation of a Restoration Project	Linear Feet	Landowner Initiated	\$1,000

Table 6: CFD Formation Timeline

#	Description	Item:	Date:
1	Review draft Rate and Method of Apportionment	Report	May 15
2	Resolution of Intention to Establish CFD	Resolution	June 17
3	Record CFD Boundary Map with County		July 1
4	Review draft CFD Report	Report	July 1
5	Notice of Public Hearing in newspaper - 7 days prior to hearing		July 29
6	Resolution of Formation - Public Hearing	Resolution	Aug 5
7	Resolution Calling for Special Election	Resolution	Aug 5
8	Resolution Declaring Results	Resolution	Aug 5
9	Ordinance Levying Special Tax	Ordinance	Aug 5
10	Record Notice of Special Tax Lien		By Aug 20
11	Submit Special Tax roll to County Auditor		Aug 10
12	Initial Tax Collection		December 2014

## 1.8 County of Napa OVOK Restoration Project Construction Schedule

### *Construction Grouping Rationale*

The proposed construction groups were defined using a number of criteria related to maintaining overall project schedule, regulatory conditions, anticipated construction costs, available funding, and landowner coordination. In addition, project goals and priorities for specific types and scale of habitat creation were also considered in the construction groupings. A list of specific evaluation criteria and summary discussion of each proposed construction group follows:

1. Anticipated Construction Duration
2. Regulatory and Permitting Requirements
  - CDFW 1600-Stream Bed Alteration Agreement, CDFW ITP-Incidental Take Permit
  - Air Quality Impacts (disposal of material)
3. Anticipated Construction Cost
4. Available Funding: Grant Awards and Cycles
5. Landownership and Duration of Potential Impact to Vineyard Operations

### *Construction Group Summaries*

#### *Group A*

Based on field surveys and technical design evaluations, the Group A projects are expected to create limited temporary impacts to existing natural resources including habitat areas and specific aquatic species such as California Freshwater Shrimp (a listed threatened species). Permitting (CDFW 1600) for Group A is expected to be complete in time to allow for construction during the 2015 summer. Based on the scale and scope of the Group A projects construction is estimated to be completed under one season. All of the project sites in Group A fall under two landowners, Jackson Family Estates and Constellation. The majority of the sites are on land owned by Constellation, which simplifies coordination and limits construction impacts to a single construction season. Napa County has secured grant funding coupled with Measure A that is consistent with the anticipated construction costs for the group. The combination of factors prioritizes this group for the first phase of construction.

#### **Construction Group A ( Sites 23, 22, 21, 7, 4, 3) Project Schedule**

	<i>Activity</i>	<i>Date</i>
<b>Preliminary Design &amp; Permitting</b>	Complete Supplemental Site Surveys and Analyses	February 2014
	Complete Topographic Surveys	March 2014
	CEQA Comment Period and Approval	March to May 2014
<b>Final Design &amp; Permitting</b>	Grant Acquisition (Application Development & Submittal)	February to December 2014
	65%-Design Submittal and Landowner Review	July 2014 to August 2014

	Construction Permitting Including Agency Site Visits	October 2014 to March 2015
	95%-Design Submittal and Landowner Review	December 2014 to January 2015
	Final Design and Bidding	April 2015
Construction Implementation	Pre-construction Activities (Biological-Surveys, Landowner Site Preparations, etc)	February to June 2015
	Begin Grading & Construction	June 2015
	End Grading & Construction	November 2015
	Revegetation	November 2015 to April 2016

<sup>1</sup> Final construction implementation dates conditional on grant funding

### **Group B**

Based on field surveys and technical design evaluation, the Group B projects are expected to create limited temporary impacts to existing natural resources including habitat areas and specific aquatic species such as California Freshwater Shrimp (a listed threatened species). Based on the scale and scope of the Group A projects construction is estimated to be completed under one season. The majority of project sites in Group B fall under two related landowners Tom and Launce Gamble. Planning for design and construction at the proposed sites requires coordination between the County, the landowner and the lessee of the property, Treasury, which extends the project schedule for this construction group. Funding for these proposed projects has not been identified. The combination of factors extends the construction schedule for this group.

#### **Construction Group B (20, 19, 18, 17, 16, 15) Project Schedule**

	<b>Activity</b>	<b>Date</b>
Preliminary Design & Permitting	Complete Supplemental Site Surveys and Analyses	January 2016
	Complete Topographic Surveys	October 2015
	CEQA Comment Period and Approval	March to May 2014
Final Design & Permitting	Grant Acquisition (Application Development & Submittal)	February 2015 to September 2016
	65%-Design Submittal and Landowner Review	March to June 2016
	Construction Permitting Including Agency Site Visits	July to September 2016
	95%-Design Submittal and Landowner Review	September to December 2016
	Final Design and Bidding	January to March 2017
Construction Implementation	Pre-construction Activities (Biological-Surveys, Landowner Site Preparations, etc)	February to June 2017
	Begin Grading & Construction	June 2017
	End Grading & Construction	November 2017
	Revegetation	November 2017 to April 2018

<sup>1</sup> Final construction implementation dates conditional on grant funding

## Group C

Based on field surveys and technical design evaluations, the Group C projects are expected to require specific permits (CDFW ITP) related to anticipated impacts to existing natural resources including habitat areas and specific aquatic species such as California Freshwater Shrimp (a listed threatened species). Permitting for Group C is expected to be completed over a period of 12 to 18 months leading to construction in 2016. The Group C projects present a unique opportunity to create expansive habitat enhancement areas connected to CDFW's Napa River Ecological Preserve. The proposed projects also address significant areas of degraded habitat and extensive areas of bank instability and erosion. Based on the significant scale and scope of the Group C projects construction is estimated to be completed over a period of two seasons. The project sites in Group C fall under four (4) separate landowners, Berringer, Missimer, Traina, and Silverado, which requires more complex coordination to coordinate effective construction phasing. Donation of the Missimer parcel to the Napa County Land Trust is not anticipated to be complete until 2016. Napa County is in the process of strategizing funding opportunities based on the relatively high anticipated construction costs for the group. The combination of factors prioritizes this group for the later phases of construction assuming funding is available and secured.

**Construction Group C (14, 13, 12, 11) Project Schedule**

	<i>Activity</i>	<i>Date</i>
<b>Preliminary Design &amp; Permitting</b>	Complete Supplemental Site Surveys and Analyses	October 2014
	Complete Topographic Surveys	January 2014
	CEQA Comment Period and Approval	March to May 2014
<b>Final Design &amp; Permitting</b>	Grant Acquisition (Application Development & Submittal)	February 2014 to December 2015
	65%-Design Submittal and Landowner Review	October 2014 to December 2014
	Construction Permitting Including Agency Site Visits	January 2015 to December 2015
	95%-Design Submittal and Landowner Review	September 2015 to January 2016
	Final Design and Bidding	February to March 2016
<b>Construction Implementation</b>	Pre-construction Activities (Biological-Surveys, Landowner Site Preparations, etc)	February to June 2016
	Begin Grading & Construction	June 2016 (Phase 1) & June 2017 (Phase 2)
	End Grading & Construction	November 2016 (Phase 1) & November 2017 (Phase 2)
	Revegetation	November 2016 to April 2017 (Phase 1) & November 2017 to April 2018 (Phase 2)

<sup>1</sup> Final construction implementation dates conditional on grant funding

## **Group D**

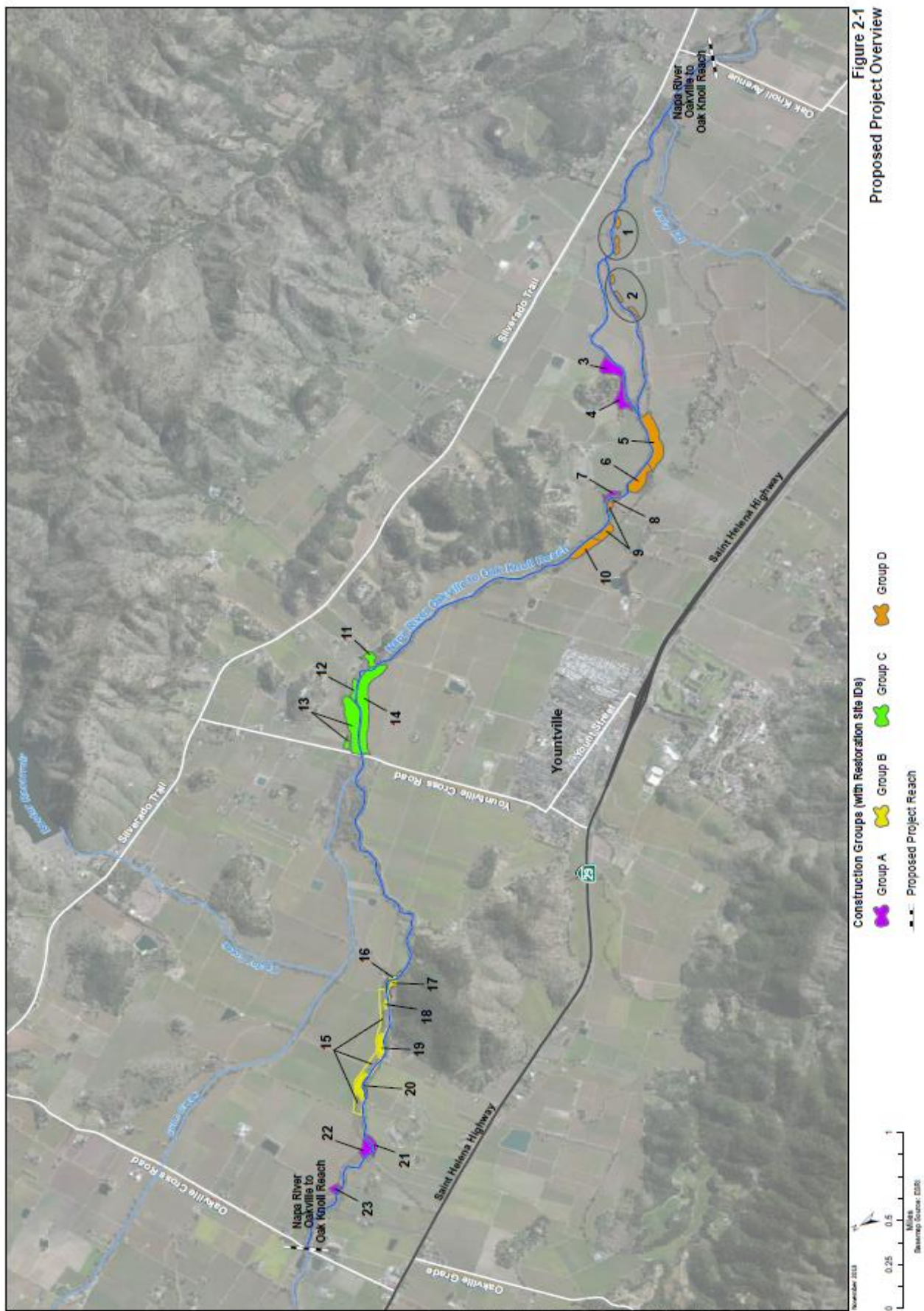
Based on field surveys and technical design evaluations, the Group D projects are expected to create limited temporary impacts to existing natural resources including habitat areas and specific aquatic species such as California Freshwater Shrimp (a listed threatened species). Based on the significant scale and scope of the Group D projects construction is estimated to be completed over a period of two seasons. The project sites in Group D fall under four (4) separate landowners; Miller, Massa, Krug, and Silverado Premium Properties which will require more effort to coordinate access agreements and construction phasing. The project sites are grouped, in part, due to their proximity and adjacency to one another as well as the more complex landowner scenario. Napa County is in the process of pursuing grant funding opportunities to support the relatively high anticipated construction costs for the group. Planning for design and construction at the proposed sites requires coordination between the County and landowners which extends the project schedule for this construction group. Funding for these proposed projects has not been identified. The combination of factors extends construction for this group to the later phases of the project.

### **Construction Group D (10, 9, 8, 6, 5, 2, 1) Project Schedule**

	<b>Activity</b>	<b>Date</b>
<b>Preliminary Design &amp; Permitting</b>	Complete Supplemental Site Surveys and Analyses	January 2017
	Complete Topographic Surveys	January 2017
	CEQA Comment Period and Approval	March to May 2014
<b>Final Design &amp; Permitting</b>	Grant Acquisition (Application Development & Submittal)	February 2016 to October 2017
	65%-Design Submittal and Landowner Review	May to July 2017
	Construction Permitting Including Agency Site Visits	May to July 2017
	95%-Design Submittal and Landowner Review	October to December 2017
	Final Design and Bidding	February to May 2018
<b>Construction Implementation</b>	Pre-construction Activities (Biological-Surveys, Landowner Site Preparations, etc)	February to June 2018
	Begin Grading & Construction	June 2018 (Phase 1) & June 2019 (Phase 2)
	End Grading & Construction	November 2018 (Phase 1) & November 2019 (Phase 2)
	Revegetation	November 2018 to April 2019 (Phase 1) & November 2019 to April 2020 (Phase 2)

<sup>1</sup> Final construction implementation dates conditional on grant funding







## Appendix B

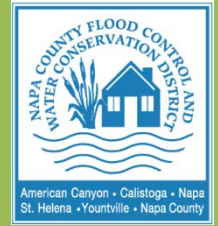
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### Napa River Restoration: Oakville to Oak Knoll Reach Community Facilities District Guidance Document



# **NAPA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT**

**Community Facilities District No. 2014-01**



## **Community Facilities District Report**



**Oakville - Oak Knoll  
Maintenance, Monitoring and Restoration Project**

**Napa, California  
September 2014**

Prepared by: Kristin Lowell Inc.

# **COMMUNITY FACILITIES DISTRICT REPORT**

## **CONTENTS**

### **Introduction**

- A. Description of Services
- B. Proposed Boundaries of the Community Facilities District
- C. Cost Estimate
- D. Rate and Method of Apportionment
- E. Special Taxed Parcels

\* \* \* \* \*

EXHIBIT A – List of Authorized Services

EXHIBIT B - Boundary Map

EXHIBIT C - Cost Estimate

EXHIBIT D – Rate and Method of Apportionment of Special Tax

EXHIBIT E – List of Special Taxed Parcels

EXHIBIT F – Napa River Restoration Oakville to Oak Knoll Reach CFD Guidance Document

**Napa County Flood Control and Water Conservation District  
Community Facilities District No. 2014-01  
(Oakville - Oak Knoll Maintenance, Monitoring and Restoration Project)**

**INTRODUCTION**

On August 12, 2014, the Napa County Flood Control and Water Conservation District (the "District") Board of Directors adopted a "Resolution of the Board of Directors of the Napa County Flood Control and Water Conservation District to Establish a Community Facilities District" (the "Resolution of Intention"), stating its intention to form the Napa County Flood Control and Water Conservation District Community Facilities District No. 2014-01 (Oakville – Oak Knoll Maintenance, Monitoring and Restoration Project) (the "CFD") pursuant to the Mello-Roos Community Facilities Act of 1982, Sections 53311 et. seq., California Government Code (the "Act") and to levy a special tax to finance the costs of certain public services in and for such Community Facilities District.

In the Resolution of Intention, the District expressly ordered the preparation of a written report (the "Report"), for the CFD containing the following:

1. A description of the Services which will be required to adequately meet the needs of the CFD; and
2. An estimate of the fair and reasonable cost of the Services included therewith.

For particulars, reference is made to the Resolution of Intention for the CFD, as previously approved and adopted by the Council.

**NOW, THEREFORE**, the undersigned does hereby submit the following data:

**A. DESCRIPTION OF SERVICES.** A general description of the proposed services is set forth in Exhibit "A" attached hereto and hereby made a part hereof.

**B. PROPOSED BOUNDARIES OF THE COMMUNITY FACILITIES DISTRICT.** The proposed boundaries of the CFD are those properties and parcels in which special taxes may be levied to pay for the costs and expenses of the Services. The proposed boundaries of the CFD are described on the recorded map of the CFD on file with the Secretary of the District, to which reference is hereby made. A reduced copy of the proposed boundaries of the CFD is set forth in Exhibit "B" attached hereto and hereby made a part hereof.

**C. COST ESTIMATE.** The cost estimate for the Services for the CFD is set forth in Exhibit "C" attached hereto and hereby made a part hereof.

**D. RATE AND METHOD OF APPORTIONMENT OF SPECIAL TAX.** The Rate and Method of Apportionment of Special Tax for the CFD is set forth in Exhibit "D" attached hereto and hereby made a part hereof.

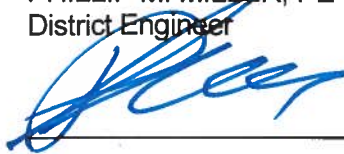
**E. LIST OF SPECIAL TAXED PARCELS.** The list of parcels to receive the special tax is set forth in Exhibit "E" attached hereto and hereby made a part hereof.

## CERTIFICATIONS

The undersigned respectfully submits the enclosed Community Facilities District Report as directed by the Board of Directors.

Dated: September 11, 2014

PHILLIP M. MILLER, PE  
District Engineer



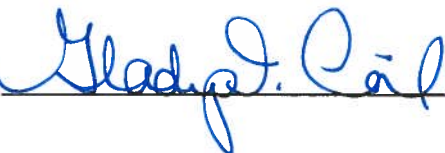
I HEREBY CERTIFY that the enclosed Community Facilities District Report was filed with me on the 12 day of September, 2014.

GLADYS I. COIL, Secretary of the District Board  
Napa County, California

By 

I HEREBY CERTIFY that the Community Facilities District Report was approved and confirmed by the Board of Directors of the Napa County Flood Control and Water Conservation District, on the 23rd day of September, 2014.

GLADYS I. COIL, Secretary of the District Board  
Napa County, California

By 

## **EXHIBIT A**

### **Napa County Flood Control and Water Conservation District Community Facilities District No. 2014-01 (Oakville - Oak Knoll Maintenance, Monitoring and Restoration Project)**

#### **LIST OF AUTHORIZED SERVICES**

The public services to be funded by Napa County Flood Control and Water Conservation District CFD No. 2014-01 shall consist of maintenance, monitoring, and restoration of the Napa River between Oakville and Oak Knoll reach. The objectives of the services are to:

1. Minimize bank erosion through vegetation management, large woody debris realignment and/or relocation, debris/large trash removal, and biotechnical stabilization.
2. Maintain the function of constructed instream habitat enhancement structures.
3. Control target non-native invasive and Pierce's disease host plants, to the extent practicable, within the riparian corridor of the reach.

For a complete description of the authorized services please refer to the Napa River Restoration Oakville to Oak Knoll Reach CFD Guidance Document, attached hereto as Exhibit F.

## **EXHIBIT B**

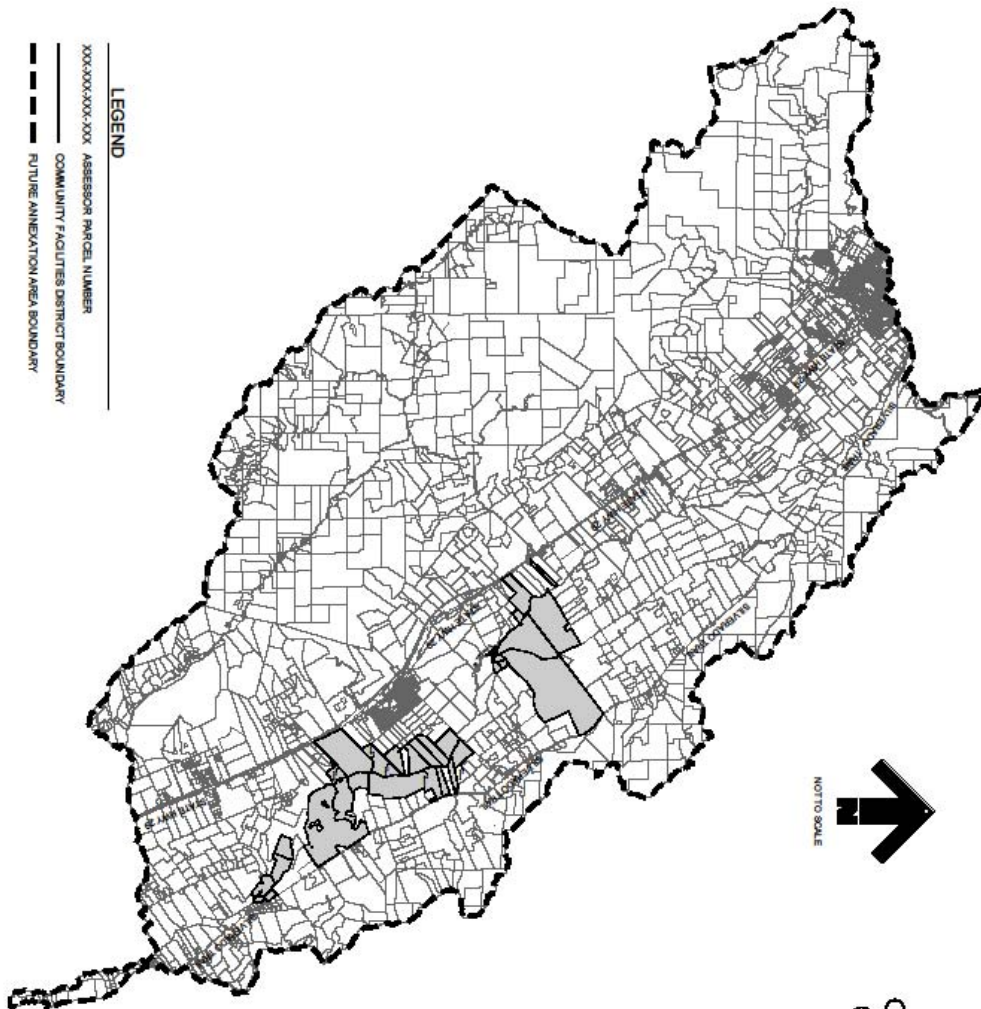
**Napa County Flood Control and Water Conservation District  
Community Facilities District No. 2014-01  
(Oakville - Oak Knoll Maintenance, Monitoring and Restoration Project)**

### **BOUNDARY MAP**

Reference is hereby made to the recorded boundary map on file in the office of the Secretary of the District for a description of the boundaries of the CFD. A reduced copy of the cover page of the boundary map is included on the following page.



PROPOSED BOUNDARIES OF  
NAPA COUNTY FLOOD CONTROL AND  
WATER CONSERVATION DISTRICT  
COMMUNITY FACILITIES DISTRICT NO. 2014-01  
(Outside - Oak Knoll Maintenance, Monitoring and Restoration Project)  
COUNTY OF NAPA, STATE OF CALIFORNIA  
SHEET 1 OF 6



1. FILED IN THE OFFICE OF THE CLERK OF THE BOARD OF DIRECTORS THIS \_\_\_\_\_ DAY OF \_\_\_\_\_ 2014.

\_\_\_\_\_  
SECRETARY OF THE BOARD  
NAPA COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT

2. I HEREBY CERTIFY THAT THE WITHIN MAP SHOWING PROPOSED BOUNDARIES OF NAPA COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT DOMINANTLY RELATES TO 2014-01, COUNTY OF NAPA, STATE OF CALIFORNIA, AND WAS PREPARED BY ME OR UNDER MY CLOSE PERSONAL SUPERVISION AND REVIEWED BY ME SINCE \_\_\_\_\_ DAY OF \_\_\_\_\_ 2014.

\_\_\_\_\_  
SECRETARY OF THE BOARD  
NAPA COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT

3. FILED THIS \_\_\_\_\_ DAY OF \_\_\_\_\_ 2014, AT THE HOUR OF \_\_\_\_\_ O'CLOCK, \_\_\_\_\_ IN THE OFFICE OF THE COUNTY RECORDER IN THE COUNTY OF NAPA, STATE OF CALIFORNIA.

\_\_\_\_\_  
COUNTY RECORDER  
COUNTY OF NAPA  
RECORDING NUMBER: \_\_\_\_\_

KRISTIN LOWELL INC.  
PUBLIC FINANCE SOLUTIONS



## EXHIBIT C

**Napa County Flood Control and Water Conservation District  
Community Facilities District No. 2014-01  
(Oakville - Oak Knoll Maintenance, Monitoring and Restoration Project)**

### **COST ESTIMATE**

The following estimate is the projected annual expense for the initial year the services are to be provided.

<b>Budget Item</b>	<b>Cost Breakdown</b>	<b>Annual Cost Estimate</b>
<b>Monitoring, Permitting, Planning</b>		
Annual Surveys, Development of Work Plans, Assessment Management	Linear Feet	\$7,652
Monitoring	Linear Feet	\$5,000
<b>Total Cost and Rate</b>		<b>\$12,653</b>
<b>Channel Maintenance Activities</b>		
Down Tree Management	Linear Feet	\$12,000
Debris Management	Linear Feet	\$10,000
Vegetation Management	Linear Feet	\$12,000
Streambank Erosion Management	Linear Feet	\$12,394
<b>Total Cost and Rate</b>		<b>\$46,394</b>
<b>Maintenance of Restoration Features</b>		
Repair and maintenance of Floodplain Benches	Acreage or Linear Feet	\$4,000
Maintenance of Created Vegetation Buffers	Acreage or Linear Feet	\$4,800
Repair and Maintenance of Aquatic Habitat Enhancement Structures	Acreage or Linear Feet	\$5,100
Repair and maintenance of Streambank Stability Structures	Acreage or Linear Feet	\$5,100
Invasive Plants Removal, PD Management and Revegetation	Acreage or Linear Feet	\$10,000
<b>Total Cost and Rate</b>		<b>\$20,560</b>
<b>Total Cost of Community Facilities District</b>		<b>\$79,608</b>

## EXHIBIT D

### **Napa County Flood Control and Water Conservation District Community Facilities District No. 2014-01 (Oakville - Oak Knoll Maintenance, Monitoring and Restoration Project)**

#### **RATE AND METHOD OF APPORTIONMENT OF SPECIAL TAX**

A special tax shall be levied within the Napa County Flood Control and Water Conservation District Community Facilities District No. 2014-01 (the "CFD") and shall be collected each fiscal year for 20 years commencing with Fiscal Year 2014-2015, in an amount determined through the application of the procedures described below. All the property in the CFD, unless exempted by law, shall be taxed for the purposes, to the extent, and in the manner herein provided, including property subsequently annexed to the CFD, unless a separate Rate and Method of Apportionment of Special Tax is adopted for the annexation area.

#### **A. DEFINITIONS**

The terms hereinafter set forth have the following meanings:

**"Act"** means the Mello-Roos Community Facilities Act of 1982, as amended, being Chapter 2.5 of Part 1 of Division 2 of Title 5 of the California Government Code.

**"Administrative Expenses"** means, for any Fiscal Year, any actual or reasonably estimated costs directly related to the administration of the CFD, including: the costs of computing and levying the Special Taxes (whether by the District or any designee thereof); the costs of collecting the Special Taxes (whether by the County on the property tax rolls, by the District through direct billing of the property owners, by the County or the District through foreclosure proceedings, or otherwise); the fees and expenses of legal counsel; costs related to property owner inquiries regarding the Special Tax; and all other costs and expenses of the District in any way related to the establishment or administration of the CFD or administration of the Special Tax.

**"Administrator"** means the District Engineer or designee thereof responsible for the annual administration of the Special Tax.

**"Assessor's Parcel"** means a lot or parcel shown on an official map of the County Assessor designating parcels by Assessor's parcel numbers.

**"Authorized Services"** means those public services authorized to be funded by the CFD as set forth in the Resolution of Intention:

- Channel Maintenance
- Monitoring
- Restoration Site Maintenance

**"Base Special Tax"** means the Special Tax levied against each Assessor's Parcel for each Fiscal Year, as determined in accordance with Section D below.

**“Board”** means the Napa County Flood Control and Water Conservation District Board of Directors, acting as the legislative body of the CFD.

**“CFD”** means the Napa County Flood Control and Water Conservation District Community Facilities District No. 2014-01.

**“County”** means the County of Napa.

**“District”** means the Napa County Flood Control and Water Conservation District.

**“Exempt Property”** means all Assessor’s Parcels that are exempt from the Special Tax under Section E below.

**“Fiscal Year”** means the period starting July 1 and ending on the following June 30.

**“Future Annexation Areas”** means the areas designated for potential future annexation into the CFD as shown in the CFD boundary map recorded in the County Recorder’s Office.

**“Linear Footage”** means the number of linear feet of river frontage on an Assessor’s Parcel, as determined by the District from time to time in accordance with Section D.

**“Maintenance Parcel”** means any Assessor’s Parcel classified as such for any Fiscal Year under Section B.

**“Maximum Special Tax”** means the maximum Special Tax, determined in accordance with Section C below, that can be levied in a particular Fiscal Year on an Assessor’s Parcel.

**“Monitoring Parcel”** means any Assessor’s Parcel classified as such for any Fiscal Year under Section B.

**“Optional Services”** means the services included in Authorized Services and identified as Optional Services as set forth in the Resolution of Intention, which a Property Owner may request for an Assessor’s Parcel in accordance with Section E herein. Optional Services include:

- Managed Retreat, such as back planting
- Managed Retreat, such as biotechnical streambank stabilization
- Planning, Design, Permitting of a Restoration Project
- Implementation of a Restoration Project

**“Optional Services Special Tax”** means a special tax on an Assessor’s Parcel in addition to Base Special Tax to pay for Optional Services as requested from a Property Owner.

**“Parcel Classification”** means the classification of each Assessor’s Parcel made by the District for each Fiscal Year under Section B.

**“Property Owner”** means, for each Fiscal Year, the legal owner of an Assessor’s Parcel as shown on the last equalized County Assessor’s roll for that Fiscal Year, or such other owner of the fee interest in that Assessor’s Parcel who has provided proof of ownership to the District.

**“Resolution of Intention”** means the resolution entitled “Resolution of Intention of the Board of Directors of the Napa County Flood Control and Water Conservation District to Establish a Community Facilities District” adopted by the Board on August 12, 2014, and as may be amended from time to time.

**“Restoration Linear Footage”** means the number of linear feet on an Assessor’s Parcel that was part of the Restoration Project, as determined by the District from time to time in accordance with Section D.

**“Restoration Project”** means the capital improvement project funded through the District to restore and enhance long term river and floodplain function, enhance native riparian plant communities, improve the quality and resilience of aquatic and terrestrial riparian habitat, and reduce property damage and sediment delivery associated with ongoing bank erosion processes.

**“Restoration Project Parcel”** means any Assessor’s Parcel classified as such for any Fiscal Year under Section B.

**“Special Taxes”** means the special taxes authorized to be levied by the CFD under the Act, the Resolution of Intention, and this Rate and Method of Apportionment of Special Tax.

**“Special Tax Requirement”** means, for each Fiscal Year, that amount required, after taking into account available amounts held in the funds and accounts established for the CFD to: (i) pay Administrative Expenses; (ii) pay directly for Authorized Services; and (iii) pay for reasonably anticipated delinquent Special Taxes based on the delinquency rate for Special Taxes levied in the previous Fiscal Year.

**“Taxable Property”** means, for each Fiscal Year, all of the property within the boundaries of the CFD that is subject to the Special Tax and not exempt from the Special Tax pursuant to the Act.

## **B. ASSIGNMENT TO PARCEL CLASSIFICATION**

Each Fiscal Year, the District shall classify each Assessor’s Parcel as Taxable Property or Exempt Property, and shall then further classify each Assessor’s Parcel of Taxable Property in one or more of the following categories:

- Maintenance Parcel
- Monitoring Parcel, and
- Restoration Project Parcel.

The District may classify an Assessor’s Parcel as a Restoration Project Parcel only if that Assessor’s Parcel is included in the Restoration Project.

**C. MAXIMUM SPECIAL TAX**

Each Fiscal Year, the Maximum Special Tax for each Assessor's Parcel shall equal the sum of (i) the current Base Special Tax determined pursuant to Section D, (ii) any Optional Services Special Tax requested to be levied on that Assessor's Parcel for that Fiscal Year by the respective Property Owner pursuant to Section E, (iii) any Base Special Taxes or Optional Services Special Taxes from prior Fiscal Years that have not yet been paid, and (iv) penalties and interest that have accrued on the delinquent Special Taxes.

**D. CALCULATION OF BASE SPECIAL TAX**

The Base Special Tax for each Assessor's Parcel shall be based on its Parcel Classifications under Section B and its Linear Footage and Restoration Linear Footage determined as set forth below.

The Base Special Tax per Linear Foot and Restoration Linear Foot for each Parcel Classification is shown below in Table 1.

**Table 1  
Base Special Tax**

<b>Parcel Classification</b>	<b>Linear Foot Base Special Tax</b>	<b>Restoration Linear Foot Base Special Tax</b>
Maintenance Parcel	\$0.88	\$0.00
Monitoring Parcel	\$0.24	\$0.00
Restoration Project Parcel	\$0.00	\$1.17

All of the Base Special Taxes set forth in Table 1 above shall increase each Fiscal Year, beginning with Fiscal Year 2015-16, by the same percentage as the increase, if any, in the March Engineering News Record Construction Cost Index for the City of San Francisco.

The total Base Special Tax for each Assessor's Parcel shall equal the sum of the Base Special Taxes for each applicable Parcel Classification for that Assessor's Parcel, calculated as set forth in Table 1 above.

For Fiscal Year 2014-15, the Linear Footage and Restoration Linear Footage for each Assessor's Parcel in the CFD are set forth in Exhibit A hereto. For future Fiscal Years, the Linear Footage and Restoration Linear Footage for each Assessor's Parcel shall be determined by the District in its sole discretion, as will be evidenced by an amendment to Exhibit A hereto filed with the District Administrator, and the recordation of an amendment to the Notice of Special Tax Lien for the CFD.

**E. CALCULATION OF OPTIONAL SERVICES SPECIAL TAX**

Any Property Owner may request that the District provide Optional Services to that Property Owner's respective property in the CFD. The Optional Services Special Tax will be levied in addition to the Base Special Tax.

The Optional Services Special Tax per Linear Foot for each Optional Service is shown below in Table 2.

**Table 2**  
**Optional Services Special Tax**

<b>Optional Services</b>	<b>Linear Foot Optional Service Special Tax</b>
Managed Retreat-Back Planting	\$75.00
Managed Retreat-Biotechnical Streambank Stabilization	\$200.00
Planning, Design, Permitting of Restoration Project	\$250.00
Implementation of a Restoration Project	\$1,000.00

Any Property Owner who desires to request Optional Services on an Assessor's Parcel must submit a signed written request for that Assessor's Parcel, in the form attached as Exhibit B hereto (the "Request and Consent"), for each Fiscal Year during which the Optional Services Special Tax will be levied, specifying the specific Optional Services requested. The Property Owner must submit a Request and Consent no later than the May 1 immediately preceding the beginning of the Fiscal Year for which the Optional Services are requested.

**F. METHOD OF APPORTIONMENT; PROVISION OF SERVICES**

Each Fiscal Year, the Board shall levy Special Taxes on each Assessor's Parcel classified as Taxable Property in an amount equal to the sum of the following: (a) Base Special Taxes up to 100% of the applicable Maximum Special Tax as needed to satisfy the Special Tax Requirement, plus (b) the amount of Optional Services Special Taxes set forth in a Request and Consent submitted by the applicable Property Owner pursuant to Section E.

Each Fiscal Year, the District shall provide Authorized Services to each parcel of Taxable Property in accordance with its classifications under Section B, and with any Request and Consent submitted by the applicable Property Owner pursuant to Section E. as follows:

- Any Assessor's Parcel classified as and subject to the levy of Base Special Taxes as a Maintenance Parcel shall receive that portion of Authorized Services designated as "Maintenance Services" under the Resolution of Intention.

- Any Assessor's Parcel classified as and subject to the levy of Base Special Taxes as a Monitoring Parcel shall receive that portion of Authorized Services designated as "Monitoring Services" under the Resolution of Intention.

- Any Assessor's Parcel classified as and subject to the levy of Base Special Taxes as a Restoration Project Parcel shall receive that portion of Authorized Services designated as "Restoration Project Services" under the Resolution of Intention.

- Any Assessor's Parcel for which the District has received a Request and Consent by the preceding May 1 shall receive those Optional Services specified in the Request and Consent.

**G. EXEMPTIONS**

No Special Tax shall be levied on any Assessor's Parcel that is expressly exempted by the Act.

**H. FUTURE ANNEXATIONS**

Any Property Owner of an Assessor's Parcel that is not included in the original CFD formation but within the CFD Future Annexation Area, as shown on the CFD boundary map may request to annex his/her property into the CFD at any time. The Special Tax levied against that Assessor's Parcel number shall be subject to the Special Tax calculation as identified in Sections D and E above.

**I. REVIEW/APPEAL PROCESS**

Any Property Owner may file a written appeal of the Special Tax on his/her property with the CFD Administrator, provided that the appellant is current in his/her payments of Special Taxes. During the pendency of an appeal, all Special Taxes previously levied must be paid on or before the payment date established when the levy was made. The appeal must specify the reasons why the appellant claims the Special Tax was levied in error. The CFD Administrator shall review the appeal, meet with the appellant if the CFD Administrator deems necessary, and advise the appellant of its determination. If the CFD Administrator agrees with the appellant, the CFD Administrator shall make a recommendation to the Board to eliminate or reduce the Special tax on the appellant's property and/or to provide a refund to appellant. The approval of the Board or its designee must be obtained prior to any such elimination or reduction. If the CFD Administrator disagrees with the appellant and the appellant is dissatisfied with the determination, the appellant then has 30 days in which to appeal to the Board by filing a written notice of appeal with the Clerk of the Board, provided that appellant is current in his/her payments of Special Tax. The second appeal must specify the reasons why the appellant disagrees with the CFD Administrator's determination. The Clerk of the Board shall schedule the appeal to be heard before the Board.

**J. MANNER OF COLLECTION**

The Special Tax shall be collected in the same manner and at the same time as ordinary *ad valorem* property taxes; provided, however that the District may directly bill the Special Taxes, may collect Special Taxes at a different time or in a different manner if necessary to meet its financial obligations, and may covenant to foreclose and may actually foreclose on a delinquent Assessor's Parcel as permitted by the Act.

The Special Tax shall be levied and collected starting in Fiscal Year 2014-15, and the final year of the Special Tax levy shall be Fiscal Year 2033-34.



## EXHIBIT E

### Napa County Flood Control and Water Conservation District Community Facilities District No. 2014-01 (Oakville - Oak Knoll Maintenance, Monitoring and Restoration Project)

#### LIST OF SPECIAL TAXED PARCELS

APN	Legal Owner	Land Use	Linear Frontage	Linear Frontage Units	Restoration Linear Frontage	Maintenance \$	Monitoring \$	Restoration \$	TOTAL Parcel Special Tax
031-080-005-000	Jackson Family Estates I Llc	AGR	1,763	1,763	686	\$1,551.44	\$423.12	\$802.62	\$2,777.18
031-080-017-000	Traina Vineyards Llc	AGR	263	263		\$231.44	\$63.12	\$0.00	\$294.56
031-080-031-000	Franciscan Vineyards Inc	AGR	2,897	2,897	1,491	\$2,549.36	\$695.28	\$1,744.47	\$4,989.12
031-100-030-000	7550 Llc	AGR	722	722	624	\$635.36	\$173.28	\$730.08	\$1,538.72
031-110-003-000	State Farm Ranch Llc	AGR	4,009	4,009	1,730	\$3,527.92	\$962.16	\$2,024.10	\$6,514.18
031-110-011-000	State Farm Ranch Llc	AGR	2,518	2,518		\$2,215.84	\$604.32	\$0.00	\$2,820.16
031-110-018-000	Gamble George T & Collette Y	RES	318	302	318	\$265.76	\$72.48	\$372.06	\$710.30
031-110-021-000	Gamble George T & Collette Y	RES	133	126	133	\$110.88	\$30.24	\$155.61	\$296.74
031-140-002-000	Gamble George T Tr	RES	167	159	167	\$139.57	\$38.06	\$195.39	\$373.02
031-140-003-000	Gamble George T Tr	RES	886	842	560	\$740.70	\$202.01	\$655.20	\$1,597.92
031-140-007-000	1552 Yount Mill Road Llc	RES	191	181	72	\$159.28	\$43.44	\$84.24	\$286.96
031-160-022-000	Gamble George T Tr	AGR	840	840		\$739.20	\$201.60	\$0.00	\$940.80
031-160-023-000	Gamble George T Tr	AGR	727	727		\$639.76	\$174.48	\$0.00	\$814.24
031-220-014-000	Yahome Vineyards Lp	AGR	353	353	200	\$310.64	\$84.72	\$234.00	\$629.36
031-220-016-000	Traina J Todd Buchanan Etal	AGR	710	710	710	\$624.80	\$170.40	\$830.70	\$1,625.90
031-220-017-000	Missimer Family Limited Partnership	UAGR	1,482	741	1,482	\$652.08	\$177.84	\$1,733.94	\$2,563.86
036-010-013-000	Miller Vineyards Llc	UAGR	2,012	1,006	895	\$885.28	\$241.44	\$1,047.15	\$2,173.88
036-010-020-000	Yahome Vineyards Lp	AGR	2,440	2,440		\$2,147.20	\$585.60	\$0.00	\$2,732.80
036-010-026-000	Treasury Wine Estates Americas Co	AGR	1,832	1,832	1,832	\$1,612.16	\$439.68	\$2,143.44	\$4,195.28
036-010-027-000	Treasury Wine Estates Americas Co	AGR	685	685	685	\$602.80	\$164.40	\$801.45	\$1,568.66
036-010-028-000	Treasury Wine Estates Americas Co	AGR	908	908	564	\$799.04	\$217.92	\$659.88	\$1,676.84
036-010-029-000	Treasury Wine Estates Americas Co	AGR	1,761	1,761		\$1,549.68	\$422.64	\$0.00	\$1,972.32
036-010-030-000	Treasury Wine Estates Americas Co	AGR	333	333		\$293.04	\$79.92	\$0.00	\$372.96
036-010-031-000	Treasury Wine Estates Americas Co	AGR	258	258		\$227.04	\$61.92	\$0.00	\$288.96

APN	Legal Owner	Land Use	Linear Frontage	Linear Frontage Units	Restoration Linear Frontage	Maintenance \$	Monitoring \$	Restoration \$	TOTAL Parcel Special Tax
036-110-034-000	Russell Janice R Suc Tr	AGR	1,353	1,353	952	\$1,190.20	\$324.60	\$1,113.84	\$2,628.64
036-120-063-000	Spp Napa Vineyards Llc	AGR	938	938	759	\$825.44	\$225.12	\$888.03	\$1,938.60
036-120-073-000	Spp Napa Vineyards Llc	AGR	3,882	3,882	1,083	\$3,416.16	\$931.68	\$1,267.11	\$5,614.96
036-120-075-000	Spp Napa Vineyards Llc	AGR	3,120	3,120		\$2,745.60	\$748.80	\$0.00	\$3,494.40
039-040-032-000	Yahome Vineyards Lp	AGR	5,398	5,398		\$4,750.24	\$1,295.52	\$0.00	\$6,045.76
039-040-041-000	Robert Mondavi Properties Inc	AGR	2,131	2,131		\$1,875.28	\$511.44	\$0.00	\$2,386.72
039-040-050-000	Robert Mondavi Properties Inc	AGR	1,295	1,295	130	\$1,139.60	\$310.80	\$152.10	\$1,602.50
039-040-052-000	Robert Mondavi Properties Inc	AGR	6,455	6,455	2,500	\$5,680.40	\$1,549.20	\$2,925.00	\$10,154.60
039-051-001-000	Spp Napa Vineyards Llc	AGR	1,774	1,774		\$1,561.12	\$425.76	\$0.00	\$1,986.88
<b>Total</b>			<b>54,554</b>	<b>52,721</b>	<b>17,573</b>	<b>\$46,394.31</b>	<b>\$12,652.99</b>	<b>\$20,560.41</b>	<b>\$79,607.78</b>

## Appendix C

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CEQA Document – Initial Study/ Mitigated Negative  
Declaration

*(provided under separate cover)*



## Appendix D

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CDFW Permit, Memorandum of Understanding  
with the Town of Yountville and Agreement for  
Maintenance of American Canyon Streams





State of California – The Natural Resources Agency  
DEPARTMENT OF FISH AND GAME  
Bay Delta Region  
7329 Silverado Trail  
Napa, CA 94558  
(707) 944-5500  
[www.dfg.ca.gov](http://www.dfg.ca.gov)

EDMUND G. BROWN, JR., Governor  
CHARLTON H. BONHAM, Director



RECEIVED  
JUN 14 2012

NAPA COUNTY FLOOD CONTROL AND  
WATER CONSERVATION DISTRICT

June 12, 2012

Napa County Flood Control  
and Water Conservation District  
Attention: Richard Thomasser  
804 First Street  
Napa, California 94559

Subject: Final Lake or Streambed Alteration Agreement  
Notification No. 1600-2011-0349-R3  
Napa County Stream Maintenance Program

Dear Mr. Thomasser:

Enclosed is the final Streambed Alteration Agreement ("Agreement") for the Napa County Stream Maintenance Program ("Project"). Before the Department may issue an Agreement, it must comply with the California Environmental Quality Act ("CEQA"). In this case, the Department, acting as a responsible agency, filed a notice of determination ("NOD") on June 12, 2012 based on information contained in the Negative Declaration the lead agency prepared for the Project.

Under CEQA, filing a NOD starts a 30-day period within which a party may challenge the filing agency's approval of the project. You may begin your project before the 30-day period expires if you have obtained all necessary local, state, and federal permits or other authorizations. However, if you elect to do so, it will be at your own risk.

If you have any questions regarding this matter, please contact Suzanne Gilmore, Environmental Scientist, at (707) 944-5536 or [sgilmore@dfg.ca.gov](mailto:sgilmore@dfg.ca.gov).

Sincerely,

Craig J. Weightman  
Acting Environmental Program Manager  
Bay Delta Region

cc: Warden Morton  
Lieutenant Jones  
Suzanne Gilmore

*Conserving California's Wildlife Since 1870*





CALIFORNIA DEPARTMENT OF FISH AND GAME  
BAY DELTA REGION  
7329 SILVERADO TRAIL  
NAPA, CALIFORNIA 94558  
(707) 944-5520  
[WWW.DFG.CA.GOV](http://WWW.DFG.CA.GOV)



**STREAMBED ALTERATION AGREEMENT**  
NOTIFICATION No. 1600-2011-0349-R3  
MULTIPLE SITES

NAPA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT  
NAPA COUNTY STREAM MAINTENANCE PROGRAM

This Streambed Alteration Agreement (Agreement) is entered into between the California Department of Fish and Game (DFG) and the Napa County Flood Control and Water Conservation District (Permittee) as represented by Richard Thomasser acting on behalf of Permittee.

**RECITALS**

WHEREAS, pursuant to Fish and Game Code (FGC) section 1602, Permittee notified DFG on September 27, 2011 and submitted additional information on November 20, 2011 that Permittee intends to complete the project described herein.

WHEREAS, pursuant to FGC section 1603, DFG has determined that the project could substantially adversely affect existing fish or wildlife resources and has included measures in the Agreement necessary to protect those resources.

WHEREAS, Permittee has reviewed the Agreement and accepts its terms and conditions, including the measures to protect fish and wildlife resources.

NOW THEREFORE, Permittee agrees to complete the project in accordance with the Agreement

**PROJECT LOCATION**

This Agreement authorizes routine maintenance activities in the County of Napa that fall under the jurisdiction and responsibility of Permittee. Project activities will occur within Napa County, including the Napa River, Putah Creek (Lake Berryessa), and Suisun Creek watersheds as shown in Exhibit 1.

**PROJECT DESCRIPTION**

The project is limited The Napa County Flood Control and Water Conservation District (NCFCD) (Permittee) proposes to conduct routine maintenance within the County of Napa. Routine maintenance shall be defined as those periodically scheduled and

implemented activities necessary to maintain the water transport capacity of stream channels and maintain the structural and functioning integrity of existing flood control and sediment detention structures on or affecting streams.

Maintenance activities which both parties agree may be considered "routine" are described in Attachment A. In brief summary, these activities include clearing of debris from existing culverts, minor vegetation removal, debris removal in streams sufficient to restore water flow, bank stabilization using bio-engineered techniques, maintenance and repair of existing sidewalks and trails, and removal of hazardous man-made structures from water bodies for public safety and habitat improvement. Routine maintenance do not include any new work other than described in Attachment A. Routine maintenance does not include the removal of or damage to living riparian vegetation other than that specified in Attachment A.

This 1602 Agreement consists of the Agreement, Attachment A (covered activities), Attachment B (list of definitions), and Exhibit 1 (map of the sections of creeks and channels).

## **PROJECT IMPACTS**

Projects impacts that could occur if the measures to protect fish and wildlife are not followed:

Existing fish or wildlife resources the project could substantially adversely affect include: California red-legged frog (*Rana draytonii*), foothill yellow-legged frog (*Rana boylei*), western pond turtle (*Actinemys marmorata*), steelhead (*Oncorhynchus mykiss irideus*), pallid bat (*Antrozous pallidus*), common aquatic and terrestrial species.

The adverse effects the project could have on the fish or wildlife resources identified above include: chronic and stochastic increases of sedimentation to streams, loss or decline of riparian and/or emergent marsh habitat, direct take of fish and other aquatic species.

## **MEASURES TO PROTECT FISH AND WILDLIFE RESOURCES**

### **1. Administrative Measures**

Permittee shall meet each administrative requirement described below.

- 1.1 Documentation at Project Site. Permittee shall make the Agreement, any extensions and amendments to the Agreement, and all related notification materials and California Environmental Quality Act (CEQA) documents, readily available at the project site at all times and shall be presented to DFG personnel, or personnel from another state, federal, or local agency upon request.

- 1.2 Providing Agreement to Persons at Project Site. Permittee shall provide copies of the Agreement and any extensions and amendments to the Agreement to all persons who will be working on the project at the project site on behalf of Permittee, including but not limited to contractors, subcontractors, inspectors, and monitors.
- 1.3 Notification of Conflicting Provisions. Permittee shall notify DFG if Permittee determines or learns that a provision in the Agreement might conflict with a provision imposed on the project by another local, state, or federal agency. In that event, DFG shall contact Permittee to resolve any conflict.
- 1.4 Project Site Entry. Permittee agrees that DFG personnel may enter the project site at any time to verify compliance with the Agreement.
- 1.5 Inspections. DFG personnel or its agents may inspect the routine maintenance activities performed at any of the work sites at any time. As a result of field inspection, DFG may require that additional conditions be applied to specific activities to protect sensitive biological resources. Such conditions may be amended into this Agreement with the agreement of both parties, or if an exception to authorized activities is identified, Permittee may be asked to submit separate written notification to DFG Bay Delta Region pursuant to Condition 1.7, below.
- 1.6 Authorized Routine Maintenance Activities. Only those activities specifically described in the Project Description shall be conducted under this Agreement.
- 1.7 Exceptions to Authorized Activities. Permittee shall submit separate written notification (Forms FG 2023 and FG 2024) pursuant to Section 1602 of the California Fish and Game Code, together with the required fee prescribed in the DFG Streambed Alteration Agreement fee schedule, and otherwise follow the normal notification process prior to the commencement of work activities in all cases where one or more of the following conditions apply:

The proposed work does not meet the criteria established for Covered Activities in Attachment A of this Agreement;

Work will occur at a location where the Department advises Permittee that conditions affecting fish and wildlife resources on the site have substantially changed or such resources would be adversely affected by the proposed activity; and/or

The proposed work would adversely impact a State of California (State) Species of Special Concern or State or federally listed rare, threatened, endangered or candidate species or its habitat.

## **2. Avoidance and Minimization Measures**

To avoid or minimize adverse impacts to fish and wildlife resources identified above, Permittee shall implement each measure listed below when doing maintenance activities within the scope of this RMA.

- 2.1 Work within creeks with natural (earthen) bottoms shall be performed only between June 15 and October 15 to minimize adverse impacts to fish and wildlife resources and their habitats. Revegetation work is not confined to this time period. Debris removal immediately necessary to prevent flooding may be conducted at anytime.
- 2.2 No phase of the project shall be initiated if construction work and installation of associated erosion control measures cannot be completed prior to the onset of a storm event predicted by 72-hour weather forecasts from the National Weather Service.
- 2.3 No equipment shall be operated in wetted portions of the stream (including but not limited to ponded, flowing, or wetland areas) at any time.
- 2.4 This Agreement does not authorize the take of any State or federally listed threatened species, endangered species, species of special concern, or candidate species discovered at work sites. If DFG determines, or Permittee finds that there are such species on the work site, Permittee shall notify DFG Bay Delta Region, US Fish and Wildlife Service (USFWS), and/or US Army Corps of Engineers (USACOE) as appropriate. Permittee shall immediately cease work until DFG and other applicable agencies deem that the concern over special status species has been resolved. This agreement does not authorize capture and/or handling of listed species.
- 2.5 Activities occurring within potential habitat for California freshwater shrimp shall be limited to vegetation management and debris removal above the water level. Vegetation or debris overhanging into pools or glides within the natural reaches of the channel shall not be removed or altered.
- 2.6 If Permittee or its employees, contractors, or agents injures or kills a special-status species, or finds any such animal injured or dead, all

activities in the work area shall immediately cease, and DFG and U.S. Fish and Wildlife Service shall be notified by telephone within 1 hour of the discovery.

- 2.7 Prior to conducting maintenance activities at a given site, a qualified biologist or biological monitor shall assess physical site features to determine whether the site and/or surrounding areas are likely to support special-status species. Permittee shall also consult a current map of California Natural Diversity Database (CNDDB) occurrences in the project area and determine whether the work site is within reasonable dispersal distance of a known species occurrence.
- 2.8 A qualified biologist shall hold an annual training session for staff responsible for performing routine maintenance activities. Staff will be trained to recognize special-status species and their habitats. Staff will also be trained to use protective measures to ensure that such species are not adversely impacted by routine maintenance activities. The training program shall be updated at least annually to reflect current special-status species management practices. At least one staff person with up-to-date training in special-status species protective measures shall be present at each work site at all times.
- 2.9 If maintenance work or tree removal occurs during the nesting season of protected raptors and migratory birds (February 1 to August 31), a focused survey for active nests of such birds shall be conducted by a qualified biologist (as determined by a combination of academic training and professional experience in biological sciences and related resource management activities) within 15 days prior to the beginning to Project-related activities. The results of the survey shall be faxed to (707) 944-5595. Refer to Notification Number 1600-2011-0349-3 when submitting the survey to the Department. If this survey finds evidence of such nesting work shall be postponed until the younglings have fledged. If a lapse in Project-related work of 7 days or longer occurs, another focused survey shall be conducted and if required, consultation with the Department shall be required before Project work can be reinitiated.
- 2.10 A qualified biologist or biological monitor shall conduct a habitat assessment for bats at work sites where culverts, structures and/or trees would be removed or otherwise disturbed for a period of more than two hours. The habitat assessment shall include a visual inspection of features within 50 feet of the work area for potential roosting features no more than 48 hours prior to disturbance of such features. Habitat features found during the survey shall be flagged or marked.

If any habitat features identified in the habitat assessment will be altered or disturbed by project activities, a phased disturbance strategy shall be employed. Non-habitat trees or structural features shall be removed one (1) day prior to removal of habitat features. Permittee shall not attempt to directly disturb (e.g. shake, prod) roosting features.

If bats (individuals or colonies, not just roosting habitat) are detected during the habitat assessment, DFG Bay Delta Region shall be notified immediately. DFG reserves the right to provide additional provisions to this agreement in the event that roosting bats are found.

- 2.11 If suitable habitat for the California red-legged frog exists at a given work site or within reasonable dispersal distance, a qualified biologist or biological monitor shall conduct a reconnaissance-level survey for this species within 48 hours of the commencement of routine maintenance activities. Surveys from previous years may be used as a guide, but should not be relied upon to determine whether habitat is present. If California red-legged frogs are found during surveys or construction, work shall be placed on hold until further notice from DFG. DFG reserves the right to require separate written notification (Forms FG 2023 and FG 2024) pursuant to Section 1602 of the California Fish and Game Code or provide additional provisions to this Agreement in the event that California red-legged frogs are discovered.
- 2.12 If habitat for western pond turtles, yellow-legged frogs, rare plants, or other special-status species exists at a given work site and such species are known to exist within reasonable dispersal distance of the work area, a qualified biologist or biological monitor shall conduct a reconnaissance-level survey within 48 hours of the commencement of routine maintenance activities. If there is potential for rare plants to occur at a work site, biological surveys shall be conducted during the appropriate blooming period, prior to initiation of routine maintenance activities. If special-status species are found during surveys or construction and could be adversely impacted by work activities, work shall be placed on hold until further notice from DFG. DFG reserves the right to require separate written notification (Forms FG 2023 and FG 2024) pursuant to Section 1602 of the California Fish and Game Code or provide additional provisions to this Agreement.

- 2.13 In order to protect the valley elderberry long-horned beetle, elderberry plants (*Sambucas nigra*) shall not be removed or pruned.
- 2.14 The disturbance or removal of native vegetation shall not exceed the minimum necessary to prevent potential flooding. Precautions shall be taken to avoid other damage to vegetation by people or equipment. Branches and/or limbs overhanging the channel and impacting water flows shall be properly pruned. Woody and herbaceous plants, fallen trees, or trunks or limbs lodged in the bed or bank causing flow restriction shall be cut off at the bed or bank invert with small tools and removed with winch and cable or other equipment operated from top of bank. Root structures are not to be disturbed. Large woody debris that does not obstruct the flow of water shall be left in place.
- 2.15 Invasive plant species including Himalayan blackberry (*Rubus armeniacus*), vinca (*Vinca minor*), pampas grass (*Cortaderia selloana*), Giant reed (*Arundo donax*), pepper weed (*Lepidium dictyotum*), and non-native invasive grasses within each area of operations shall be removed and areas denuded of vegetation shall be replanted with locally propagated native tree and shrub species. Appropriate native plants and spacing can be found in the "California Salmonid Stream Habitat Restoration Manual." Planting techniques can include seed casting, hydroseeding, or live planting methods using the techniques in Part XI of the Manual. The most current version of the manual can be found at:  
<http://www.dfg.ca.gov/fish/REsources/HabitatManual.asp>
- 2.16 Permittee shall avoid activities that will spread or introduce exotic plants. All invasive exotic plants at work sites shall be removed in such a manner that they will not sprout or be allowed to spread.
- 2.17 Herbicides may be used at the Permittee's discretion with implementation of the following protective measures:
- Permittee shall use caution to apply the least practicable amount of herbicides necessary to effectively control nuisance plants.
- Permittee shall use the least concentrated formulation of herbicide possible and practicable.
- All herbicides shall be applied by a certified pesticide applicator in accordance with regulations set by the California Department of Pesticide Regulation and according to labeled instructions.
- Permittee shall use extreme caution to not apply any herbicide

directly to water. If herbicides must be applied next to water, Permittee shall use preventative measures to ensure that the chemical does not accidentally flow into or stream through the air into the water.

Herbicides shall only be applied on calm days with winds below 5 miles per hour.

Care shall be taken to avoid spraying native vegetation with herbicides. Spraying within 100 feet of existing mitigation sites shall be done by hand.

Should any fish or animal kills occur following application of herbicides, such kills shall be reported to DFG Bay Delta Region within 24 hours.

Permittee shall use Milestone, rather than Weedestroy (or other 2,4,D product) wherever and whenever possible. Weedestroy is not to be applied within 10 feet of open water.

Regardless of the contents of this Agreement, Permittee is responsible for any environmental damage caused by the application or use of substances that prove harmful to fish and aquatic wildlife.

- 2.18 Live trees may be removed only if they are blocking flow or restricting the capacity of the channel; no other trees shall be removed. Any trees which must be cut from stream banks shall be cut at ground level, leaving the root mass in place to maintain bank stability. If root mass is to be removed within the channel, Permittee shall notify DFG for written approval. Any trees removed shall be replaced according to Measure 3.1, and exposed/ disturbed areas shall be revegetated.
- 2.19 Willow thinning for bioengineering material shall be conducted in such a manner as to encourage willows to achieve mature overstory vegetation. Thinning of willows shall focus on removal of lower branches that will impede low flows. At no time shall more than 1/3 of a willow be harvested. Care shall be taken during harvest not to trample or over harvest the willow sources.
- 2.20 To ensure a successful revegetation effort, all plants shall be monitored and maintained as necessary for five years. The following success criteria shall apply:



All planting shall have a minimum of 80% survival at the end of 5 years.

Planting shall attain 75% cover after 5 years.

If the survival and/or cover requirements are not meeting these goals, Permittee is responsible for replacement planting, additional watering, weeding, invasive exotic eradication, or any other practice, to achieve these requirements. Replacement plants shall be monitored with the same survival and growth requirements for five years after planting.

Revegetation monitoring shall be conducted annually for a period of five (5) years to determine whether these goals have been met. If the survival and/or cover requirements are not projected to meet these goals, based on annual monitoring, Permittee is responsible for replacement planting, additional watering, weeding, invasive exotic eradication, or any other practice(s) that would to achieve these requirements.

- 2.21 Staging areas shall be located at least 30 feet from the top of bank or on the outboard side of levees. Vegetation disturbance shall be limited to the immediate construction footprint and a single access pathway.
- 2.22 Staging and storage areas for equipment, materials, fuels, lubricants and solvents shall be located outside of the stream channel and banks. Stationary equipment such as motors, pumps, generators, compressors and welders, located adjacent to the stream, shall be positioned over drip-pans. Any equipment or vehicles driven and/or operated in proximity to the stream must be checked and maintained daily. Vehicles must be moved away from the stream prior to refueling and lubrication.
- 2.23 Except as explicitly described in Attachment A of this Agreement, the removal of native soils, rock, gravel, vegetation, and vegetative debris from the stream bed or stream banks is prohibited. Embedded pieces of large woody debris or stumps that potentially serve as basking sites or that encourage pool formation shall be left in place if there is adequate flood flow capacity.
- 2.24 Permittee shall remove all debris, raw construction materials and wastes from the project site following the completion of maintenance activities. Food-contaminated wastes generated during construction shall be removed on a daily basis to avoid attracting predators to work sites. All temporary fences, barriers, and/or flagging shall be

completely removed from work sites and properly disposed of upon completion of maintenance activities. Permittee or its contractors shall not dump any litter or construction debris within the riparian/stream zone.

- 2.25 All exposed soils within the work area shall be stabilized immediately following the completion of earthmoving activities to prevent erosion into the stream channel. Erosion control measures, such as silt fences, straw hay bales, gravel or rock lined ditches, water check bars, and broadcasted straw shall be used. Erosion control measures shall be monitored during and after each storm event for effectiveness. Modifications, repairs and improvements to erosion control measures shall be made as needed to protect water quality. At no time shall silt laden runoff be allowed to enter the stream or directed to where it may enter the stream.
- 2.26 Upon completion of construction and prior to the onset of wet weather, all construction material and/or debris, including removed vegetation, shall be removed from the stream channel to an area not subject to inundation.
- 2.27 Flow diversions shall be done in a manner that prevents pollution and/or siltation and which shall provide flows to downstream reaches. Flows to downstream reaches shall be provided during all times that the natural flow would have supported aquatic life. Said flows shall be sufficient quality and quantity, and of appropriate temperature to support fish and other aquatic life both above and below the diversion. Normal flow shall be restored to the affected stream immediately upon completion of work at that location.
- 2.28 Culvert replacement shall not increase culvert size by more than 12 inches.
- 2.29 All bank stabilization projects shall be conducted using bioengineering techniques. Use of concrete and rip rap may only occur in areas such as culvert inlets and outlets, previously rip rapped areas and existing concrete lined channels. Installation of gabions is not included in this agreement. Mitigation for rip rap installation shall at a minimum include removal of concrete, rip rap, or other hard structure from an adjacent site at a ratio of 3:1. Proposed mitigation shall be included in any notification as required under Condition #4.1
- 2.30 Permittee shall ensure that bioengineered features do not transfer the erosive force of the stream to the opposite or downstream banks

or cause the formation of downstream eddies. The channel shall not be narrowed as a result of bank repairs, and features that modify the natural stream gradient (as measured on a longitudinal profile) shall not be installed in the channel.

- 2.31 All sediment removal projects greater than 25 linear feet shall receive written approval from DFG prior to project activities.

### 3. Compensatory Measures

To compensate for adverse impacts to fish and wildlife resources identified above that cannot be avoided or minimized, Permittee shall implement each measure listed below.

- 3.1 All native trees between 3 and 6 inches in diameter (at breast height) removed as a result of proposed work activities shall be replaced at a 3:1 ratio with a combination of native trees and/or appropriate understory and lower canopy plantings. Native trees greater than 6 inches in diameter shall be replaced with native trees at a 6:1 ratio to mitigate for permanent net loss of canopy cover. Non-native trees greater than 3 inches in diameter shall be replaced at a 1:1 ratio. All trees greater than 24 inches in diameter shall be replaced on an inch-for-inch basis. Replacement plantings shall consist of 5-gallon saplings; locally-collected seeds, stakes, or other suitable nursery stock, as appropriate and shall be native species adapted to the lighting, soil and hydrological conditions at the replanting site. If replanting within the work area is unfeasible due to slope steepness or other physical constraints, replacement trees may be planted at an alternate location along the stream corridor as approved by DFG.
- 3.2 All disturbed slopes around and on the banks shall be seeded, mulched and fertilized with native perennial, shrub and grass species to replace the same habitat type removed. Native grasses shall be from the following list: Meadow barley (*Hordeum brachyantherum*), Blue wildrye (*Elymus glaucus*), California brome (*Bromus carinatus*), Creeping wildrye (*Leymus triticoides*), California oatgrass (*Danthonia californica*), and California melic (*Melica californica*). Seeding shall be completed before October 15 of the year construction begins.

### 4. Reporting Measures

Permittee shall meet each reporting requirement described below.

- 4.1 The Applicant shall provide to the Department of Fish and Game Bay Delta Region written notification of proposed routine maintenance activities to be performed that year by **June 1** of each year. The

written notification of proposed routine maintenance activities shall include:

- 1) Work plans describing the type and scope of work planned including the volume and type of materials displaced, the equipment to be used; and type, density and area of vegetation to be affected.
- 2) Proposed mitigation measures including but limited to invasive species removal and/or native habitat replacement.
- 3) The location of the covered activity, and the name, if any of the river or stream affected.
- 4) The earliest commencement date, estimated termination date and proposed hours of operation.
- 5) Directions to the work site including a map displaying the public and private roads used to access the work site.
- 6) Plan-view maps showing site attributes before and after completion of the covered activity. The maps shall also delineate the location of permanent and temporary storage areas for equipment, materials, spoils; and any important fish or wildlife habitat features (e.g. snags and nests in the terrestrial environment; LWD, deep pools, and undercut banks in the aquatic environment) in the area of disturbance.
- 7) Pre-project photographs of each covered activity including important fish and wildlife habitat features.

4.2 The Permittee shall provide the Department of Fish and Game Bay Delta Region written notification of maintenance Projects completed each year. Annual reports shall include the Project location, a brief Project description, quantity of material removed from each site in cubic yards, and all associated impacts to vegetation. Spatially referenced before/after photographs. Each annual report shall include the appropriate fee determined from the DFG Streambed Alteration Agreement Fee Schedule for work completed under this Agreement based upon the number of Projects completed in the reporting period. Reports and annual fees are due by **January 1**. The Department may terminate this agreement if late reports and fees are not submitted.

4.3 The Permittee shall provide a status report to the Department of Fish and Game Bay Delta Region every four years. The status report

shall be delivered to the Department no later than 90 days prior to the end of each four-year period, and shall include all of the following:

- 1) A copy of the original agreement
- 2) The status of the activity covered by the agreement
- 3) An evaluation of the success or failure of the measures in the agreement to protect the fish and wildlife resources that the activity may substantially adversely affect.
- 4) A discussion of any factors that could increase the predicted adverse impacts on fish and wildlife resources, and a description of the resources that may be adversely affected.

4.4 Notification to the California Natural Diversity Database. If any sensitive species are observed in project surveys, Permittee shall submit California Natural Diversity Database (CNDDDB) forms to the CNDDDB within five working days of the sightings, and provide DFG Bay Delta Region with copies of the CNDDDB forms and survey maps.

4.5 Biological Surveys. The results of any biological surveys conducted shall be emailed or faxed to DFG Bay Delta Region prior to commencement of work, referencing Notification 1600-2011-0349-3. Permittee is encouraged to combine survey results for multiple sites and multiple species into a single document.

## CONTACT INFORMATION

Any communication that Permittee or DFG submits to the other shall be in writing and any communication or documentation shall be delivered to the address below by U.S. mail, fax, or email, or to such other address as Permittee or DFG specifies by written notice to the other.

### To Permittee:

Napa County Flood Control and Water Conservation District  
Attn: Richard Thomasser  
804 First Street  
Napa, California 94559  
Fax (707) 259-8619  
Richard.thomasser@countyofnapa.org

To DFG:

Department of Fish and Game  
Bay Delta Region – Regional Manager  
7329 Silverado Trail  
Napa, California 94558  
Attn: Lake and Streambed Alteration Program  
Notification #1600-2011-0349-R3  
Fax (707) 944-5553

**LIABILITY**

Permittee shall be solely liable for any violations of the Agreement, whether committed by Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents or contractors and subcontractors, to complete the project or any activity related to it that the Agreement authorizes.

This Agreement does not constitute DFG's endorsement of, or require Permittee to proceed with the project. The decision to proceed with the project is Permittee's alone.

**SUSPENSION AND REVOCATION**

DFG may suspend or revoke in its entirety the Agreement if it determines that Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, is not in compliance with the Agreement.

Before DFG suspends or revokes the Agreement, it shall provide Permittee written notice by certified or registered mail that it intends to suspend or revoke. The notice shall state the reason(s) for the proposed suspension or revocation, provide Permittee an opportunity to correct any deficiency before DFG suspends or revokes the Agreement, and include instructions to Permittee, if necessary, including but not limited to a directive to immediately cease the specific activity or activities that caused DFG to issue the notice.

**ENFORCEMENT**

Nothing in the Agreement precludes DFG from pursuing an enforcement action against Permittee instead of, or in addition to, suspending or revoking the Agreement.

Nothing in the Agreement limits or otherwise affects DFG's enforcement authority or that of its enforcement personnel.

## **OTHER LEGAL OBLIGATIONS**

This Agreement does not relieve Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, from obtaining any other permits or authorizations that might be required under other federal, state, or local laws or regulations before beginning the project or an activity related to it.

This Agreement does not relieve Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, from complying with other applicable statutes in the FGC including, but not limited to, FGC sections 2050 et seq. (threatened and endangered species), 3503 (bird nests and eggs), 3503.5 (birds of prey), 5650 (water pollution), 5652 (refuse disposal into water), 5901 (fish passage), 5937 (sufficient water for fish), and 5948 (obstruction of stream).

Nothing in the Agreement authorizes Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, to trespass.

## **AMENDMENT**

DFG may amend the Agreement at any time during its term if DFG determines the amendment is necessary to protect an existing fish or wildlife resource.

Permittee may amend the Agreement at any time during its term, provided the amendment is mutually agreed to in writing by DFG and Permittee. To request an amendment, Permittee shall submit to DFG a completed DFG "Request to Amend Lake or Streambed Alteration" form and include with the completed form payment of the corresponding amendment fee identified in DFG's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5).

## **TRANSFER AND ASSIGNMENT**

This Agreement may not be transferred or assigned to another entity, and any purported transfer or assignment of the Agreement to another entity shall not be valid or effective, unless the transfer or assignment is requested by Permittee in writing, as specified below, and thereafter DFG approves the transfer or assignment in writing.

The transfer or assignment of the Agreement to another entity shall constitute a minor amendment, and therefore to request a transfer or assignment, Permittee shall submit to DFG a completed DFG "Request to Amend Lake or Streambed Alteration" form and include with the completed form payment of the minor amendment fee identified in DFG's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5).

## **EXTENSIONS**

In accordance with FGC section 1605(b), Permittee may request one extension of the Agreement, provided the request is made prior to the expiration of the Agreement's term. To request an extension, Permittee shall submit to DFG a completed DFG "Request to Extend Lake or Streambed Alteration" form and include with the completed form payment of the extension fee identified in DFG's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5). DFG shall process the extension request in accordance with FGC 1605(b) through (e).

If Permittee fails to submit a request to extend the Agreement prior to its expiration, Permittee must submit a new notification and notification fee before beginning or continuing the project the Agreement covers (Fish & G. Code, § 1605, subd. (f)).

## **EFFECTIVE DATE**

The Agreement becomes effective on the date of DFG's signature, which shall be: 1) after Permittee's signature; 2) after DFG complies with all applicable requirements under the California Environmental Quality Act (CEQA); and 3) after payment of the applicable FGC section 711.4 filing fee listed at [http://www.dfg.ca.gov/habcon/ceqa/ceqa\\_changes.html](http://www.dfg.ca.gov/habcon/ceqa/ceqa_changes.html).

## **TERM**

This Agreement shall expire on December 31, 2022, unless it is terminated or extended before then. All provisions in the Agreement shall remain in force throughout its term. Permittee shall remain responsible for implementing any provisions specified herein to protect fish and wildlife resources after the Agreement expires or is terminated, as FGC section 1605(a)(2) requires.

## **EXHIBITS**

The documents listed below are included as exhibits to the Agreement and incorporated herein by reference.

- A. Attachment A - Covered Activities
- B. Attachment B - Definition of Terms
- C. Attachment C - Annual Notifications of Proposed Work (reserved for future exhibits)
- D. Exhibit 1 - Map of Napa County streams and water bodies for maintenance



## **ATTACHMENT A COVERED ACTIVITIES**

### **1. Vegetation Management:**

Removal of parts of woody and herbaceous plants, fallen trees, or trunks or limbs lodged in the bed or bank causing flow restriction shall be cutoff at the bed or bank invert with small tools and removed with winch and cable or other equipment operated from top of bank. Root structures are not to be disturbed and the debris disposed at a place where it cannot reenter State waters. No heavy equipment may be operated in the streambed.

Control of weeds and grasses on channel access roads or shoulders by mowing, or herbicide application may take place between April 1st and October 15th of each year. Herbicide application will conform to all applicable County, State, and Federal Regulations and licenses. Only EPA registered herbicides (such as Rodeo) shall be used in channels for vegetation control. Only mowing or EPA registered herbicides (such as Rodeo) shall be used to control weeds and grasses on channel banks.

Vegetation enhancement associated with other routine maintenance activities including replanting, new planting, and maintenance of plantings.

### **2. Debris and Sediment Removal:**

Physical removal of silt, debris, rubbish, non-living materials, and algae from concrete lined channels where no flow or minimal flow is present. If water is present a flow diversion structure would be constructed up stream and water would be discharged down stream through a sediment control structure.

Removal of small amounts of debris and sediment from within and around structures (less than 200 cu yd.) affecting no more than 25 ft of watercourse in natural channels and 50 ft. in constructed flood control channels. (See definition of structures).

Removal of sediment and debris from waterways affecting no more than 25 feet of a watercourse in a natural stream channel, 150 feet in an artificial earthen channel or 200 feet in a concrete lined channel.

These activities will not exceed a cumulative annual total of 100 feet in a natural stream and 500 feet in a flood control channel (including concrete lined). Sediment removal shall not exceed an annual total of 500 cubic yards.

\*Note all sediment removal projects greater than 25 feet in length shall receive written approval from DFG prior to project activities.

### **3. Structure Maintenance and Repair:**

Repair, replacement in kind, or maintenance of drainage and erosion control structures including but not limited to, storm drain outfalls, tide gates, slide gates, culverts, revetments, bank protection, energy dissipaters, grade structures, sediment basins, weirs, trash racks, stream gauge structures, fish ladders, fish screens, utility line crossings, bridges (including support structures), road embankments, and access ramps.

## AUTHORITY

If the person signing the Agreement (signatory) is doing so as a representative of Permittee, the signatory hereby acknowledges that he or she is doing so on Permittee's behalf and represents and warrants that he or she has the authority to legally bind Permittee to the provisions herein.

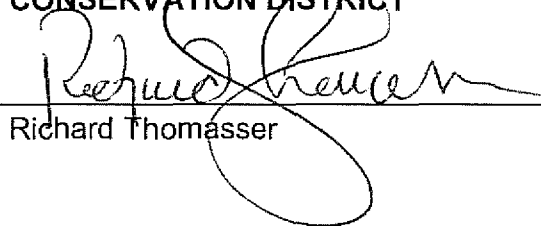
## AUTHORIZATION

This Agreement authorizes only the project described herein. If Permittee begins or completes a project different from the project the Agreement authorizes, Permittee may be subject to civil or criminal prosecution for failing to notify DFG in accordance with FGC section 1602.

## CONCURRENCE


The undersigned accepts and agrees to comply with all provisions contained herein.

### NAPA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

  
Richard Thomasser

May 9, 2012  
Date

### FOR DEPARTMENT OF FISH AND GAME

  
Craig Weightman  
Acting Program Manager

June 12, 2012  
Date

Prepared by: S. Gilmore  
Environmental Scientist

Date sent: March 15, 2012  
Revised sent: April 17, 2012  
Revised sent: May 8, 2012

Repair, maintain or resurface existing bike lanes, paths, and sidewalks within the riparian corridor or stream zone so long as the width of the paved surface is not increased.

#### 4. Bank Repair:

Repair of concrete lined channels in-kind.

Repair of constructed engineered channels 200 linear feet or less using the method of least impact to complete the repair. The primary repair method shall be bioengineering techniques such as a brush mattress or willow wall, etc. If bioengineering (see definition of bioengineering) techniques do not provide a solution to the repair of the eroded banks (because of such as poor soils, percolation of water, limited space or steepness of slopes) other methods may be explored.

Repair in natural channels is limited to 100 feet using the method of least impact to accomplish the repair.

#### 5. Temporary Water Diversions

Temporary water diversions associated with other related maintenance activities using structures such as cofferdams not exceeding 3 feet in height or sumps, with or without pumps, provided that all water is discharged into a silt control structure before release and provided that the channel is restored to its original configuration after work is completed.

#### 7. Exempt Activities

The following routine maintenance activities are not subject to the provisions of the Routine Maintenance Agreement (RMA) between the State of California Department of Fish and Game and NFCD. These activities are also not subject to the provisions of Section 1600 of the State Department of Fish and Game Code if performed within the parameters stated below.

- a. Trash and debris removal not including silt removal (baby diapers, shopping carts, metal, wood, plastic etc).
- b. Removal of trash and vegetation from trash racks, pilings and piers. This is vegetation that has flowed down the channel and has piled up on the trash rack or pilings and piers that would impede the flow leading to potential flooding upstream.
- c. Servicing of water quality monitoring stations, stream gages, etc. What this means is replacing damaged sensors, uncovering intake tubes, replacing samplers. Repairing damaged equipment housing.

Note: Materials embedded in the bottom of the channel are subject to the provisions of Fish and Game Code Section 1600.

## **ATTACHMENT B DEFINITION OF TERMS**

As used herein and for purposes of the Agreement

Bioengineering: the application of the principles of engineering and natural sciences to flood control maintenance and erosion control. Bioengineering applications may be used to reduce the impacts on the natural and urban environment. Methods that may be used: willow wattling, revegetation with native plants, seeding, installation of rootballs, brush layering, brush matting, inter-planting riprap, plantings and combinations of the above methods.

Biological monitor: a person employed by the Permittee who has undergone training in avoidance and minimization measures specific to special-status species potentially present at a given site. The biological monitor is responsible for ensuring that such measures are properly performed to protect against take. The biological monitor must have attended the most recent annual training conducted by the Permittee's qualified biologist and must demonstrate basic familiarity with species biology, avoidance measures, and the terms of the Agreement, if asked. If the biological monitor is to perform pre-work habitat assessments, s/he must be familiar with applicable habitat assessment methodology for listed species.

Channel reach: a section of a stream defined by uniform habitat features, such as a particular type of bed substrate, geomorphologic channel characteristics, and riparian vegetation. In urban environments, reaches may be defined by upstream and downstream barriers, such as bridge footings or weirs.

Concrete-lined channel: flood control channels with concrete sides and bottom.

Debris: non-living vegetative or woody matter, trash, concrete rubble, etc. This definition does not include living vegetation.

Emergency project: is defined in the State Fish and Game Code, section 1600.

Facility: the collective flood control structures and management practices employed with the watershed of a stream draining to the San Francisco Bay. From a flood control perspective, the stream and its tributaries are the primary component of the "facility".

Flood control channel or engineered channel: an artificial open channel or ditch constructed for drainage or flood control purposes.

Flood control structures: levee, dams, and artificially constructed channels for flood control purposes.

Heavy equipment: any equipment used including tractors that is larger than a pick-up truck:

Rubber tired backhoe/loaders

Rubber tired skip loaders

Rubber tracked or tired bobcat loaders

Rubber tired flail mowers

Drag lines with buckets

Hyrdo-vacuum machines operated from top of bank

Natural channel: a stream or watercourse that has not been modified as described above. A natural channel may include erosion control structures, culverts or other minor modifications.

Project: a routine maintenance activity performed by the Permittee during a given year. Each annual activity shall be construed as one project for fee purposes. A project does not include minor debris removal such as minor tree trimming, removing a shopping cart or a bag of garbage.

Qualified biologist: a person with a combination of academic training and professional experience in the biological sciences.

Reasonable dispersal distance: the distance from a particular location, such as a CNDDDB occurrence location or a critical habitat location, that a given species would be expected to disperse for mating, breeding, foraging, nesting, and other activities. The reasonable dispersal distance can be determined on a species-by-species level based on current scientific literature. For example, CNDDDB occurrences of California red-legged frog in a given creek indicate a high likelihood that this species also occurs downstream within the same creek system because flows provide easy downstream dispersal.

Special-status species: any species identified as a candidate or sensitive species in local or regional plans, policies or regulations, or by DFG or the U.S. Fish and Wildlife Service. Plants on Lists 1A, 1B, or 2, published by the California Native Plant Society, are also considered special-status species for the purposes of this Agreement.

Structure: storm drain outfalls, tide gates, slide gates, culverts, revetments, bank protection, energy dissipaters, grade structures, sediment basins, weirs, diversion structures, trash racks, stream gauge structures, fish ladders, fish screens, utility line crossings, bridge piers.

Take: as defined in Section 86 of the California Fish and Game Code, and for federally listed species, as defined in Section 9 of the U.S. Endangered Species Act.

**EXHIBIT 1**  
**ROUTINE MAINTENANCE LOCATIONS FOR NAPA COUNTY FLOOD CONTROL**  
**DISTRICT**

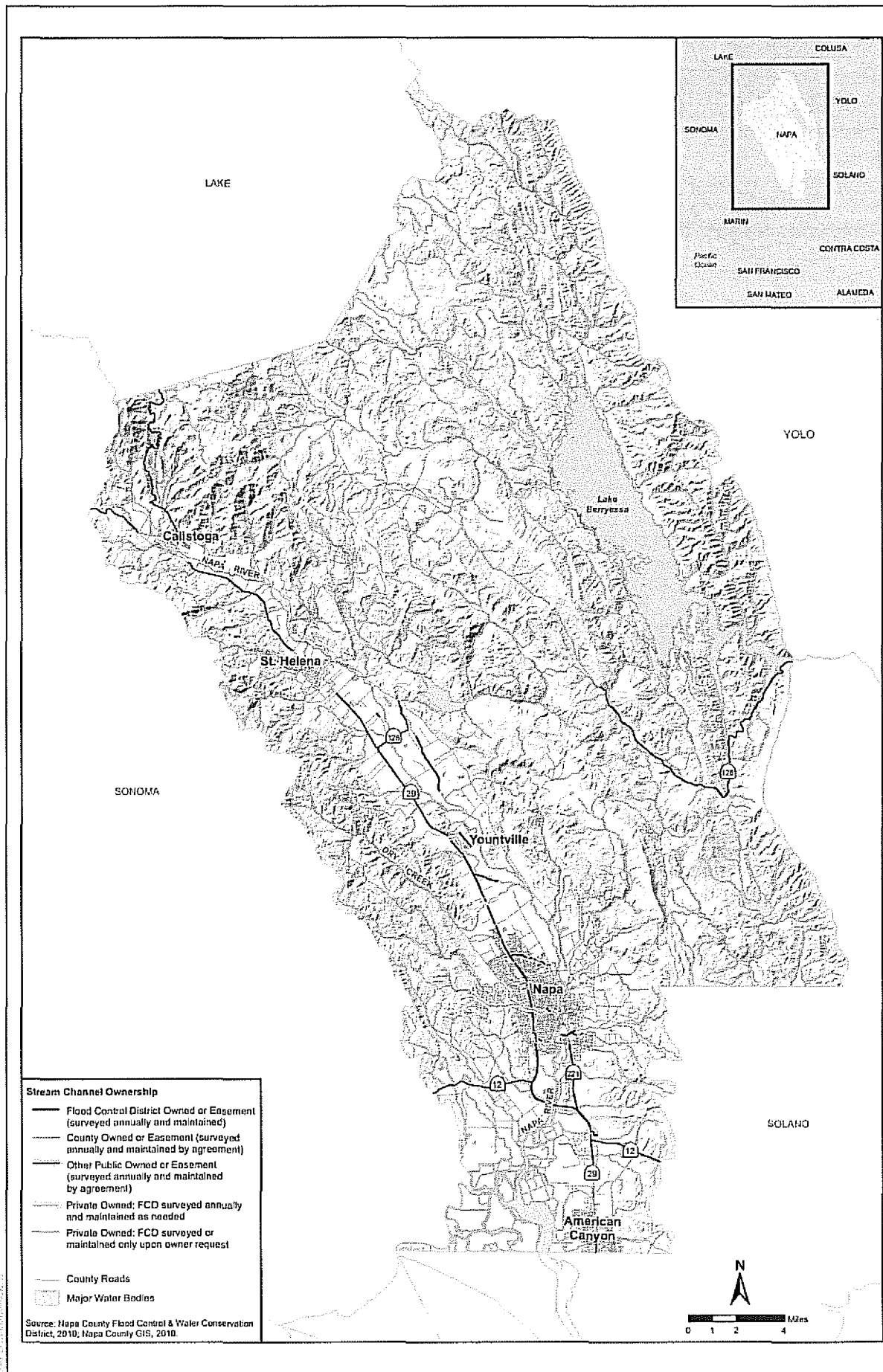


Figure 1-1  
Napa County Stream Maintenance Program Area and Maintenance Reaches





**ATTACHMENT C**  
**ANNUAL NOTIFICATIONS OF PROPOSED WORK**

(Reserved for future exhibits)



FOR DEPARTMENT USE ONLY				
Date Received	Amount Received	Amount Due	Date Complete	Notification No.
9/27/11	\$ 2689.50	\$		1600-2011-0349-3



STATE OF CALIFORNIA  
DEPARTMENT OF FISH AND GAME  
**NOTIFICATION OF LAKE OR STREAMBED ALTERATION**



Complete EACH field, unless otherwise indicated, following the enclosed instructions and submit ALL required enclosures. Attach additional pages, if necessary.

**1. APPLICANT PROPOSING PROJECT**

Name	Richard Thomasser, Operations Manager			Fish & Game
Business/Agency	Napa County Flood Control and Water Conservation District			SEP 27 2011
Street Address	804 First Street			Yountville
City, State, Zip	Napa, CA 94559			
Telephone	(707) 259-8600	Fax	(707) 259-8619	
Email	richard.thomasser@countyofnapa.org			

**2. CONTACT PERSON** (Complete only if different from applicant)

Name			
Street Address			
City, State, Zip			
Telephone		Fax	
Email			

**3. PROPERTY OWNER** (Complete only if different from applicant)

Name			
Street Address			
City, State, Zip			
Telephone		Fax	
Email			

**4. PROJECT NAME AND AGREEMENT TERM**

A. Project Name		Napa County Stream Maintenance Program		
B. Agreement Term Requested		<input type="checkbox"/> Regular (5 years or less) <input checked="" type="checkbox"/> Long-term (greater than 5 years)		
C. Project Term		D. Seasonal Work Period		E. Number of Work Days
Beginning (year)	Ending (year)	Start Date (month/day)	End Date (month/day)	
2012	2022	01/01	12/31	

## NOTIFICATION OF LAKE OR STREAMBED ALTERATION

### 5. AGREEMENT TYPE

Check the applicable box. If box B, C, D, or E is checked, complete the specified attachment.	
A.	<input type="checkbox"/> Standard (Most construction projects, excluding the categories listed below)
B.	<input type="checkbox"/> Gravel/Sand/Rock Extraction (Attachment A) <span style="float: right;">Mine I.D. Number: _____</span>
C.	<input type="checkbox"/> Timber Harvesting (Attachment B) <span style="float: right;">THP Number: _____</span>
D.	<input type="checkbox"/> Water Diversion/Extraction/Impoundment (Attachment C) <span style="float: right;">SWRCB Number: _____</span>
E.	<input checked="" type="checkbox"/> Routine Maintenance (Attachment D)
F.	<input type="checkbox"/> DFG Fisheries Restoration Grant Program (FRGP) <span style="float: right;">FRGP Contract Number: _____</span>
G.	<input type="checkbox"/> Master
H.	<input type="checkbox"/> Master Timber Harvesting

### 6. FEES

Please see the current fee schedule to determine the appropriate notification fee. Itemize each project's estimated cost and corresponding fee. <b>Note: The Department may not process this notification until the correct fee has been received.</b>			
	A. Project	B. Project Cost	C. Project Fee
1	10 year Stream Maintenance Program		
2			
3			
4			
5			
		D. Base Fee (if applicable)	\$2,689.50
		<b>E. TOTAL FEE ENCLOSED</b>	<b>\$2,689.50</b>

### 7. PRIOR NOTIFICATION OR ORDER

A. Has a notification previously been submitted to, or a Lake or Streambed Alteration Agreement previously been issued by, the Department for the project described in this notification?	
<input type="checkbox"/> Yes (Provide the information below) <input checked="" type="checkbox"/> No	
Applicant: _____ Notification Number: _____ Date: _____	
B. Is this notification being submitted in response to an order, notice, or other directive ("order") by a court or administrative agency (including the Department)?	
<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (Enclose a copy of the order, notice, or other directive. If the directive is not in writing, identify the person who directed the applicant to submit this notification and the agency he or she represents, and describe the circumstances relating to the order.)	
<input type="checkbox"/> Continued on additional page(s)	

# NOTIFICATION OF LAKE OR STREAMBED ALTERATION

## 8. PROJECT LOCATION

### A. Address or description of project location.

*(Include a map that marks the location of the project with a reference to the nearest city or town, and provide driving directions from a major road or highway)*

Project Location: Stream maintenance activities can occur anywhere throughout Napa County. However, the District has maintenance authority (ownership or easement agreements) for approximately 13 miles of flood control channels and easements throughout the county, including the Napa River and Lake Berryessa watersheds.

Map: Refer to Figure 1-1 through Figure 1-5 in Chapter 1 of the Stream Maintenance Manual.

Directions: Various; locations change on an annual basis depending on the locations that require maintenance.

☒ Continued on additional page(s)

B. River, stream, or lake affected by the project. \*Attached maps

C. What water body is the river, stream, or lake tributary to? San Pablo Bay and Lake Berryessa

D. Is the river or stream segment affected by the project listed in the state or federal Wild and Scenic Rivers Acts?

☐ Yes

☒ No

☐ Unknown

E. County Napa

F. USGS 7.5 Minute Quad Map Name

G. Township

H. Range

I. Section

J. ¼ Section

Napa

6N

4W

☐ Continued on additional page(s)

K. Meridian (check one)

☐ Humboldt

☒ Mt. Diablo

☐ San Bernardino

L. Assessor's Parcel Number(s)

Varies Annually

☐ Continued on additional page(s)

M. Coordinates (If available, provide at least latitude/longitude or UTM coordinates and check appropriate boxes)

Latitude/Longitude	Latitude:	Varies Annually		Longitude:	Varies Annually	
	<input type="checkbox"/> Degrees/Minutes/Seconds		<input type="checkbox"/> Decimal Degrees		<input type="checkbox"/> Decimal Minutes	
UTM	Easting:	Northing:		<input checked="" type="checkbox"/> Zone 10 <input type="checkbox"/> Zone 11		
Datum used for Latitude/Longitude or UTM		<input type="checkbox"/> NAD 27		<input type="checkbox"/> NAD 83 or WGS 84		

## NOTIFICATION OF LAKE OR STREAMBED ALTERATION

### 9. PROJECT CATEGORY AND WORK TYPE *(Check each box that applies)*

PROJECT CATEGORY	NEW CONSTRUCTION	REPLACE EXISTING STRUCTURE	REPAIR/MAINTAIN EXISTING STRUCTURE
Bank stabilization – bioengineering/recontouring	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Bank stabilization – rip-rap/retaining wall/gabion	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Boat dock/pier	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Boat ramp	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bridge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Channel clearing/vegetation management	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Culvert	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Debris basin	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Dam	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Diversion structure – weir or pump intake	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Filling of wetland, river, stream, or lake	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Geotechnical survey	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Habitat enhancement – revegetation/mitigation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Levee	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Low water crossing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Road/trail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sediment removal – pond, stream, or marina	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Storm drain outfall structure	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Temporary stream crossing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Utility crossing : Horizontal Directional Drilling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Jack/bore	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Open trench	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (specify):	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## NOTIFICATION OF LAKE OR STREAMBED ALTERATION

### 10. PROJECT DESCRIPTION

A. Describe the project in detail. Photographs of the project location and immediate surrounding area should be included.

- Include any structures (e.g., rip-rap, culverts, or channel clearing) that will be placed, built, or completed in or near the stream, river, or lake.
- Specify the type and volume of materials that will be used.
- If water will be diverted or drafted, specify the purpose or use.

Enclose diagrams, drawings, plans, and/or maps that provide all of the following: site specific construction details; the dimensions of each structure and/or extent of each activity in the bed, channel, bank or floodplain; an overview of the entire project area (i.e., "bird's-eye view") showing the location of each structure and/or activity, significant area features, and where the equipment/machinery will enter and exit the project area.

Stream maintenance activities conducted by the District are described in detail the Stream Maintenance Manual (attached). Maintenance include the following activities:

1. Vegetation Management includes trimming, pruning, mowing, and removal of flow constricting vegetation and planting native vegetation within stream channels and the riparian corridor. These activities are conducted to maintain flow conveyance capacity, establish a native riparian corridor and control non-native, invasive vegetation. Herbicides are also used to control non-native, invasive vegetation. Management activities are relatively consistent, though locations change annually depending on recent growth and blockages. Vegetation management occurs year-round. See Chapter 4 of the Manual for further details.
2. Downed Tree Management involves addressing tree and limb obstructions which threaten flood conveyance or channel stability. This is one of the most common stream maintenance activities conducted by the District. The preference is to leave downed wood in place to provide instream aquatic habitat. However, if necessary to maintain flood control, downed trees and limbs are either cut into smaller pieces, repositioned in the channel, or removed entirely as a last resort. Downed tree management occurs year-round. See Chapter 5 of the Manual for further details.
2. Erosion Protection and Bank Stabilization involves preventative erosion measures, such as planting appropriate native species along exposed banks, and bank repairs using a variety of biotechnical approaches. More involved repairs requiring engineered solutions, are subject to individual project permits. See Chapter 6 of the Manual for further details.
3. Sediment and Debris Removal activities are conducted to maintain the flow capacity of a stream channel and prevent flooding. Typically sediment removal activities take place along 100-200 ft long channel segments to alleviate a specific flood control problem at an individual crossing, culvert or other facility. Removed sediment and debris is taken to appropriate disposal sites. Sediment and debris removal activities occur during June 15th to October 31st. See Chapter 7 of the Manual for further details.

☒ Continued on additional page(s)

B. Specify the equipment and machinery that will be used to complete the project.

Hand maintenance equipment: sheers, loppers, hand saw mowers, chainsaws, shovels, picks

Heavy equipment: flail mower, rubber-tracked excavators, extending arm excavators, small bulldozers, front end loaders, 10 cubic yard dump trucks

☐ Continued on additional page(s)

C. Will water be present during the proposed work period (specified in box 4.D) in the stream, river, or lake (specified in box 8.B).

☒ Yes    ☐ No (Skip to box 11)

D. Will the proposed project require work in the wetted portion of the channel?

☒ Yes (Enclose a plan to divert water around work site)

☐ No

# NOTIFICATION OF LAKE OR STREAMBED ALTERATION

## 11. PROJECT IMPACTS

A. Describe impacts to the bed, channel, and bank of the river, stream, or lake, and the associated riparian habitat. Specify the dimensions of the modifications in length (linear feet) and area (square feet or acres) and the type and volume of material (cubic yards) that will be moved, displaced, or otherwise disturbed, if applicable.

Program impacts are currently being evaluated in a CEQA compliance document. Impacts will be generally similar throughout the County. Impact avoidance and minimization measures will be implemented and site-specific conditions will be evaluated annually as projects are identified for maintenance. Annual notification reports including site-specific impact evaluations will be submitted to regulatory agencies for review and approval prior to implementation of maintenance activities.

☒ Continued on additional page(s)

B. Will the project affect any vegetation? ☒ Yes (Complete the tables below) ☐ No

Vegetation Type	Temporary Impact	Permanent Impact
Varies annually. See Manual.	Linear feet: _____ Total area: _____	Linear feet: _____ Total area: _____
	Linear feet: _____ Total area: _____	Linear feet: _____ Total area: _____

Tree Species	Number of Trees to be Removed	Trunk Diameter (range)
Varies annually. See Manual.		

☒ Continued on additional page(s)

C. Are any special status animal or plant species, or habitat that could support such species, known to be present on or near the project site?

☒ Yes (List each species and/or describe the habitat below) ☐ No ☐ Unknown  
See Manual and forthcoming CEQA document.

☒ Continued on additional page(s)

D. Identify the source(s) of information that supports a "yes" or "no" answer above in Box 11.C.

CEQA analysis

☒ Continued on additional page(s)

E. Has a biological study been completed for the project site?

☐ Yes (Enclose the biological study) ☒ No

*Note: A biological assessment or study may be required to evaluate potential project impacts on biological resources.*

F. Has a hydrological study been completed for the project or project site?

☐ Yes (Enclose the hydrological study) ☒ No

*Note: A hydrological study or other information on site hydraulics (e.g., flows, channel characteristics, and/or flood recurrence intervals) may be required to evaluate potential project impacts on hydrology.*



## NOTIFICATION OF LAKE OR STREAMBED ALTERATION

### 12. MEASURES TO PROTECT FISH, WILDLIFE, AND PLANT RESOURCES

A. Describe the techniques that will be used to prevent sediment from entering watercourses during and after construction.

See BMPs identified in Table 3-1 of the Manual.

☒ Continued on additional page(s)

B. Describe project avoidance and/or minimization measures to protect fish, wildlife, and plant resources.

See BMPs identified in Table 3-1 of the Manual.

☒ Continued on additional page(s)

C. Describe any project mitigation and/or compensation measures to protect fish, wildlife, and plant resources.

See BMPs identified in Table 3-1 of the Manual.

☒ Continued on additional page(s)

### 13. PERMITS

List any local, state, and federal permits required for the project and check the corresponding box(es). Enclose a copy of each permit that has been issued.

- A. San Francisco Regional Water Quality Control Board ☐ Applied ☐ Issued
- B. \_\_\_\_\_ ☐ Applied ☐ Issued
- C. \_\_\_\_\_ ☐ Applied ☐ Issued
- D. Unknown whether ☐ local, ☐ state, or ☐ federal permit is needed for the project. (Check each box that applies)

☐ Continued on additional page(s)

## NOTIFICATION OF LAKE OR STREAMBED ALTERATION

### 14. ENVIRONMENTAL REVIEW

<b>A. Has a draft or final document been prepared for the project pursuant to the California Environmental Quality Act (CEQA), National Environmental Protection Act (NEPA), California Endangered Species Act (CESA) and/or federal Endangered Species Act (ESA)?</b>			
<input checked="" type="checkbox"/> <b>Yes</b> (Check the box for each CEQA, NEPA, CESA, and ESA document that has been prepared and enclose a copy of each) <input type="checkbox"/> <b>No</b> (Check the box for each CEQA, NEPA, CESA, and ESA document listed below that will be or is being prepared)			
<input type="checkbox"/> Notice of Exemption <input type="checkbox"/> Initial Study <input type="checkbox"/> Negative Declaration <input type="checkbox"/> THP/ NTMP	<input checked="" type="checkbox"/> Mitigated Negative Declaration <input type="checkbox"/> Environmental Impact Report <input type="checkbox"/> Notice of Determination (Enclose) <input checked="" type="checkbox"/> Mitigation, Monitoring, Reporting Plan	<input type="checkbox"/> NEPA document (type): _____ <input type="checkbox"/> CESA document (type): _____ <input type="checkbox"/> ESA document (type): _____	
<b>B. State Clearinghouse Number (if applicable)</b>		In progress	
<b>C. Has a CEQA lead agency been determined?</b>		<input checked="" type="checkbox"/> <b>Yes</b> (Complete boxes D, E, and F) <input type="checkbox"/> <b>No</b> (Skip to box 14.G)	
<b>D. CEQA Lead Agency</b>		Napa County	
<b>E. Contact Person</b>		Patrick Lowe	<b>F. Telephone Number</b>
		(707) 259-5937	
<b>G. If the project described in this notification is part of a larger project or plan, briefly describe that larger project or plan.</b>			
N/A			
<input type="checkbox"/> Continued on additional page(s)			
<b>H. Has an environmental filing fee (Fish and Game Code section 711.4) been paid?</b>			
<input type="checkbox"/> <b>Yes</b> (Enclose proof of payment) <input checked="" type="checkbox"/> <b>No</b> (Briefly explain below the reason a filing fee has not been paid)			
Filing fee will be paid when the CEQA Notice of Determination is filed (spring 2012).			
<i>Note: If a filing fee is required, the Department may not finalize a Lake or Streambed Alteration Agreement until the filing fee is paid.</i>			

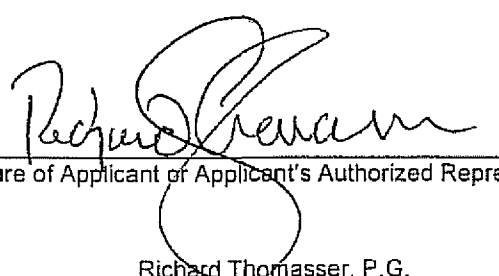
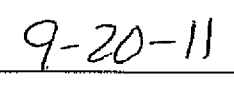
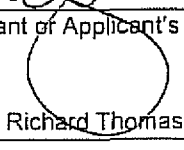
### 15. SITE INSPECTION

<b>Check one box only.</b>
<input checked="" type="checkbox"/> In the event the Department determines that a site inspection is necessary, I hereby authorize a Department representative to enter the property where the project described in this notification will take place at any reasonable time, and hereby certify that I am authorized to grant the Department such entry.
<input type="checkbox"/> I request the Department to first contact (insert name) _____ at (insert telephone number) _____ to schedule a date and time to enter the property where the project described in this notification will take place. I understand that this may delay the Department's determination as to whether a Lake or Streambed Alteration Agreement is required and/or the Department's issuance of a draft agreement pursuant to this notification.

**16. DIGITAL FORMAT**

Is any of the information included as part of the notification available in digital format (i.e., CD, DVD, etc.)?
<input checked="" type="checkbox"/> Yes (Please enclose the information via digital media with the completed notification form)
<input type="checkbox"/> No

**17. SIGNATURE**

<p>I hereby certify that to the best of my knowledge the information in this notification is true and correct and that I am authorized to sign this notification as, or on behalf of, the applicant. I understand that if any information in this notification is found to be untrue or incorrect, the Department may suspend processing this notification or suspend or revoke any draft or final Lake or Streambed Alteration Agreement issued pursuant to this notification. I understand also that if any information in this notification is found to be untrue or incorrect and the project described in this notification has already begun, I and/or the applicant may be subject to civil or criminal prosecution. I understand that this notification applies only to the project(s) described herein and that I and/or the applicant may be subject to civil or criminal prosecution for undertaking any project not described herein unless the Department has been separately notified of that project in accordance with Fish and Game Code section 1602 or 1611.</p>	
	
Signature of Applicant or Applicant's Authorized Representative	Date
	
Richard Thomasser, P.G.	
Print Name	

**NOTIFICATION OF LAKE OR STREAMBED ALTERATION**

Applicant Name: Napa County Flood Control & Water Conserv District

Project Title: Napa County Stream Maintenance Program

**ATTACHMENT D**

**Routine Maintenance**

If the applicant is notifying the Department to obtain an agreement for routine maintenance activities, Section I must be completed and the information and documents described in Sections II and III must be submitted with the notification.

**I. REGULARLY RE-OCCURRING MAINTENANCE ACTIVITIES**

These are generally activities designed to maintain channel capacity. Check each box that applies:

☒ Sediment removal:

- ☒ In and around bridges, culverts, storm drain outlets, and/or water diversion inlets
- ☒ Stream channel bottom
- ☐ Pond or lake
- ☐ Marina basin
- ☐ Other: \_\_\_\_\_

☒ Clearing trash and debris

☒ Removing fallen trees

☒ Removing dead (not dormant) trees and shrubs

☒ Vegetation:

- ☒ Limbing and/or trimming of branches and tree limbs
- ☐ Vegetation removal under high power lines
- ☒ Mowing levee slopes and stream banks
- ☒ Mowing within stream and floodway channels
- ☒ Removing emergent (e.g., bulrush and cattails) or other near water vegetation with:
  - ☒ hand tools
  - ☒ mechanical vegetation cutters and shredders
  - ☒ heavy equipment (soil disturbance)
  - ☒ chemicals

NOTIFICATION OF LAKE OR STREAMBED ALTERATION  
ATTACHMENT D

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- ☒ Removing vegetation from the ***upper half*** of the bank with:
  - ☒ hand tools
  - ☒ mechanical vegetation cutters or shredders
  - ☒ heavy equipment (soil disturbance)
  - ☒ chemicals
- ☒ Removing vegetation from the ***lower half*** of bank with:
  - ☒ hand tools
  - ☒ mechanical vegetation cutters or shredders
  - ☒ heavy equipment (soil disturbance)
  - ☒ chemicals
- ☒ Removing vegetation within the channel with:
  - ☒ hand tools
  - ☒ mechanical vegetation cutters and shredders
  - ☒ heavy equipment (soil disturbance)
  - ☒ chemicals
- ☒ Removing invasive, non-native plants with:
  - ☒ hand tools
  - ☒ mechanical vegetation cutters and shredders
  - ☒ heavy equipment (soil disturbance)
  - ☒ chemicals
- ☐ Other: \_\_\_\_\_
- ☐ Debris and brush pile burning
- ☐ Burning levees
- ☒ Minor erosion repair:
  - ☒ Repair at existing erosion control sites
  - ☒ New erosion repair
- ☒ Revegetation with local, native plant species



**NAPA COUNTY FLOOD CONTROL AND  
WATER CONSERVATION DISTRICT AGREEMENT NO. 459 (FC)**

**TOWN OF YOUNTVILLE AGREEMENT NO. \_\_\_\_\_**

**MEMORANDUM OF UNDERSTANDING  
RELATED TO WATERSHED AND STREAMS MANAGEMENT**

This MEMORANDUM OF UNDERSTANDING ("MOU") is made as of September 15, 2015, by and between the Napa County Flood Control and Water Conservation District, a special District of the State of California ("District"), and the Town of Yountville, a municipal corporation of the State of California ("Town").

**WHEREAS**, the District and Town share overlapping responsibilities for stream maintenance and watershed management; and

**WHEREAS**, the Parties will mutually benefit from coordinating human and financial resources to achieve the greatest watershed management; and

**WHEREAS**, District and the Town now desire to enter into this Agreement to set forth the manner in which the Parties shall collaborate in watershed and stream management:

**NOW, THEREFORE**, in consideration of the foregoing, the mutual agreements of the parties, and other valuable consideration the sufficiency of which is hereby acknowledged, the parties hereby agree as follows:

1. The Parties shall meet as needed, but at least once each fiscal year, to plan watershed and stream management priorities and the fiscal responsibilities of each Party related thereto.
2. The activities covered by this agreement are outlined in Exhibit A and may include sharing of labor resources or financial resources provided those resources are appropriate for the activities to be performed. Financial support shall meet and adhere to any and all conditions and or restrictions that pertain to the revenues to be used by either party.
3. The financial commitments of the Parties to either fund or perform activities of joint benefit and interest shall be outlined and approved through the normal and customary budgeting procedures of each party.
4. The cost of labor, materials, and supplies, direct and indirect expenditures shall be at those rates determined through the normal and customary procedures of the Parties and such labor, materials, and supplies, direct and indirect expenditures shall be appropriated following the purchasing and accounting rules of each party.

## ADDITIONAL TERMS AND CONDITIONS

5. **Term.** The term of this Agreement shall be ongoing unless terminated by either party without cause upon thirty (30) days written notice.
6. **Other Termination.** If, during the term of this Agreement or any extension thereof subsequent to the first fiscal year during the term, DISTRICT or TOWN is unable to appropriate sufficient funds to meet its obligations under this Agreement, such funds are not otherwise available to DISTRICT or TOWN for this purposes, and there are no other legal procedures or available funds by or with which such obligations can be met, and such non-appropriation of funds has not resulted from any act or omission within the control of DISTRICT or TOWN each Party shall have the right to terminate this Agreement by giving the other Party written notice of such termination at least thirty (30) days prior to the effective date of the termination. In the event of such termination, the Parties shall be obligated to each other only for payment of compensation and reimbursement of expenses for services satisfactorily completed or incurred and for which invoices are submitted as of the effective date of such termination.
7. **Hold Harmless/Indemnification.** To the full extent permitted by law, DISTRICT and TOWN shall each defend, indemnify and hold harmless each other as well as their respective officers, agents and employees from any claims, suits, proceedings, loss or liability, including reasonable attorney's fees, for personal injury (including death) or damage to property, arising out of or connected with any acts or omissions of that party or its officers, agents, employees, volunteers, or other contractors or their subcontractors, when performing any activities or obligations required of that party under this Agreement. Each party shall notify the other party immediately in writing of any claim or damage related to activities performed under this Agreement. The parties shall cooperate with each other in the investigation and disposition of any claim arising out of the activities under this Agreement, providing that nothing shall require either party to disclose any documents, records or communications that are protected under peer review privilege, attorney-client privilege, or attorney work product privilege.
8. **Warranty of Legal Authority.** Each party warrants and covenants that it has the present legal authority to enter into this Agreement and to perform the acts required of it hereunder. If any party is found to lack the authority to perform the acts required of it hereunder or is prevented from performing the acts by a court of competent jurisdiction, this Agreement shall be void as to that party.
9. **Assignment/Delegation.** As between the District and Town, neither party hereto shall assign, or transfer any benefit or obligations of this Agreement without the prior written consent of the other, and no assignment shall be of any force or effect whatsoever unless and until the other party shall have so consented.
10. **Severability.** In the event any provision of this Agreement is held to be invalid or unenforceable, the valid or enforceable portion thereof and the remaining provisions of this Agreement will remain in full force and effect.
11. **Attorneys' Fees.** The prevailing party in any legal action brought by one party against the other and arising out of this Agreement shall be entitled to reimbursement for its expenses, including court costs and reasonable attorneys' fees.



12. **Waiver.** Any waiver (express or implied) by either the District or Town of any breach of this Agreement shall not constitute a waiver of any other or subsequent breach.

13. **Notices.** Whenever notice is to be given, it shall be in writing and delivered by personal, overnight express or courier service, with a written receipt, or sent by registered or certified mail in a sealed envelope, postage prepaid, return receipt requested and addressed as follows:

***District:***

District Engineer  
Napa County Flood Control  
and water Conservation District  
804 First Street  
Napa, CA 94559

***Town:***

Public Works Director  
Town Of Yountville  
6550 Yount Street  
Yountville, CA 94559

Changes may be made in addresses to where notices are to be delivered by giving notice pursuant to this paragraph.

13. **Entire Agreement.** This document is intended both as the final expression of the agreement between the parties hereto with respect to the included terms and as a complete and exclusive statement of the terms of the Agreement.

14. **Amendment.** This Agreement may only be amended in writing by an amendment authorized by the District's Board of Directors and the Town's Town Council.

15. **Recitals Adopted.** The parties hereby agree to and adopt the Agreement recitals as portions of the Agreement.

16. **Joint Defense in Event of Third Party Challenges to the Agreement.** In the event of a third party challenge of any type to this Agreement, the parties agree to jointly defend the validity and implementation of the Agreement.

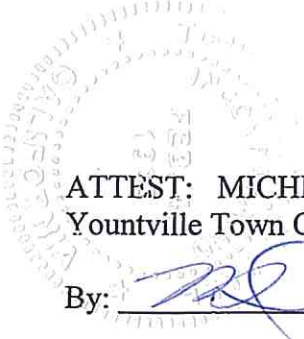
17. **Counterparts Signature.** This Agreement may be executed in counterparts, each of which shall be an original, but all counterparts shall constitute one agreement.

///

///

///

IN WITNESS WHEREOF, this Agreement was executed by the parties hereto as of the date first above written.



ATTEST: MICHELLE DAHME,  
Yountville Town Clerk

By: [Signature]

APPROVED AS TO FORM:  
MICHAEL R. COBDEN,  
Yountville Town Attorney

By: [Signature]

TOWN OF YOUNTVILLE

By: [Signature]  
JOHN F. DUNBAR, Mayor

"ENTITY"

NAPA COUNTY FLOOD CONTROL AND  
WATER CONSERVATION DISTRICT, a special  
district of the State of California

By: [Signature]  
BRAD WAGENKNECHT  
Chairperson of the Board of Directors

"DISTRICT"

<p>APPROVED AS TO FORM Office of County Counsel</p> <p>By: <u>Robert C. Martin (By E-Sign.)</u> County Counsel</p> <p>Date: <u>December 23, 2014</u></p>	<p>APPROVED BY THE BOARD OF DIRECTORS OF THE NAPA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT</p> <p>Date: <u>9/15/15</u></p> <p>Processed By: <u>[Signature]</u> Deputy Clerk of the Board <u>District Secretary</u></p>	<p>ATTEST: GLADYS I. COIL <del>Clerk of the Board of Supervisors</del> <u>District Secretary</u></p> <p>By: <u>[Signature]</u></p>
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## EXHIBIT A

### ACTIVITIES OF MUTUAL INTEREST AND BENEFIT

The following activities are covered by this MOU as being of mutual watershed and streams benefit to the District and Town. This list may be amended from time to time.

- 1) The District and Town will meet annually to coordinate and prioritize annual stream maintenance activities within the Town limits.
- 2) Agreed upon projects will be included in the District Stream Maintenance Program Annual Notification Document.
- 3) At the District discretion the implementation of stream and channel maintenance activities including; vegetation management, sediment removal, biotechnical bank stabilization, and debris management will occur annually.
- 4) District will assist Town with maintenance, assessment and restoration of stream channels and other waterways within the coterminous District/Town boundaries.
- 5) The District will coordinate permits and contractors to carry out annual channel maintenance activities within the Town's channels and drainage easements.
- 6) Water conservation programs and activities shall be defined and implemented by the District and Town.
- 7) Project development, management and implementation to support mutual watershed and streams benefit activities.

**NAPA COUNTY FLOOD CONTROL AND WATER  
CONSERVATION DISTRICT AGREEMENT NO. 190123B (FC)  
CITY OF AMERICAN CANYON AGREEMENT NO. 2018-112**

**(Agreement for Maintenance of American Canyon Streams)**

**THIS AGREEMENT ("Agreement")** is made and entered into as this 18<sup>th</sup> day of September, 2018, by and between the NAPA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT ("DISTRICT"), a special district of the State of California, and the CITY OF AMERICAN CANYON ("CITY"), a municipal corporation;

**RECITALS**

**WHEREAS**, the maintenance of stream channels within City minimizes the risk of damage to life and property from flooding; and

**WHEREAS**, CITY seeks to undertake stream maintenance work with the approval and permission of regulatory permitting agencies with jurisdiction over such work; and

**WHEREAS**, DISTRICT undertakes stream maintenance activities throughout Napa County using methods approved by regulatory permitting agencies under its Stream Maintenance Program; and

**WHEREAS**, the DISTRICT and the CITY seek to include maintenance of channels that exist within the city limits of American Canyon in the DISTRICT's Stream Maintenance Program; and

**WHEREAS**, activities undertaken by both the CITY and the DISTRICT are subject to all applicable permit conditions including Best Management Practices described in the DISTRICT's Stream Maintenance Manual; and

**WHEREAS**, the agreed upon activities undertaken by the DISTRICT and the CITY will be included in the DISTRICT's annual notification and annual report to permitting agencies for its Stream Maintenance Program.

**TERMS**

**NOW, THEREFORE**, it is agreed by DISTRICT and CITY as follows:

1. **Term of the Agreement.** The term of this Agreement shall commence on July 1, 2018, and shall expire on June 30, 2021, unless terminated earlier in accordance with Paragraphs 9 (Termination for Cause), 10 (Other Termination), or 23(a) (Covenant of No Undisclosed Conflict); except that the obligations of the parties under Paragraphs 7 (Insurance) and 8 (Indemnification) shall continue in full force and effect after said expiration date or early



termination in relation to acts or omissions occurring prior to such dates during the term of the Agreement, and the obligations of DISTRICT to CITY shall also continue after said expiration date or early termination in relation to the obligations prescribed by Paragraphs 15 (Confidentiality), 20 (Taxes), and 21 (Access to Records/Retention).

2. **Scope of Services.** DISTRICT shall conduct those particular maintenance activities identified in the Annual Work Plan agreed upon by the CITY and DISTRICT at an annual coordination meeting. Eligible activities that may be included in the Work Plan are listed in Exhibit "A." The activities will be included in the DISTRICT's annual notification and annual report to permitting agencies for its Stream Maintenance Program.

3. **Compensation.**

(a) Rates. In consideration of DISTRICT's fulfillment of the promised work, CITY shall pay DISTRICT at the rates set forth in Exhibit "B," attached hereto and incorporated by reference herein. CITY shall reimburse DISTRICT for its documented costs up to the annual limit stated above for conducting maintenance activities described in the Annual Work Plan developed at the annual coordination meeting. DISTRICT shall conduct the particular maintenance activities agreed upon by the CITY and DISTRICT included in the Annual Work Plan and described in Exhibit "A" in the amounts set forth in Exhibit "B," attached hereto and incorporated by reference herein.

DISTRICT staff shall record time and expenses for activities performed under this Agreement and shall provide requests for reimbursement of actual costs to CITY on a semi-annual basis. Such activities and costs shall be subject to an annual limit, not to exceed \$100,000 without prior written approval of CITY. If DISTRICT identifies maintenance activities that are expected to exceed the annual limit, DISTRICT shall promptly notify CITY and parties shall meet and confer as to a course of action regarding those activities in excess of the maximum limit. DISTRICT rates for the current fiscal year are described in Exhibit "B" and will be updated annually and provided to the CITY.

(b) Expenses. Materials and other expenses will be reimbursed by CITY upon submission of an invoice in accordance with the rates and/or in accordance with the provisions set forth in Exhibit "B."

(c) Maximum Amount. Notwithstanding subparagraphs (a) and (b), the maximum payments under this Agreement shall not exceed One Hundred Thousand dollars (\$100,000); provided, however, that such amounts shall not be construed as guaranteed sums, and compensation shall be based upon services actually rendered and reimbursable expenses actually incurred.

4. **Method of Payment.** CITY shall pay the compensation required under Paragraph 3 upon submission of semi-annual invoices by DISTRICT in the manner and subject to the rates set forth in Exhibit "B."

5. **Independent Contractor.** DISTRICT shall perform this Agreement as an independent contractor. DISTRICT and the officers, agents and employees of DISTRICT are not, and shall

not be deemed, CITY employees for any purpose, including workers' compensation and employee benefits. DISTRICT shall, at DISTRICT's own risk and expense, determine the method and manner by which duties imposed on DISTRICT by this Agreement shall be performed; provided, however, that CITY may monitor the work performed by DISTRICT. CITY shall not deduct or withhold any amounts whatsoever from the compensation paid to DISTRICT, including, but not limited to amounts required to be withheld for state and federal taxes, unless required to do so by court order. As between the parties to this Agreement, DISTRICT shall be solely responsible for all such payments.

6. **Specific Performance.** It is agreed that DISTRICT, including the agents or employees of DISTRICT, shall be the sole providers of the services required by this Agreement. Because the services to be performed by DISTRICT under the terms of this Agreement are of a special, unique, unusual, extraordinary, and intellectual or time-sensitive character which gives them a peculiar value, the loss of which cannot be reasonably or adequately compensated in damages in an action of law, CITY, in addition to any other rights or remedies which CITY may possess, shall be entitled to injunctive and other equitable relief to prevent a breach of this Agreement by DISTRICT.

7. **Insurance.** DISTRICT shall obtain and maintain in full force and effect throughout the term of this Agreement, and thereafter as to matters occurring during the term of this Agreement, the following insurance coverage:

(a) Workers' Compensation Insurance. To the extent required by law during the term of this Agreement, DISTRICT shall provide workers' compensation insurance for the performance of any of DISTRICT's duties under this Agreement, including but not limited to, coverage for workers' compensation and employer's liability and a waiver of subrogation, and shall provide CITY with certification of all such coverages upon request by CITY's Risk Manager.

(b) Liability Insurance. Each party shall obtain and maintain in full force and effect during the term of this Agreement the following liability insurance coverages, issued by a company admitted to do business in California and having an A.M. Best rating of A:VII or better or equivalent self-insurance:

(1) General Liability. Each party shall obtain and maintain in full force and effect during the term of this Agreement commercial or comprehensive general liability insurance coverage (personal injury and property damage) of not less than ONE MILLION DOLLARS (\$1,000,000) combined single limit per occurrence, either issued by a company admitted to do business in the State of California and having an A.M. Best Rating of no less than A:VII or by self-insurance satisfactory to other party's risk manager or employee designated by that party to perform such function, or by a combination thereof, covering liability for any personal injury, including death, to any person and/or damage to the property of any person arising from the acts or omissions of that party under this Agreement except for acts or omissions performed in strict compliance with express direction the other party's governing board, officers or personnel. If the coverage includes an aggregate limit, the aggregate limit shall be no less than twice the per occurrence limit.

(2) Professional Liability. Each party shall obtain and maintain in full force and effect during the term of this Agreement professional liability/errors and omissions insurance



coverage in an amount of not less than ONE MILLION DOLLARS (\$1,000,000) combined single limit for each occurrence and, where provided through a policy of insurance, issued by a company admitted to do business in the State of California and having an A.M. Best Rating of A: VII or better, covering all professional acts or omissions of that party arising out of or in connection with this Agreement except for those acts or omissions performed in strict compliance with express direction from the other party's governing board, officers or personnel unless such direction was based upon professional advice from the first party or its personnel or other agents under this Agreement.

(3) Comprehensive Automobile Liability Insurance. Each party shall obtain and maintain in full force and effect during the term of this Agreement a comprehensive automobile liability insurance policy (Bodily Injury and Property Damage) on owned, hired, leased and non-owned vehicles used in conjunction with that party's activities under this Agreement of not less than ONE MILLION DOLLARS (\$1,000,000) combined single limit per occurrence.

(c) Certificates of Coverage. Insurance coverages referenced in 7(b), above, shall be evidenced by one or more certificates of coverage or, with the consent of CITY's Risk Manager, demonstrated by other evidence of coverage acceptable to CITY's Risk Manager, which shall be filed by DISTRICT with the prior to commencement of performance of any of DISTRICT's duties.

(1) The certificate(s) or other evidence of coverage shall reference this Agreement by its CITY number or title and department; shall be kept current during the term of this Agreement; shall provide that CITY shall be given no less than thirty (30) days prior written notice of any non-renewal, cancellation, other termination, or material change, except that only ten (10) days prior written notice shall be required where the cause of non-renewal or cancellation is non-payment of premium; and shall provide that the inclusion of more than one insured shall not operate to impair the rights of one insured against another insured, the coverage afforded applying as though separate policies had been issued to each insured, but the inclusion of more than one insured shall not operate to increase the limits of the company's liability.

(2) Waiver of Subrogation and Additional Insured Endorsements. For the commercial general liability insurance coverage referenced in 7(b)(1) and, for the comprehensive automobile liability insurance coverage referenced in 7(b)(3) where the vehicles are covered by a commercial policy rather than a personal policy, DISTRICT shall also file with the evidence of coverage an endorsement from the insurance provider naming CITY, its officers, employees, agents and volunteers as additional insureds and waiving subrogation. For the Workers Compensation insurance coverage, DISTRICT shall file with the evidence of coverage an endorsement waiving subrogation.

(3) The certificate or other evidence of coverage shall provide that if the same policy applies to activities of DISTRICT not covered by this Agreement, then the limits in the applicable certificate relating to the additional insured coverage of CITY shall pertain only to liability for activities of DISTRICT under this Agreement, and that the insurance provided is primary coverage to CITY with respect to any insurance or self-insurance programs maintained by CITY. The additional insured endorsements for the general liability coverage shall use Insurance Services Office (ISO) Form No. CG 20 09 11 85 or CG 20 10 11 85, or equivalent, including (if used together) CG 2010 10 01 and CG 2037 10 01; but shall not use the following forms: CG 20 10 10 93 or 03 94.



(4) Upon request by CITY's Risk Manager, DISTRICT shall provide or arrange for the insurer to provide within thirty (30) days of the request, certified copies of the actual insurance policies or relevant portions thereof.

(d) Deductibles/Retentions. Any deductibles or self-insured retentions shall be declared to CITY's Risk Manager.

(e) Inclusion in Subcontracts. Each party agrees to require all subcontractors and any other entity or person who is involved in providing services under this Agreement to comply with the Workers Compensation and General Liability insurance requirements set forth in this Paragraph 7.

**8. Hold Harmless/Defense/Indemnification.**

(a) In General. To the full extent permitted by law, DISTRICT and CITY shall each defend, indemnify and hold harmless each other as well as their appointed or elected officials, agents, employees, volunteers, or representatives from and against any and all liability, claims, actions, proceedings, losses, injuries, damages or expenses of every name, kind and description, including litigation costs and reasonable attorney's fees incurred in connection therewith, brought for or on account of personal injury (including death) or damage to property, arising out of or connected with any acts or omissions of that party or its officers, agents, employees, volunteers, or contractors or their subcontractors, when performing any activities or obligations required of that party under this Agreement. Each party shall notify the other party immediately in writing of any claim or damage related to activities performed under this Agreement. The parties shall cooperate with each other in the investigation and disposition of any claim arising out of the activities under this Agreement, providing that nothing shall require either party to disclose any documents, records or communications that are protected under peer review privilege, attorney-client privilege, or attorney work product privilege.

(b) Employee Character and Fitness. Each party accepts responsibility for determining and approving the character and fitness of its employees (including volunteers, agents or representatives) to provide the services required of each party under this Agreement, including completion of a satisfactory criminal/background check and period rechecks to the extent permitted by law. Notwithstanding anything to the contrary in this Paragraph 8, each party shall hold the other and its officers, agents and employees harmless from any liability for injuries or damages resulting from a breach of this provision or the other party's actions in this regard.

**9. Termination for Cause.** If either party shall fail to fulfill in a timely and proper manner that party's obligations under this Agreement or otherwise breach this Agreement and fail to cure such failure or breach within twenty (20) days of receipt of written notice from the other party describing the nature of the breach, the non-defaulting party may, in addition to any other remedies it may have, terminate this Agreement by giving ten (10) days prior written notice to the defaulting party in the manner set forth in Paragraph 13 (Notices). The Napa County Purchasing Agent or designee pursuant to Napa County Code section 2.36.050 is hereby authorized to make all decisions and take all actions required under this Paragraph to terminate this Agreement on behalf of DISTRICT for cause.

**10. Other Termination.** This Agreement may be terminated by either party for any reason and at any time by giving prior written notice of such termination to the other party specifying the



effective date thereof at least forty (40) days prior to the effective date, as long as the date the notice is given and the effective date of the termination are in the same fiscal year; provided, however, that no such termination may be effected by CITY unless an opportunity for consultation is provided prior to the effective date of the termination. DISTRICT hereby authorizes the Napa County Executive Officer to make all decisions and take all actions required under this Paragraph to terminate this Agreement on behalf of DISTRICT for the convenience of DISTRICT.

11. **Disposition of, Title to, and Payment for Work Upon Expiration or Termination.** DISTRICT shall be entitled to receive compensation for any satisfactory work completed prior to expiration or receipt of the notice of termination or commenced prior to receipt of the notice of termination and completed satisfactorily prior to the effective date of the termination; except that DISTRICT shall not be relieved of liability to CITY for damages sustained by CITY by virtue of any breach of the Agreement by DISTRICT whether or not the Agreement expired or otherwise terminated, and CITY may withhold any payments not yet made to DISTRICT for purpose of setoff until such time as the exact amount of damages due to CITY from DISTRICT is determined.

12. **No Waiver.** The waiver by either party of any breach or violation of any requirement of this Agreement shall not be deemed to be a waiver of any such breach in the future, or of the breach of any other requirement of this Agreement.

13. **Notices.** All notices required or authorized by this Agreement shall be in writing and shall be delivered in person or by deposit in the United States mail, by certified mail, postage prepaid, return receipt requested. Any mailed notice, demand, request, consent, approval or communication that either party desires to give the other party shall be addressed to the other party at the address set forth below. Either party may change its address by notifying the other party of the change of address. Any notice sent by mail in the manner prescribed by this paragraph shall be deemed to have been received on the date noted on the return receipt or five days following the date of deposit, whichever is earlier.

**DISTRICT**

District Engineer  
Napa County Flood Control and  
Water Conservation District  
804 First Street  
Napa, California 94558

**CITY**

Public Works Director  
City of American Canyon  
4381 Broadway St, Suite 201  
American Canyon, CA 94503

14. **Compliance with COUNTY Policies on Waste, Harassment, Drug/Alcohol-Free Workplace, and Computer Use.** Each party hereby agrees to comply, and require its employees and subcontractors to comply, with the following policies, copies of which are on file with the Clerk of the Board of Supervisors and incorporated by reference herein. Each party also agrees that it shall not engage in any activities, or permit its officers, agents and employees to do so, during the performance of any of the services required under this Agreement, which would

interfere with compliance or induce violation of these policies by the other party's employees or contractors.

(a) Waste Source Reduction and Recycled Product Content Procurement Policy adopted by resolution of the Board of Supervisors on March 26, 1991.

(b) County of Napa "Policy for Maintaining a Harassment and Discrimination Free Work Environment" revised effective August 23, 2005.

(c) County of Napa Drug and Alcohol Policy adopted by resolution of the Board of Supervisors on June 25, 1991.

(d) Napa County Information Technology Use and Security Policy adopted by resolution of the Board of Supervisors on April 17, 2001. To this end, all employees and subcontractors of CITY whose performance of services under this Agreement requires access to any portion of the DISTRICT computer network shall sign and have on file with Napa County's ITS Department prior to receiving such access the certification attached to said Policy.

(e) Napa County Workplace Violence Policy, adopted by the BOS effective May 23, 1995 and subsequently revised effective November 2, 2004, which is located in the County of Napa Policy Manual Part I, Section 37U.

**15. Confidentiality.**

a) Maintenance of Confidential Information. Confidential information is defined as all information disclosed to the other party which relates to the respective party's past, present, and future activities, as well as activities under this Agreement. Each party shall hold all such information as it may receive, if any, in trust and confidence, except with the prior written approval of the other party. Upon cancellation or expiration of this Agreement, each party shall return to the other party all written and descriptive matter which contains any such confidential information, except that each party may retain for its files a copy of the other party's work product if such product has been made available to the public by that party.

**16. No Assignments or Subcontracts.**

In General. A consideration of this Agreement is the personal reputation of DISTRICT and/or CITY; therefore, DISTRICT and/or CITY shall not assign any interest in this Agreement or subcontract any of the services either party is to perform hereunder without the prior written consent of the other party hereto, which shall not be unreasonably withheld. The inability of the assignee to provide personnel equivalent in experience, expertise, and numbers to those provided by DISTRICT and/or CITY, or to perform any of the remaining services required under this Agreement within the same time frame shall be deemed to be reasonable grounds for the other party to withhold its consent to assignment. For purposes of this subparagraph, the consent of CITY may be given by the CITY Manager. CITY expressly agrees that DISTRICT may provide any services set forth in Exhibit "A." Notwithstanding the foregoing provisions, CITY expressly agrees that DISTRICT may subcontract to the entities set forth by name in Exhibit "A."

**17. Amendment/Modification.** Except as specifically provided herein, this Agreement may be modified or amended only in writing and with the prior written consent of both parties. In particular, only, through its Purchasing Agent or designee (as long as the total contract term, including all renewals, does not exceed three (3) years and the annual aggregate compensation



paid to DISTRICT by CITY under this agreement will not exceed \$61,200 as adjusted annually beginning on July 1, 2013, to reflect the percentage change from April 1 of the prior year to April 1 of the current year in the California Consumer Price Index for all items, as determined by the California Department of Industrial Relations), or through its Board of Supervisors (in all other instances), in the form of an amendment of this Agreement, may authorize extra and/or changed work if beyond the scope of services prescribed by Exhibit "A."

**18. Interpretation; Venue.**

(a) Interpretation. The headings used herein are for reference only. The terms of the Agreement are set out in the text under the headings. This Agreement shall be governed by the laws of the State of California without regard to the choice of law or conflicts.

(b) Venue. This Agreement is made in Napa County, California. The venue for any legal action in state court filed by either party to this Agreement for the purpose of interpreting or enforcing any provision of this Agreement shall be in the Superior Court of California, County of Napa, a unified court. The venue for any legal action in federal court filed by either party to this Agreement for the purpose of interpreting or enforcing any provision of this Agreement lying within the jurisdiction of the federal courts shall be the Northern District of California. The appropriate venue for arbitration, mediation or similar legal proceedings under this Agreement shall be Napa County, California; however, nothing in this sentence shall obligate either party to submit to mediation or arbitration any dispute arising under this Agreement.

**19. Compliance with Laws.** DISTRICT and CITY shall observe and comply with all applicable Federal, State and local laws, ordinances, and codes. Such laws shall include, but not be limited to, the following, except where prohibited by law:

(a) Non-Discrimination. During the performance of this Agreement, each party and its respective subcontractors shall not deny the benefits thereof to any person on the basis of race, color, ancestry, national origin or ethnic group identification, religion or religious creed, gender or self-identified gender, sexual orientation, marital status, age, mental disability, physical disability, genetic information, or medical condition (including cancer, HIV, and AIDS), or political affiliation or belief, nor shall they discriminate unlawfully against any employee or applicant for employment because of race, color, ancestry, national origin or ethnic group identification, religion or religious creed, gender or self-identified gender, sexual orientation, marital status, age (over 40), mental disability, physical disability, genetic information, or medical condition (including cancer, HIV, and AIDS), use of family care leave, or political affiliation or belief. Each party shall ensure that the evaluation and treatment of employees and applicants for employment are free of such discrimination or harassment. In addition to the foregoing general obligations, each party shall comply with the provisions of the Fair Employment and Housing Act (Government Code section 12900, et seq.), the regulations promulgated thereunder (Title 2, California Code of Regulations, section 7285.0, et seq.), the provisions of Article 9.5, Chapter 1, Part 1, Division 3, Title 2 of the Government Code (sections 11135-11139.5) and any state or local regulations adopted to implement any of the foregoing, as such statutes and regulations may be amended from time to time. To the extent this Agreement subcontracts to one of the parties' services or works required of the other party by the State of California pursuant to agreement between the other and the State, the applicable regulations of the Fair Employment and Housing Commission implementing Government Code section 12990



(a) through (f), set forth in Chapter 5 of Division 4 of Title 2 of the California Code of Regulations are expressly incorporated into this Agreement by reference and made a part hereof as if set forth in full, and the party and any of its subcontractors shall give written notice of their obligations thereunder to labor organizations with which they have collective bargaining or other agreements.

(b) Documentation of Right to Work. Each party agrees to abide by the requirements of the Immigration and Control Reform Act pertaining to assuring that all newly-hired employees of DISTRICT performing any services under this Agreement have a legal right to work in the United States of America, that all required documentation of such right to work is inspected, and that INS Form 1-9 (as it may be amended from time to time) is completed and on file for each employee. Each party shall make the required documentation available upon request to the other party for inspection.

(c) Inclusion in Subcontracts. To the extent any of the services required of a party under this Agreement are subcontracted to a third party, the party shall include all of the provisions of this Paragraph 19 in all such subcontracts as obligations of the subcontractor.

20. **Taxes.** Each party agrees to file federal and state tax returns or applicable withholding documents and to pay all applicable taxes or make all required withholdings on amounts paid pursuant to this Agreement and shall be solely liable and responsible to make such withholdings and/or pay such taxes and other obligations including, without limitation, state and federal income and FICA taxes. Each party agrees to indemnify and hold the other party harmless from any liability it may incur to the United States or the State of California as a consequence of the other party's failure to pay or withhold, when due, all such taxes and obligations. In the event that a party is audited for compliance regarding any withholding or other applicable taxes or amounts, each party agrees to furnish the other party with proof of payment of taxes or withholdings on those earnings.

21. **Access to Records/Retention.** DISTRICT or CITY, any federal or state grantor agency funding all or part of the compensation payable hereunder, the State Controller, the Comptroller General of the United States, or the duly authorized representatives of any of the above, shall have access to any books, documents, papers, and records of the parties which are directly pertinent to the subject matter of this Agreement for the purpose of making audit, examination, excerpts, and transcriptions. Except where longer retention is required by any federal or state law, each party shall maintain all required records for at least seven (7) years after CITY makes final payment for any of the work authorized hereunder and all pending matters are closed, whichever is later.

22. **Authority to Contract.** DISTRICT and CITY each warrant hereby that they are legally permitted and otherwise have the authority to enter into and perform this Agreement.

23. **Conflict of Interest.**

(a) Covenant of No Undisclosed Conflict. The parties to the Agreement acknowledge that they are aware of the provisions of Government Code section 1090, et seq., and section 87100, et seq., relating to conflict of interest of public officers and employees. DISTRICT and CITY hereby covenant that they presently have no interest not disclosed to the other party and

shall not acquire any interest, direct or indirect, which would conflict in any material manner or degree with the performance of its services or confidentiality obligation hereunder, except as such as the other party may consent to in writing prior to the acquisition by the respective party of such conflict. Each party further warrants that it is unaware of any financial or economic interest of any public officer or employee relating to this Agreement. Each party agrees that if such financial interest does exist at the inception of this Agreement, the other may terminate this Agreement immediately upon giving written notice without further obligation by that party to the other party under this Agreement.

(b) Statements of Economic Interest. Each party acknowledges and understands that each party has developed and approved a Conflict of Interest Code as required by state law which requires CITY to file with the Elections Division of the Napa County Assessor-Clerk Recorder "assuming office," "annual, and "leaving office" Statements of Economic Interest as a "consultant," as defined in section 18701(a)(2) of Title 2 of the California Code of Regulations, unless it has been determined in writing that DISTRICT, although holding a "designated" position as a consultant, has been hired to perform a range of duties so limited in scope as to not be required to fully comply with such disclosure obligation.

By executing this Agreement, the CITY hereby determines that DISTRICT has been hired to perform a range of duties so limited in scope as to not be required to comply with such disclosure obligation.

24. **Third Party Beneficiaries.** Nothing contained in this Agreement shall be construed to create any rights in third parties and the parties do not intend to create such rights.

25. **Attorney's Fees.** In the event that either party commences legal action of any kind or character to either enforce the provisions of this Agreement or to obtain damages for breach thereof, the prevailing party in such litigation shall be entitled to all costs and reasonable attorney's fees incurred in connection with such action.

26. **Severability.** If any provision of this Agreement, or any portion thereof, is found by any court of competent jurisdiction to be unenforceable or invalid for any reason, such provision shall be severable and shall not in any way impair the enforceability of any other provision of this Agreement.

27. **Entirety of Contract.** This Agreement, including any documents expressly incorporated by reference whether or not attached hereto, constitutes the entire agreement between the parties relating to the subject of this Agreement and supersedes all previous agreements, promises, representations, understandings and negotiations, whether written or oral, among the parties with respect to the subject matter hereof.

28. **Special Terms and Conditions. [RESERVED]**



IN WITNESS THEREOF, DISTRICT and CITY have executed this Agreement as of the date first above written.

CITY OF AMERICAN CANYON

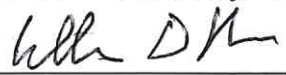
By:   
JASON HOLLEY, City Manager

"CITY"

ATTEST:  
SUELLEN JOHNSTON, City Clerk

By: 

APPROVED AS TO FORM:  
WILLIAM D. ROSS, City Attorney

By: 

NAPA COUNTY FLOOD CONTROL AND  
WATER CONSERVATION DISTRICT, a special  
district of the State of California

By:   
JILL TECHEL, Chairperson of the  
Board of Directors

<p>APPROVED AS TO FORM Office of District Counsel</p> <p>By: <i>Shana A. Bagley</i> (e-sign) Deputy District Counsel</p> <p>Date: <u>June 13, 2018</u></p>	<p>APPROVED BY THE BOARD OF DIRECTORS OF THE NAPA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT</p> <p>Date: <u>6/18</u>, 2018</p> <p>Processed by:  Deputy Secretary of the District Board</p>	<p>ATTEST: JOSE LUIS VALDEZ Secretary of the District Board</p> <p>By: </p>
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## **Exhibit A**

### **Eligible Activities for District Maintenance of American Canyon Streams**

#### **I. ACTIVITIES THAT MAY BE UNDERTAKEN BY THE DISTRICT:**

##### **Permitting:**

District staff and consultant costs to develop supporting documents to incorporate CITY into DISTRICT Stream Maintenance Manual and coverage under DISTRICT regulatory permits.

##### **Technical Studies and Biological Monitoring**

DISTRICT staff and Napa County Resource Conservation District ("RCD") staff costs for channel assessments, topographic surveys, pre-project biological monitoring, hydraulic analysis, and other technical studies as needed.

##### **SMP Planning and Coordination:**

DISTRICT staff costs to coordinate annual maintenance projects, as well as channel surveys, construction monitoring, project management, public outreach, reporting, and mitigation planning.

##### **Sediment Removal:**

DISTRICT costs to remove sediment from targeted areas where accumulation is severely reducing flow conveyance capacity. Subject to DISTRICT receipt of permit for activities in American Canyon. CITY to provide a local permitted disposal option.

##### **Channel Maintenance:**

DISTRICT costs to conduct vegetation management, debris management, downed tree management, trash removal, invasive plant management, and other SMP related activities. Does not include heavy equipment or mowing related tasks.

##### **Mitigation and Riparian Planting:**

DISTRICT costs to install plants and install irrigation system. CITY to provide point of connection for water. Costs associated with purchasing native riparian plants and other materials.

##### **RCD Coordination of Volunteer Stream Enhancement Event:**

RCD staff cost to organize trash clean up and/or riparian planting events with students or community volunteers.

##### Activities that will be undertaken by the City, unless specifically assigned to the DISTRICT in the Annual Work Plan:

(These activities are currently covered under existing CDFW Streambed Alteration Agreement received by the CITY. Notification No. 1600-2017-0147-R3, American Canyon Routine Maintenance Project)

**Mowing:**

Mow grassed areas adjacent to streams and along pathways. When CITY conducts mowing, CITY will coordinate regarding specific mowing limits in areas with DISTRICT-installed plantings and habitat improvement projects to ensure that plantings are not harmed. CITY is responsible for following conditions in the applicable permits. When requested by the CITY, and described in the Annual Work Plan, mowing may be completed by the DISTRICT and its subcontractors.

**Water:**

CITY to provide water and point of connection to support riparian planting projects on CITY property.

**II. COMPLIANCE WITH GOVERNMENT CODE SECTION 7550.** As required by Government Code section 7550, each document or report prepared by DISTRICT for or under the direction of CITY pursuant to this Agreement shall contain the numbers and dollar amounts of the Agreement and all subcontracts under the Agreement relating to the preparation of the document or written report. The Agreement and subcontract dollar amounts shall be contained in a separate section of the document or written report. If multiple documents or written reports are the subject of the Agreement or subcontracts, the disclosure section may also contain a statement indicating that the total contract amount represents compensation for multiple documents or written reports.



**Exhibit B**  
**Hourly Staff Rates and Expense Reimbursement Terms**

Environmental Resource Specialist I	\$97.66
Environmental Resource Specialist I	\$89.25
Senior Engineering Technician I	\$78.40
Engineering Technician I	\$64.98
District Operations Manager	\$127.01

DISTRICT, RCD, maintenance contractor and consultant costs will be reimbursed at cost.

Materials to be reimbursed at cost.

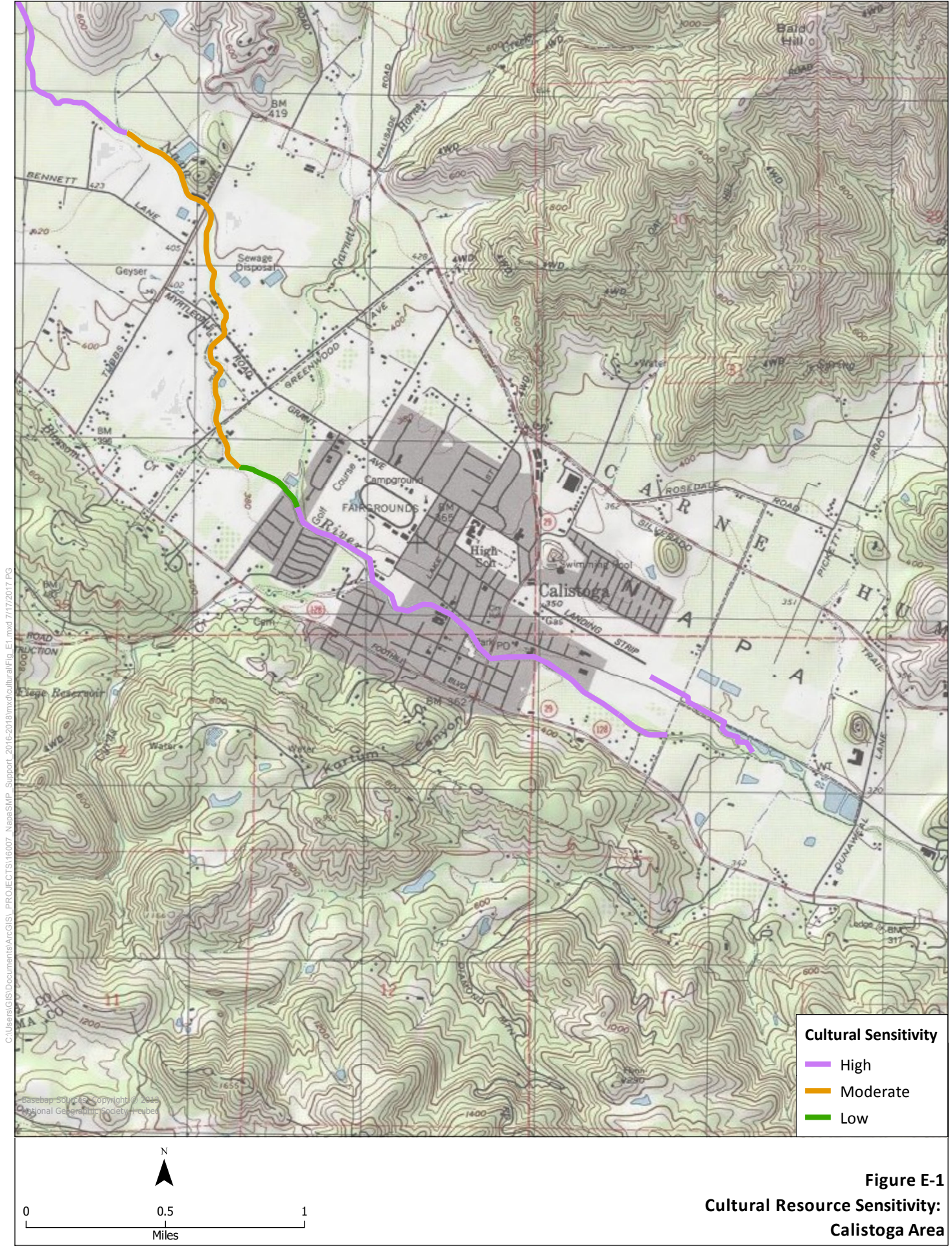
# Appendix E

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## Cultural Resources Sensitivity Maps



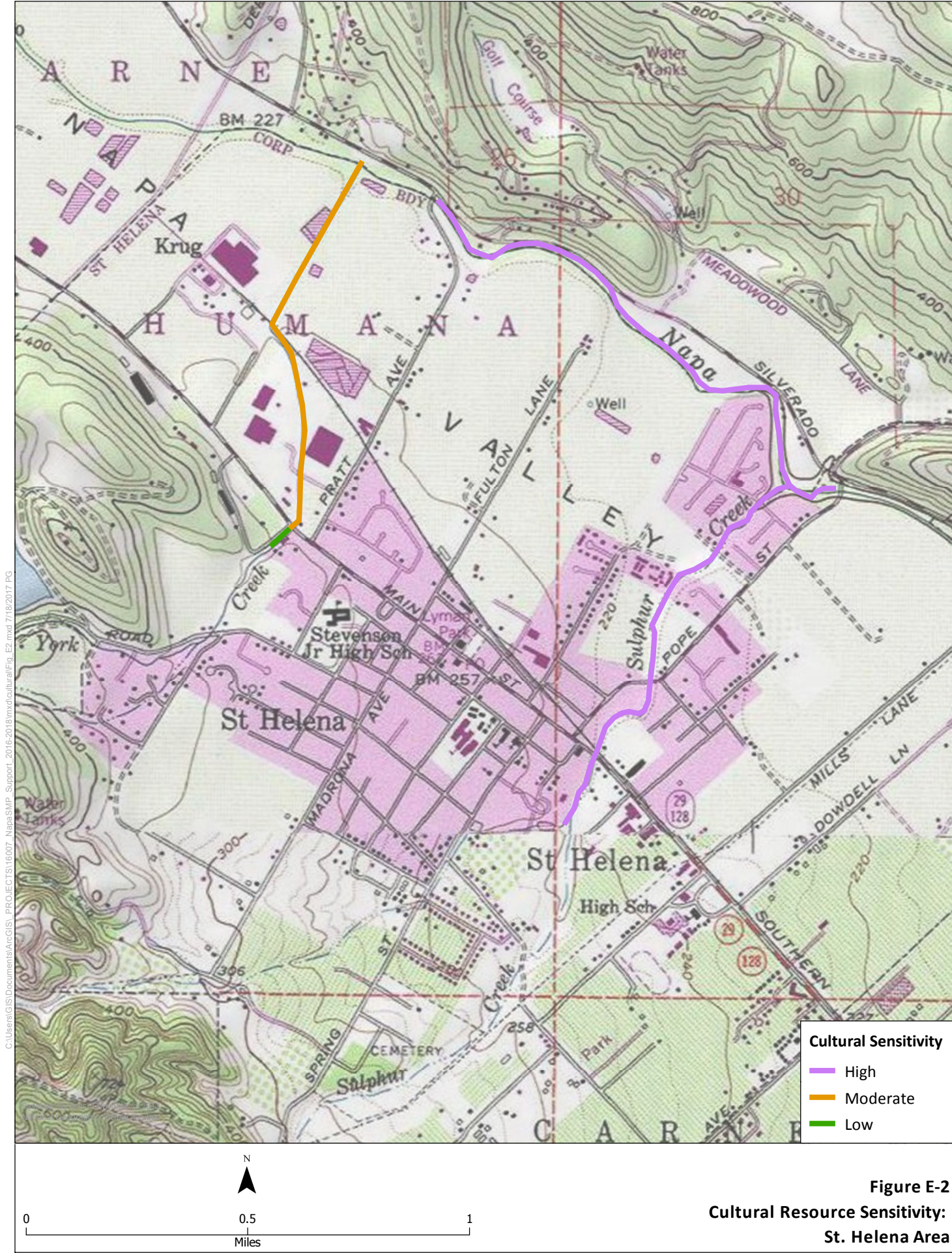




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BaseMap Source: Copyright © 2015  
National Geographic Society/DeLorme





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Figure E-2  
Cultural Resource Sensitivity:  
St. Helena Area



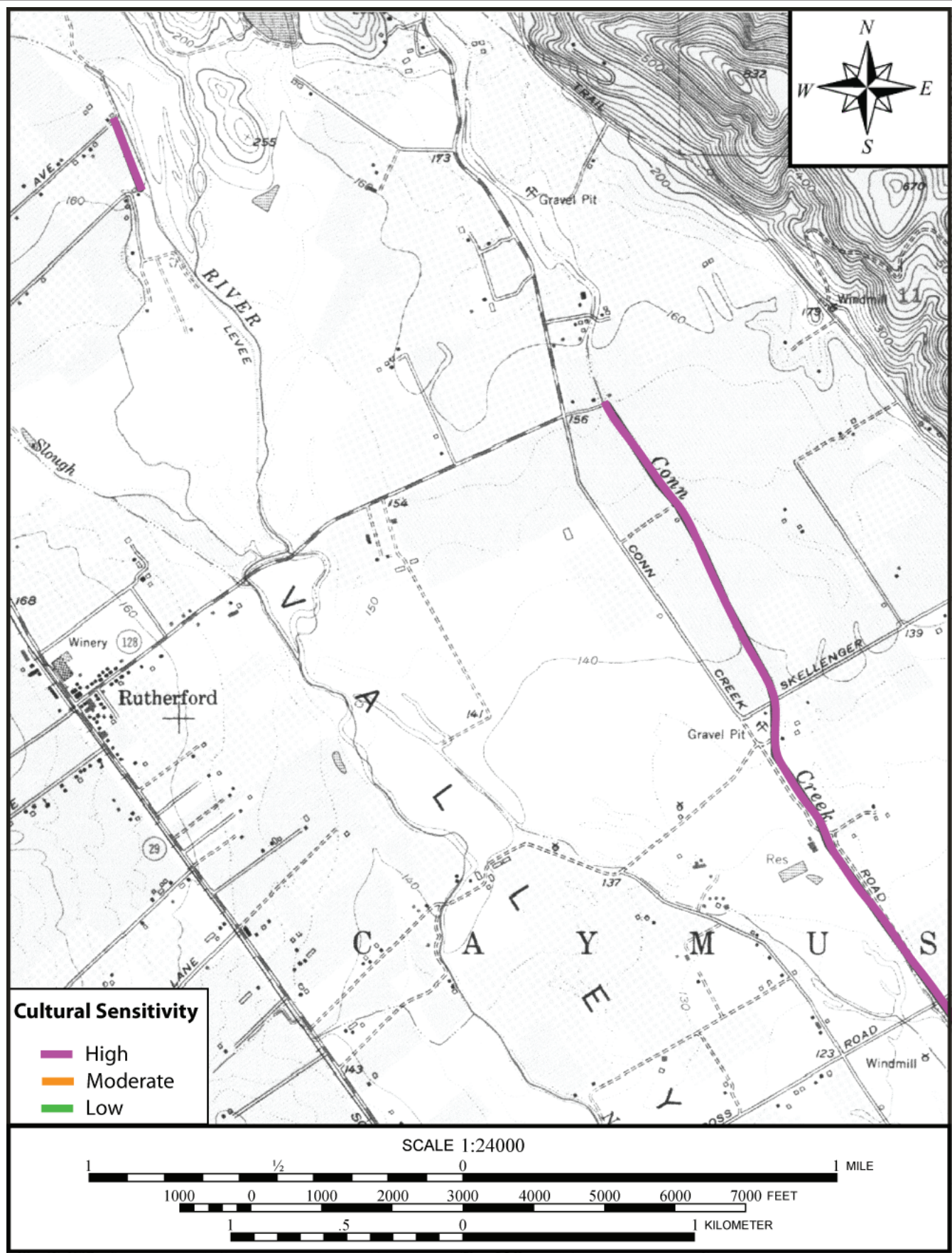
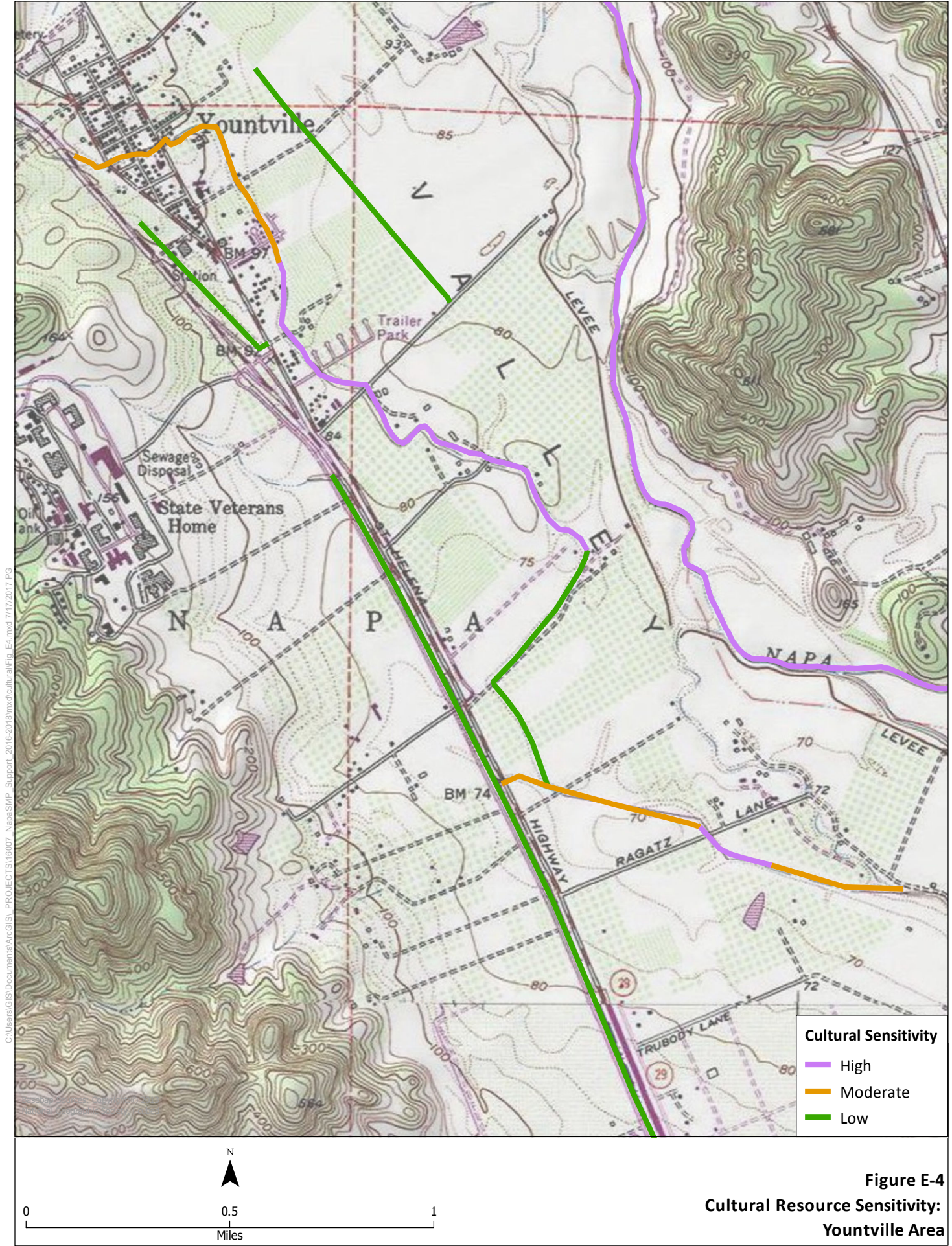


Figure E-3  
Cultural Resource Sensitivity: Conn Creek Area







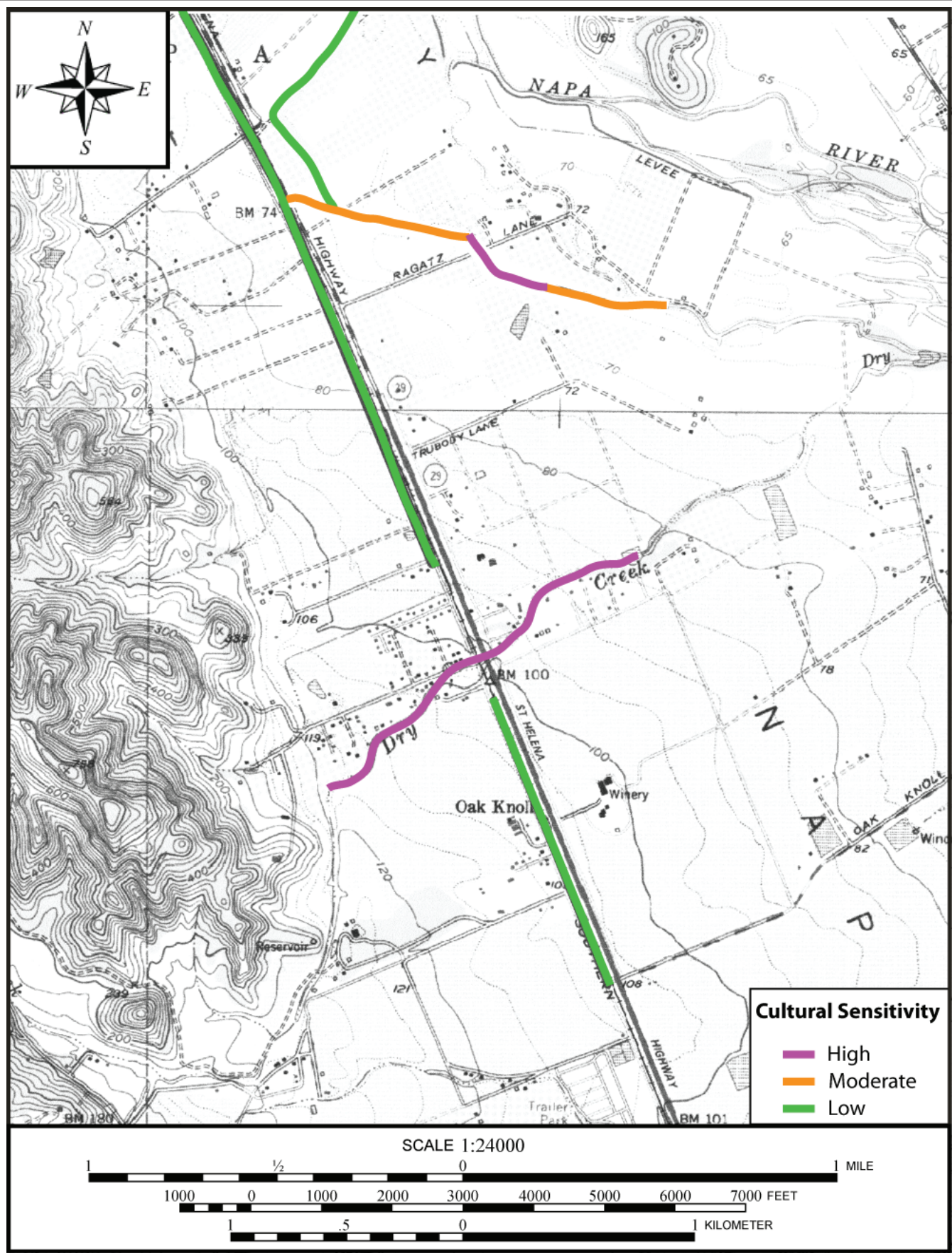


Figure E-5  
Cultural Resource Sensitivity: Oak Knoll Area



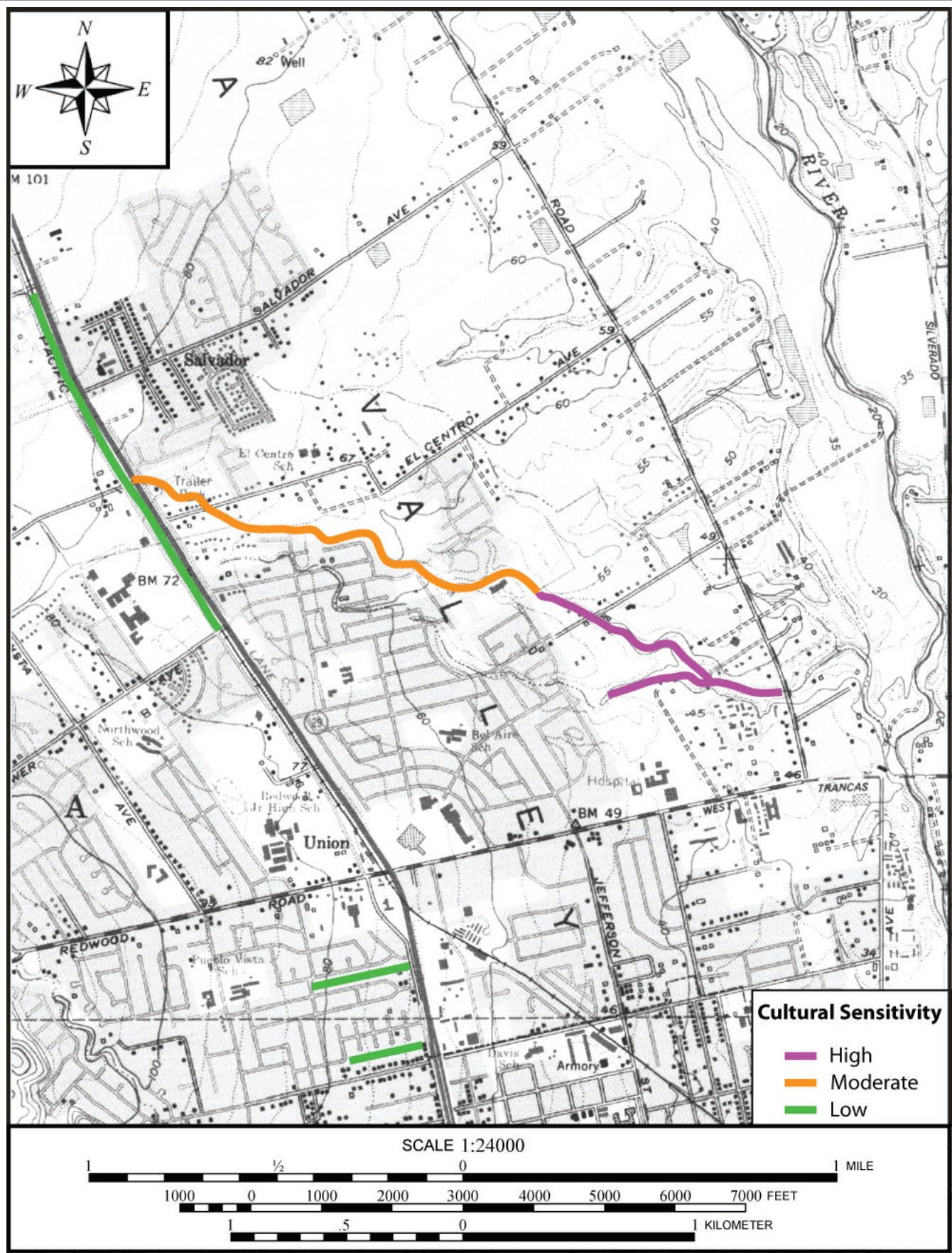


Figure E-6  
Cultural Resource Sensitivity: City of Napa North



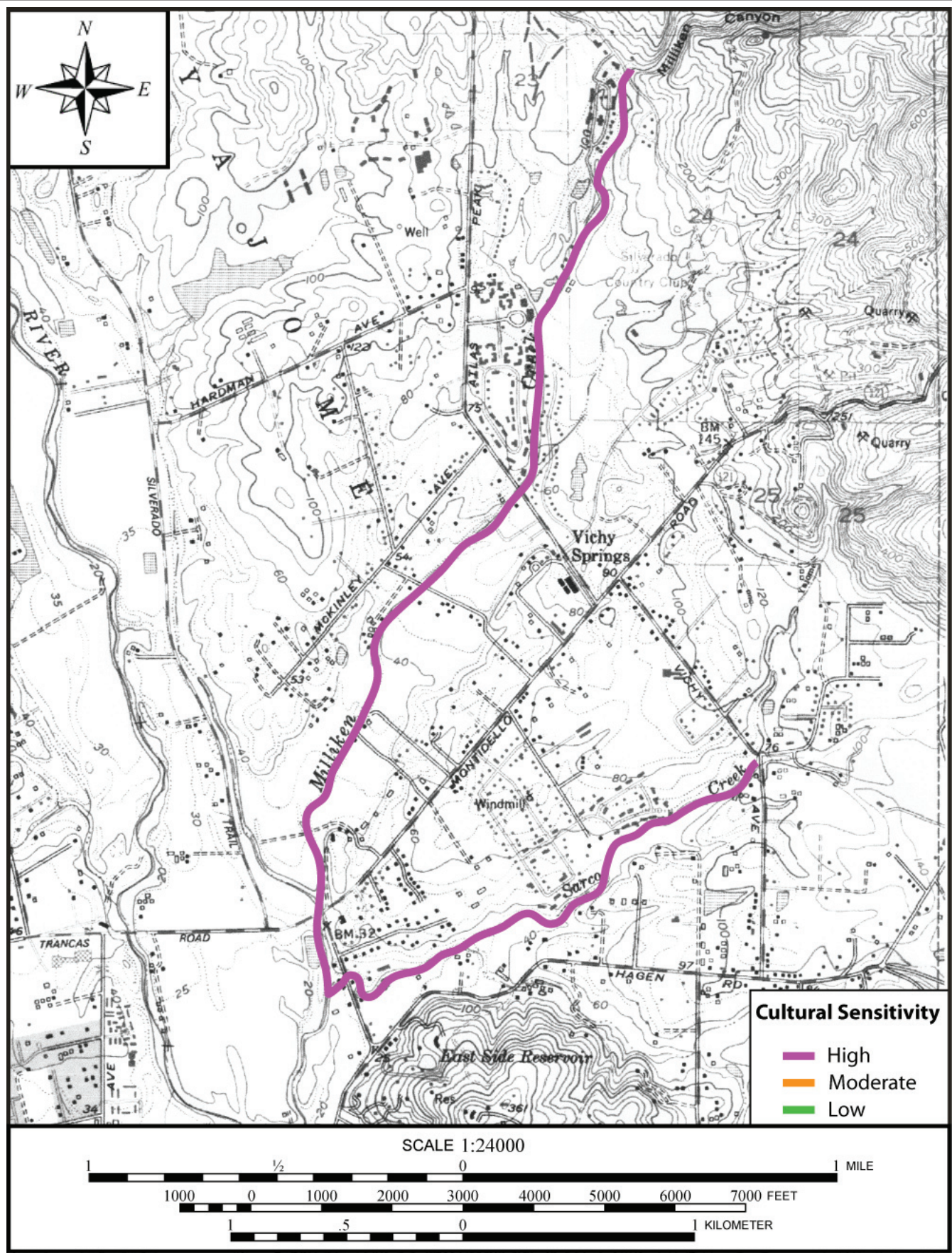


Figure E-7  
Cultural Resource Sensitivity: Milliken-Sarco Area



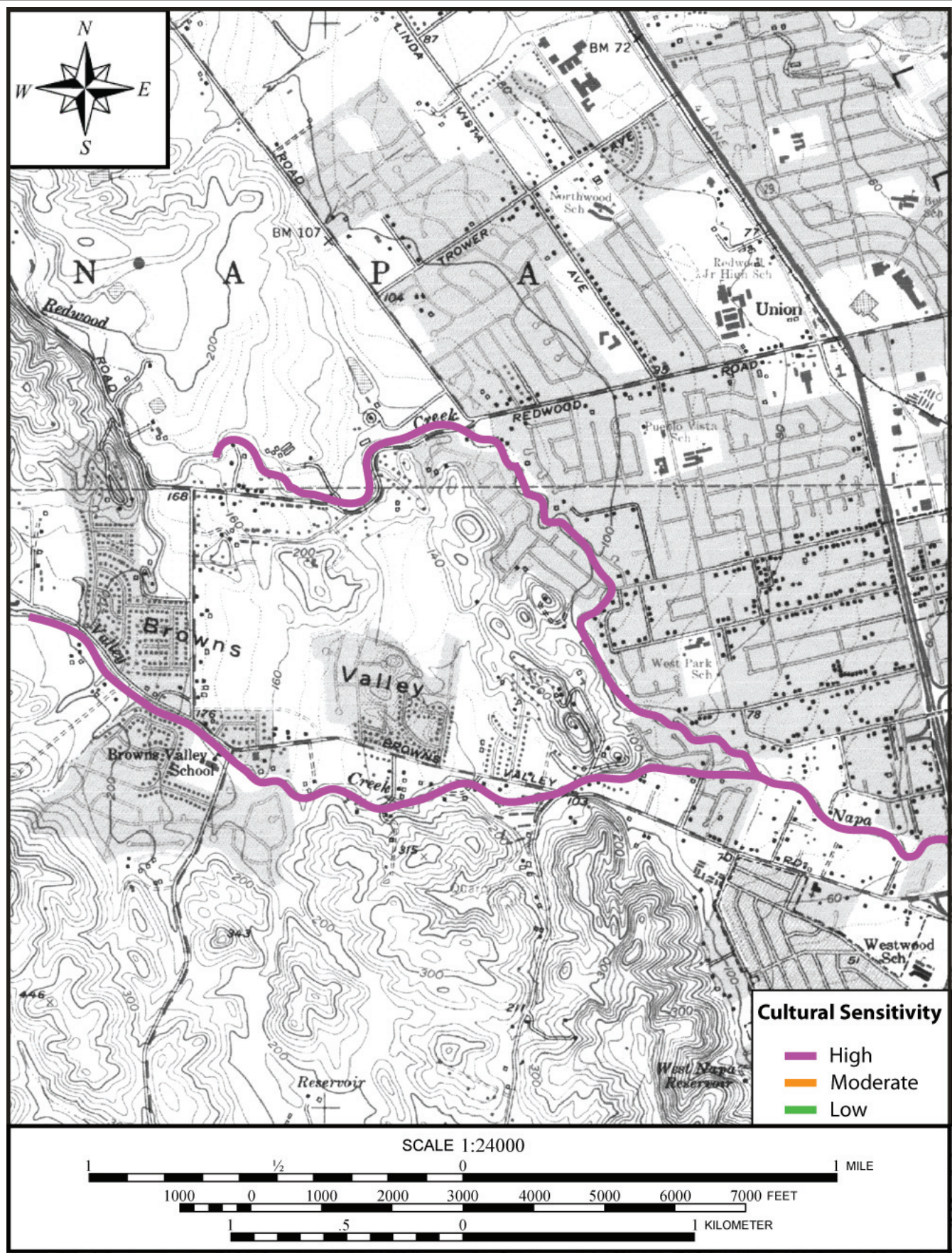
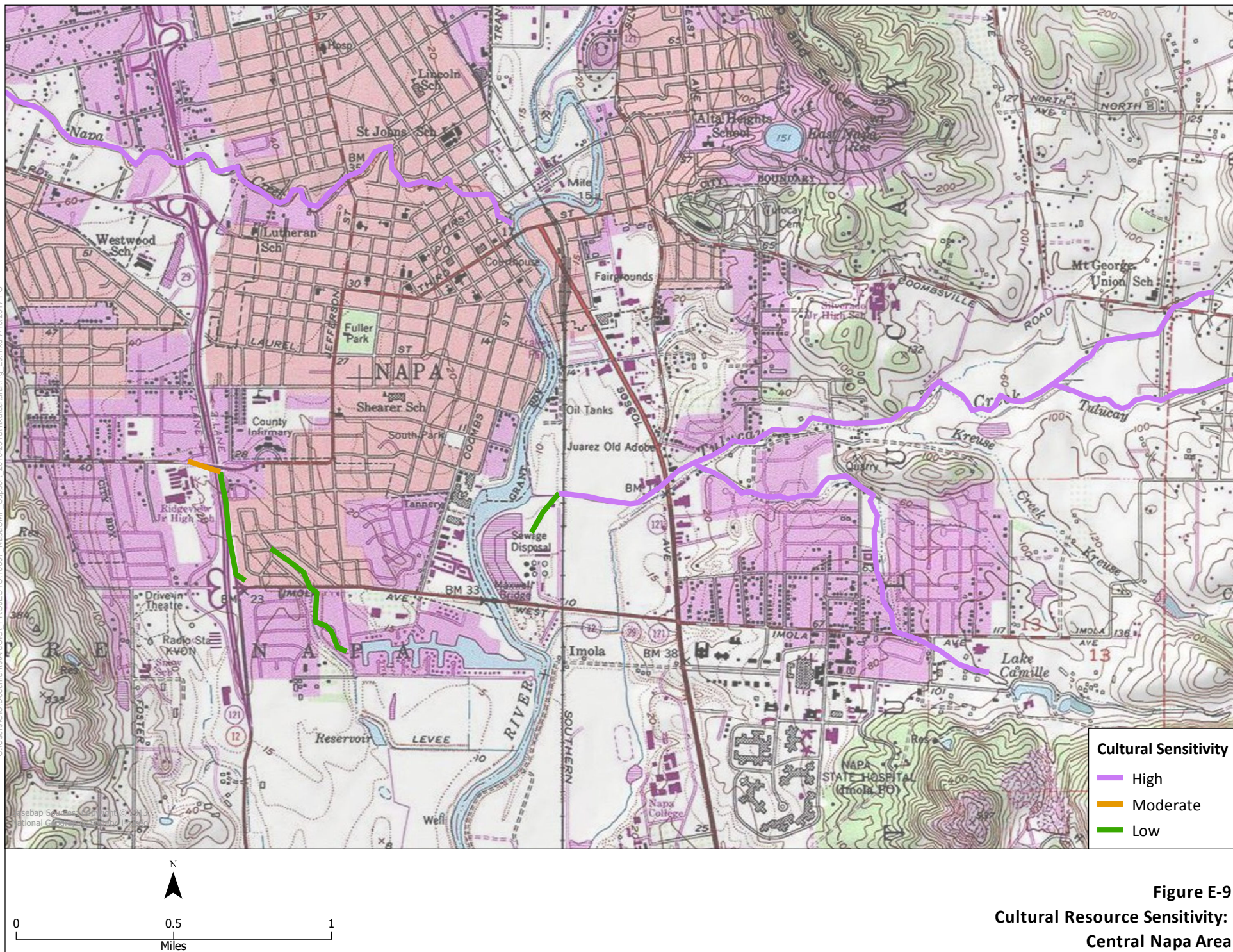


Figure E-8  
Cultural Resource Sensitivity: Browns Valley Area





**Figure E-9**  
**Cultural Resource Sensitivity:**  
**Central Napa Area**



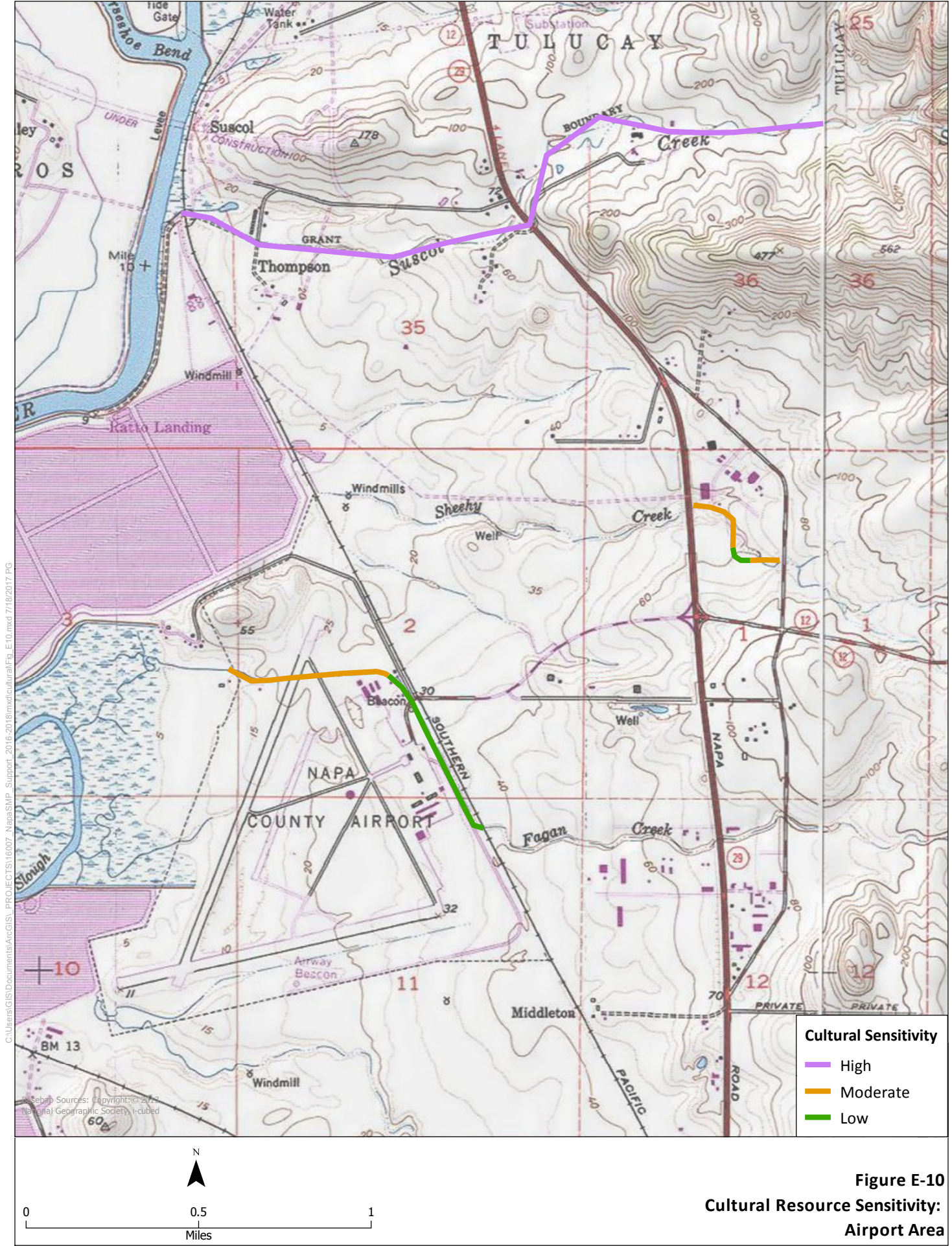
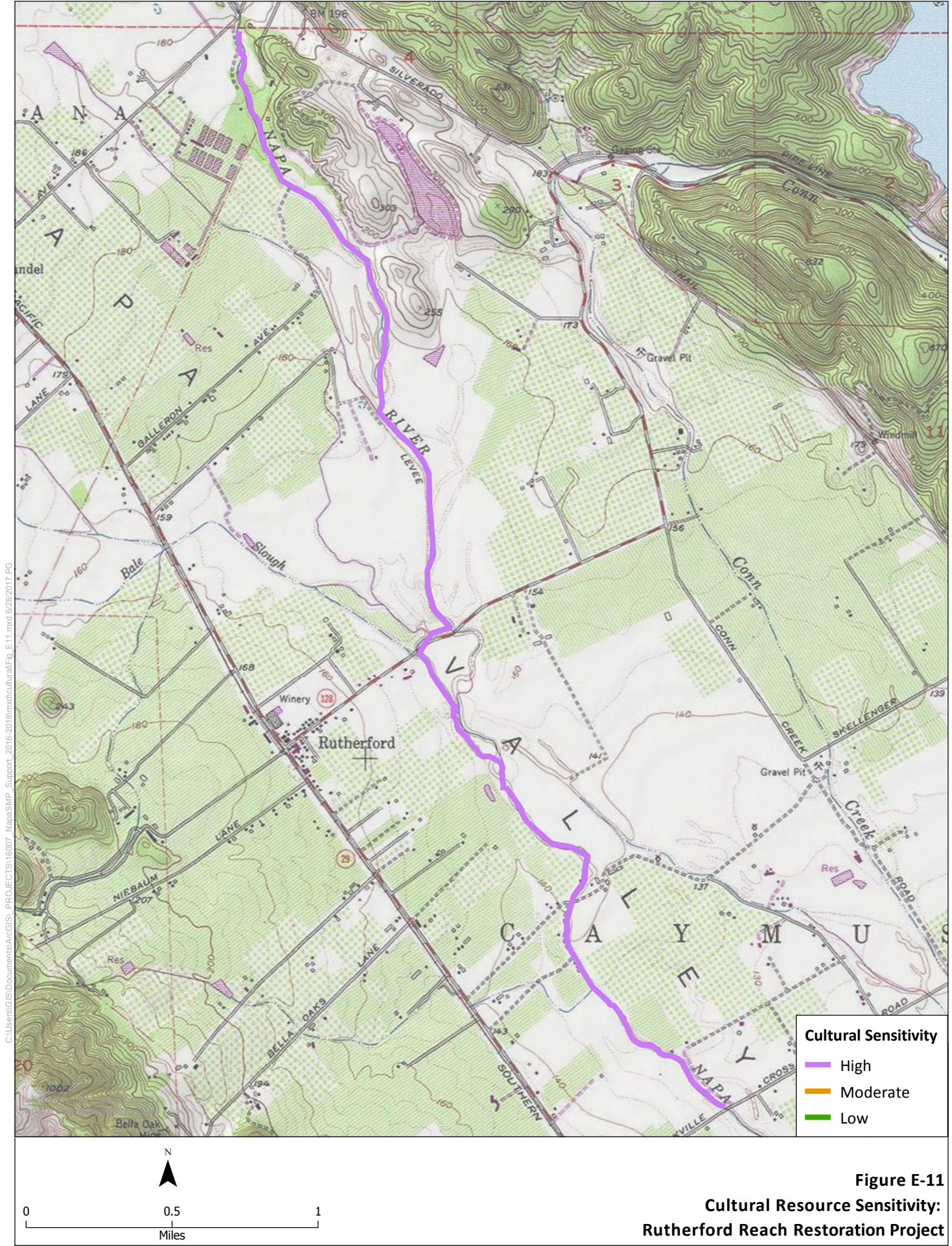


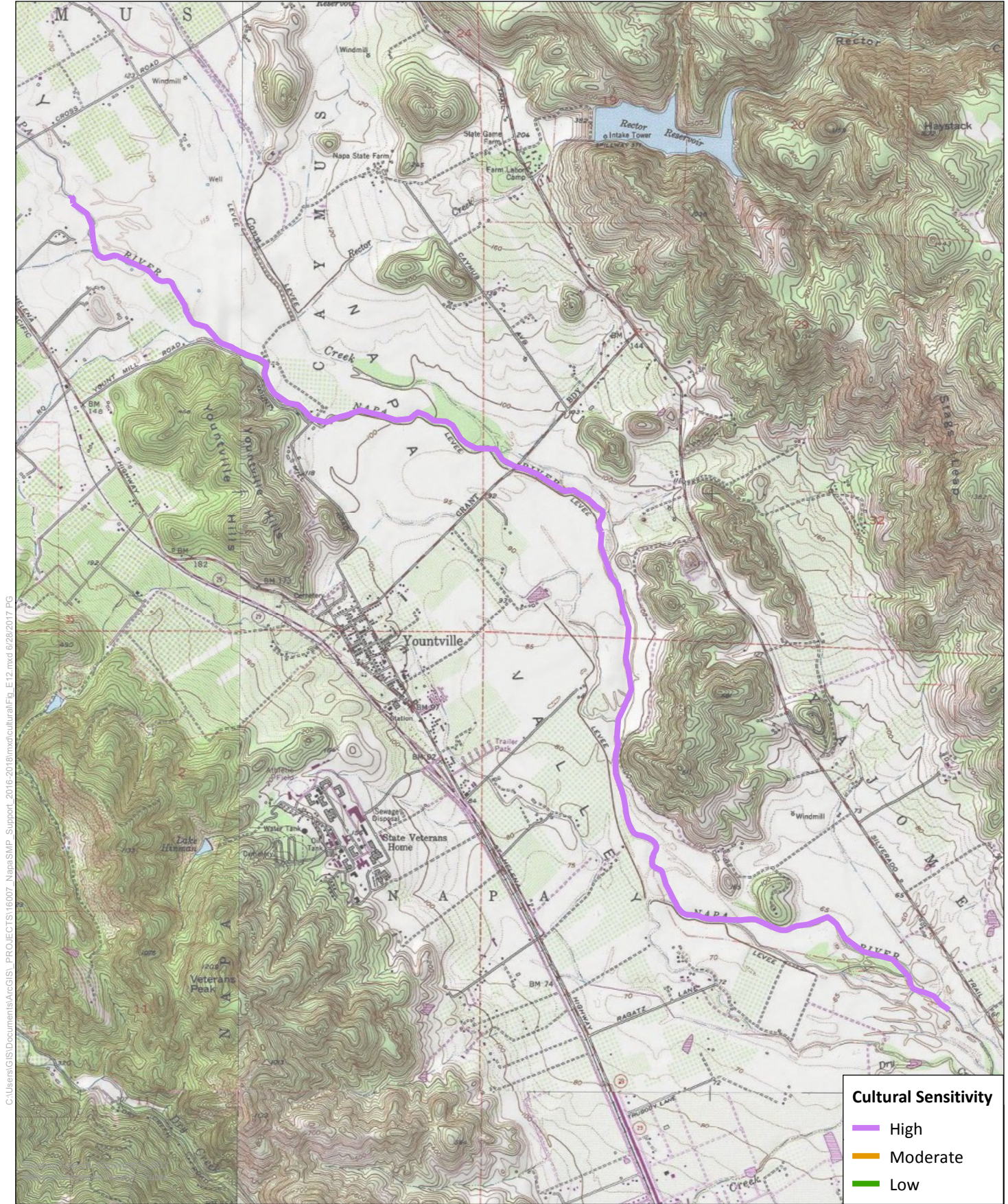
Figure E-10  
Cultural Resource Sensitivity:  
Airport Area





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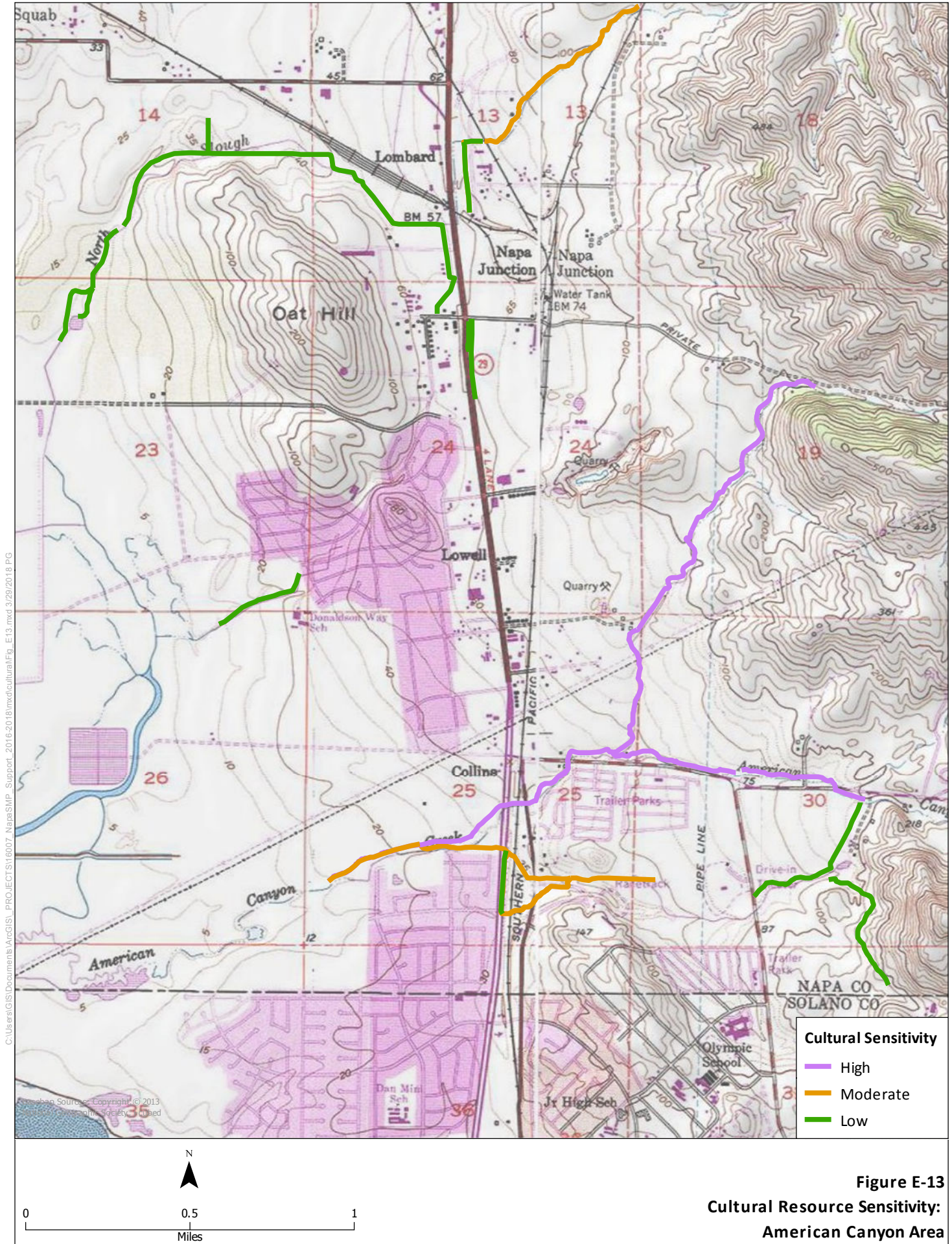




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**Figure E-12**  
**Cultural Resource Sensitivity:**  
**Oakville to Oak Knoll Restoration Project**









## Appendix F

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### Stream Maintenance Program Channel Quantitative Assessment Reports





# Napa County Flood Control and Water Conservation District

**PHILLIP M. MILLER, P.E.**  
**DISTRICT ENGINEER**

May 30, 2014

Mr. Fred Hetzel  
San Francisco Bay Regional Water Quality Control Board  
1515 Clay Street, Suite 1400  
Oakland, CA 94612

Dear Mr. Hetzel:

**Subject: Waste Discharge Requirement & Water Quality Certification Order No. R2-2012-0063:  
Stream Maintenance Program Quantitative Assessment and Channel Inventories Work  
Plan**

The Napa County Flood Control and Water Conservation (District) has prepared the enclosed Stream Maintenance Program (SMP) Quantitative Assessment and Channel Inventories Work Plan.

In 2012, the District finalized the Stream Maintenance Manual and updated the programs permits. Provision 26 of the WDR/WQC required the District to develop a work plan for conducting quantitative assessments of engineered flood control channels. Provision 43 required that the District develop a number of channel inventories and identify potential preventative maintenance projects. The enclosed report provides the District's approach and work plan for carrying out the quantitative assessments and includes all the requested inventories. The District intends to use this information to inform and guide future maintenance activities.

If you have any questions feel free to contact, Shaun Horne ([shaun.horne@countyofnapa.org](mailto:shaun.horne@countyofnapa.org)/(707)259-8624), or contact Rick Thomasser ([richard.thomasser@countyofnapa.org](mailto:richard.thomasser@countyofnapa.org)/(707)259-8657).

Thank you for taking the time to review the Report and Work Plan. We look forward to continuing to collaborate with you to protect and enhance natural resources while reducing flood risk.

Sincerely,

A handwritten signature in black ink that reads "Richard Thomasser". The signature is fluid and cursive, with a long horizontal stroke at the end.

Richard Thomasser, P.G.  
Watershed and Flood Control Operations Manager  
(707) 259-8657  
[richard.thomasser@countyofnapa.org](mailto:richard.thomasser@countyofnapa.org)





Napa County Flood Control and  
Water Conservation District

# **Stream Maintenance Program Quantitative Assessment & Channel Inventories Work Plan**

Prepared For:



Order No. R2-2012-0063



Napa County Flood Control &  
Water Conservation District  
804 First Street  
Napa CA, 94559-2623  
Contact: Richard Thomasser  
707-259-8657



May 30, 2014



# Quantitative Assessment & Channel Inventories Work Plan 2014

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# **QUANTITATIVE ASSESSMENT & CHANNEL INVENTORIES WORK PLAN**

## **1.0 Introduction**

The Napa County Flood Control and Water Conservation District is responsible for maintaining the hydrological capacity of flood control channels and natural streams to minimize flooding. The District sees itself not merely as a flood management bureau, but more broadly as a resource management agency with a duty to integrate environmental benefits (such as habitat protection and enhancement) into stream maintenance activities.

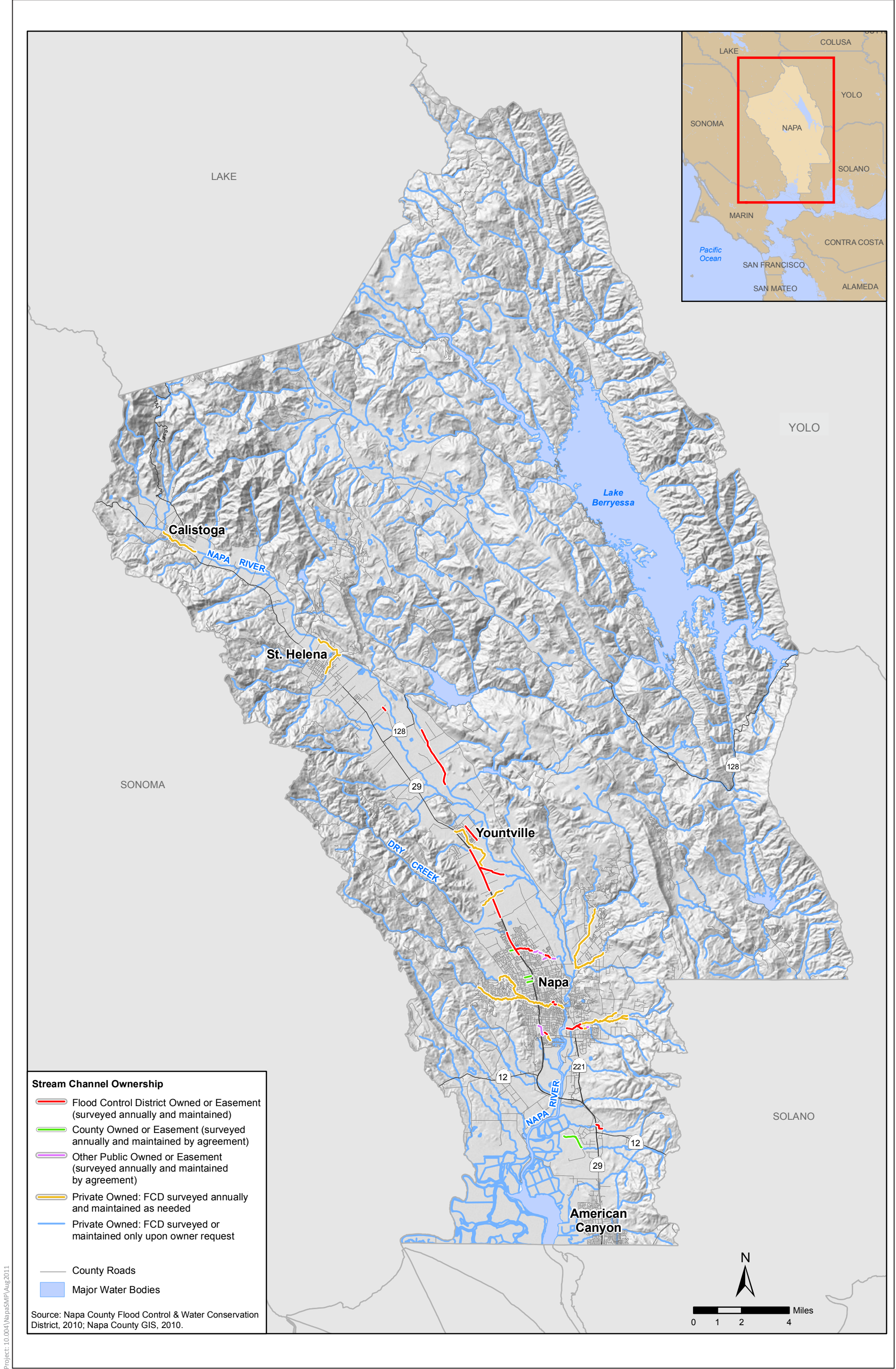
The District has maintenance responsibilities for flood control channels that the District owns in fee title, as well as other channels for which the District has a maintenance agreement or easement. The location and channel ownership types for District maintenance are presented in the in Figure 1 below. The District's staff surveys flood control channels and easements annually and prescribes maintenance activities based on existing conditions. The stream maintenance program has four primary activities: vegetation management, downed tree management, erosion protection and bank stabilization, and sediment and debris management.

The District also provides discretionary maintenance in other county channels, maintains instream facilities for their proper functioning, responds to public requests for maintenance activities at other stream and channel locations and is involved in the maintenance of ongoing restoration projects. In recent years, the District has been collaborating with private landowners and other local entities on the implementation of riparian and stream restoration projects as well as on the long term monitoring and maintenance of such projects. Additionally, the District administers a Stream Bank Stabilization Cost-Share program to assist private landowners with the implementation of biotechnical bank stabilization projects in an effort to reduce streambank erosion, improve water quality, and protect property.

## **2.0 Stream Maintenance Program**

In 2011, the District developed the Stream Maintenance Manual (SMM) to guide maintenance activities and to expand the programs permit coverage. The objective of the Manual is to provide clearly articulated guidance to avoid and minimize environmental impacts while conducting maintenance. The Manual also describes the program's organizational framework to oversee routine maintenance activities and ensure that maintenance is compliant with the terms and conditions of regulatory permits. As part of the SMP Regional Water Quality Control Boards Waste Discharge Requirements and Water Quality Certification (Order No. R2-2012-0063) the District is required to develop an inventory of engineered channels and develop a quantitative assessment of flood control channels. As part of this effort and in accordance with provision 26 of the WDR, the District has developed this work plan to carry out the quantitative channel assessment over the coming years. The purpose of this inventory and assessment is to develop priority maintenance prevention projects to enhance the physical and biological processes within the County's flood control channels.





Project: 10.004\NapaSMP\Aug 2011



Figure 1  
Napa County Stream Maintenance Program Area and Maintenance Reaches

In order to better understand channel conditions, the frequency of channel maintenance activities, and how channels respond to maintenance activities the District is actively mapping maintenance activities and monitoring post project conditions. The District conducts stream surveys each year and is developing monitoring tools to help document the response of maintenance projects. The District updated its stream maintenance database in 2013-2014 to a web based geo database, which allows field crews to use a mobile application to assess channel maintenance issues in the field and collect pertinent pre and post project details. The District has also been developing tools to monitor the presence, stability, function, and habitat characteristics of Large Woody Debris structures in natural channels. The District is committed to applying scientific principles to channel maintenance activities to enhance stream habitat conditions and physical processes while maintaining adequate channel capacity to minimize flooding.

## 2.1 Channel Types

The District maintains three types of flood control channels and streams where the District may conduct maintenance activities, including: engineered channels and “collectors”, modified/semi-modified channels, and natural streams. The SMM describes these channels and associated maintenance activities in greater detail (SMM Ch. 2).

Engineered flood control channels are typically v-shaped or trapezoidal channels (or ditches where they are small). In some locations, such channels are referred to as “collectors” where they may typically collect runoff from other small local drainages. The District owns and maintains (or provides maintenance of an easement) for approximately 5.3 miles of engineered collector channels. Examples of engineered flood control channels include the Yountville Collector and Solano Ditch. “Collector” channels in Napa County, such as the Yountville Collector or Salvador Collector channels typically collect and convey flows near roads and rail lines that may intersect the original pathway of the creek. Collectors were designed with steepened banks (generally 2:1 or less), little to no riparian corridor vegetation, and currently support poor quality habitat for species such as salmonids. These channels are typically filled with aquatic vegetation, such as cattails.

Modified channels are channels that have been widened or straightened to increase channel conveyance capacity, but not necessarily engineered to a specific design flow or specification. Examples of modified channels include the Yountville Outfall and lower reach of Salvador Creek. The District owns and maintains (or provides maintenance of an easement) for approximately 3.1 miles of modified channels. These channel reaches were primarily modified to reduce flooding of adjacent agricultural and residential developments. The banks and overall alignment of the creek channel is wider and straighter than natural channels to allow for increased flow conveyance capacity. Modified channels often support a low flow channel nested within the channel bed and some riparian corridor vegetation. Semi-modified channels have natural, un-modified stream beds and support a higher percentage of native vegetation to non-native vegetation, and a moderate to mature riparian corridor. The banks of these channels may have been modified to prevent flooding or bank erosion. The District owns and

maintains (or provides maintenance of an easement) for approximately 4.5 miles of semi-modified channels. Examples of these channels include Tulocay and Conn Creek.

The District has also identified several flood prone reaches of streams (26 mi), generally within urban areas which it surveys regularly to monitor for potential problems. Examples include portions of the Napa River and Sulpher Creek in northern Napa County (Figure 1), Hopper and Dry creeks in the Yountville region. The remaining creeks in Napa County, shown as a thin blue line in the maps of Figures 1 are privately owned creeks where District maintenance activities may take place only following a specific owner request and District staff evaluation of the appropriateness of the request. Maintenance activities are generally limited to vegetation and LWD management, invasive species eradication support, removal of trash, debris, and abandoned structures, and biotechnical erosion and bank stabilization.

### 3.0 Quantitative Assessment

The District has developed a workplan and implementation approach for carrying out the quantitative assessments of flood control easements and channels. The quantitative assessment will be carried out in channels that receive routine maintenance activities and are consider engineered flood control channels. The District conducted the quantitative assessment in accordance with provision 26 of the WDR/WQC.

#### Provision 26

*The District shall develop a workplan and an implementation schedule for developing channel capacity objectives and estimates of flood stage-discharge relationships. The Development of this information will guide the selection of annual maintenance locations needed for flood protection as reported in the Annual Workplans. Channel dimensions objectives that facilitate stream equilibrium conditions, address excessive erosion and deposition problems, and promote sustainable habitat conditions, shall be developed and used to guide channel grading and enhancements activities.*

- A. *The District shall develop roughness objectives for all major channels contained in the SMP Manual and determine the tolerance for loss of freeboard in engineered flood controls channels.*
- B. *The District shall provide preliminary estimates of stage-discharge relationships for channel reaches most likely subject to maintenance (including those areas and channels identified in the inventories for targeted and localized sediment and vegetation removal projects). These estimates should be based on field measurements. For those channels lacking sufficient high flow data, the District shall implement a program for developing stage-discharge relationships for larger magnitude flows.*
- C. *The District shall develop estimates of channel dimensions for best establishing quasi equilibrium conditions to avoid future excessive erosion of or deposition within an active channel. These dimensions can be established using a combination of information from regional stream restoration curves, reference reach data, computation of effective discharges, shear stresses and other assessments. These estimations of active channel dimension should guide the management approaches contained in the maintenance plans and be used in implementing the maintenance activities in order to achieve more sustainable channel shapes and floodplains.*



## Stream Maintenance Assessment Approach

The District's stream maintenance approach relies on recognizing fundamental hydrologic, geomorphic, and biologic processes that affect a given stream reach and adaptively managing and maintaining streams based on the underlying processes. Understanding the physical and biological setting of a particular stream reach and other contributing factors is key to determining the timing, frequency, strategy and need for various maintenance elements. To inform maintenance activities, the District developed Reach Characterization Sheets (Reach Sheets) that describe channel conditions at the District's primary maintenance locations. The Reach Sheets provide a description of the existing/baseline conditions of the channels including reach setting, physical conditions, biological conditions, and vegetation composition. The District is proposing to expand the Channel Reach Sheets in the SMM to include the quantitative assessment information to help inform maintenance activities.

The District is working with the Napa County Resource Conservation District (RCD) to develop channel assessment procedures that could be rolled out in subsequent years to the other streams channels in the SMP. An assessment of Salvador Creek was carried out to demonstrate the assessment approach and a proposed work plan for the remainder of the District's flood control channels is outlined in the subsequent section.

### 3.1 Salvador Creek Channel Assessment

The Napa County Stream Maintenance Manual divides Salvador Channel into three reaches (Reaches 1 through 3). General reach characteristics were computed for each reach using geographic information systems (GIS) methods, as summarized in Table 1. Reaches 1 through 3 are located between Highway 29 and Big Ranch Road. Stream crossings include two major street crossings (Jefferson Street and Trower Avenue culverts), three small private vehicular bridges, and five pedestrian bridges.

**Table 1:** Reach characteristics, Reaches 1 through 3, Salvador Creek.

Reach	Length (ft)	Drainage Area (mi <sup>2</sup> )	Slope (ft/ft)
1	3,750	4.71	0.0026
2	2,850	4.88	0.0027
3	3,170	5.59	0.0063

Reach slope was calculated from topographic profiles extracted from the LIDAR digital elevation model (DEM) for Napa County. There were short sections near the middle of Reaches 1 and 2 that had greater slopes, 0.0056 and 0.0080, respectively, but the lesser slope was selected for the reaches to be most conservative.

## Channel Capacity

The Jefferson Street and Trower Avenue culverts are located approximately 200-feet apart at the downstream end of Reach 1. Of these two culverts, the one with the smallest capacity will control the discharge and establish the capacity objective for the upstream reach. The District visited the culvert sites and collected culvert dimensions, inverts, and roadway elevations, and performed analyses of the culverts using the HY-8 software developed by the Federal Highway Administration (FHWA). The analyses revealed that the Trower Avenue culvert has the smaller capacity, conveying 1,360 cubic feet per second (cfs) at the top of the inlet. Therefore, the upstream channel, Reach 1, should convey a maximum of 1,360 cfs at the top-of-bank without spilling onto its floodplain.

The channel capacity objectives for Reaches 2 and 3 were computed by increasing the capacity flow for Reach 1 proportionally by the increase in drainage area. The channel capacity objectives for Salvador Creek are listed in Table 2.

**Table 2:** Channel capacity objectives Salvador Creek.

Reach	Channel Capacity Objective (cfs)
1	1,360
2	1,410
3	1,610

Channel capacity objectives are often reported in terms of peak-flow estimates; however, peak flows for Salvador Creek are not well understood and it is currently unknown what return period event corresponds to these capacity flows. The watershed is highly urbanized and common stormflow events such as the 1- and 2-years floods are known to nearly fill the channel. For example, the USGS regression equations, a common tool for estimating peak flows, predicts a 2-year flow of 324 cfs for Salvador Creek, but 9 of 10 years of stream gaging data collected at Station 28 have recorded flows well above that level, and indicate a 2-year flow of 635 cfs. Continued operation of Station 28 will eventually result in a more robust dataset which will help with frequency analysis of higher flows.

## Stage-Discharge Relationships

Salvador Creek at the Big Ranch Road crossing is the location of ALERT flood warning Station 28, and a stage-discharge rating for this station has been developed over the past several years. The discharge at Station 28 is a reasonable estimate of discharge for all locations in Reach 3. The Station 28 rating is included as Figure 2, and discharge data is publically available in real-time on [napa.onerain.com](http://napa.onerain.com). Water enters Reach 3 via storm drain outfalls which may give the Station 28 discharge a high bias for upstream locations.



Figure 2: Napa One Rain Stream and Rain Gauge Website

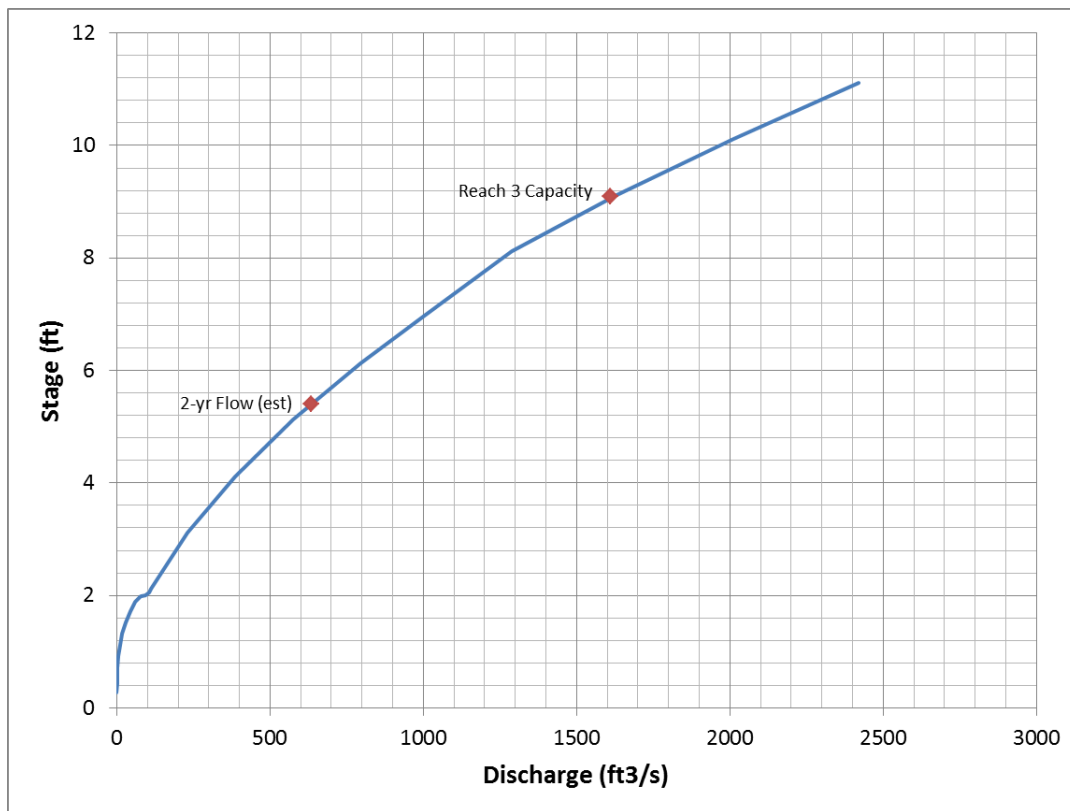
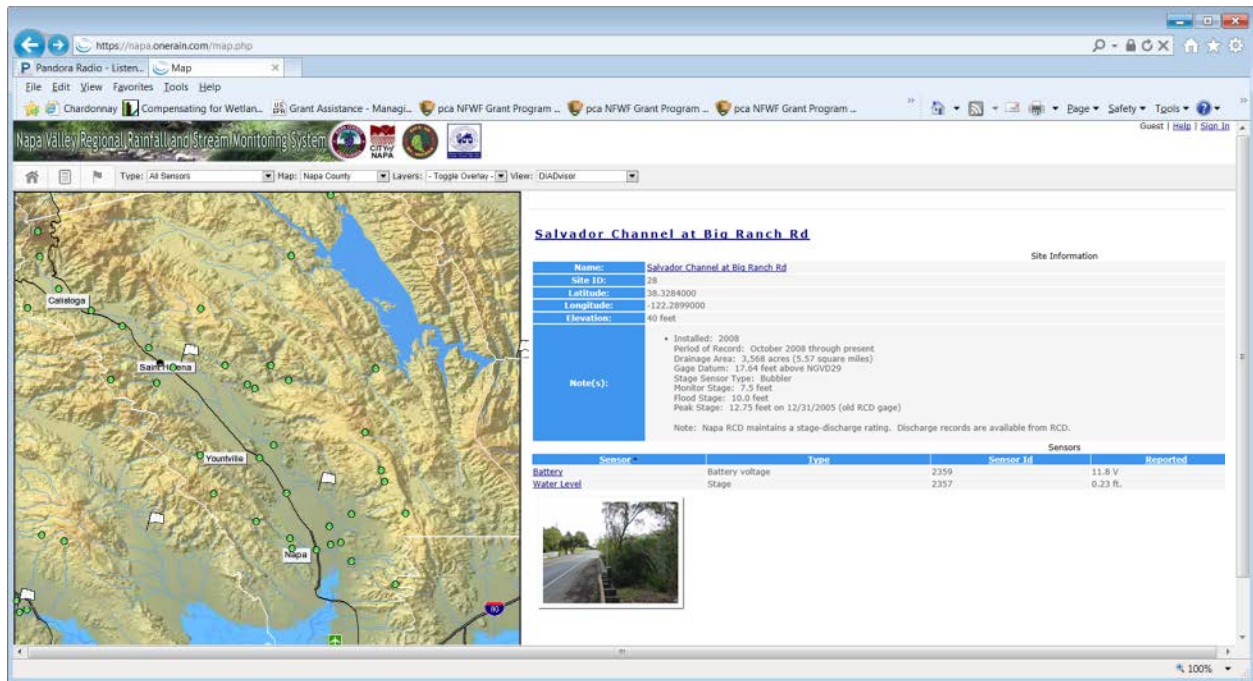
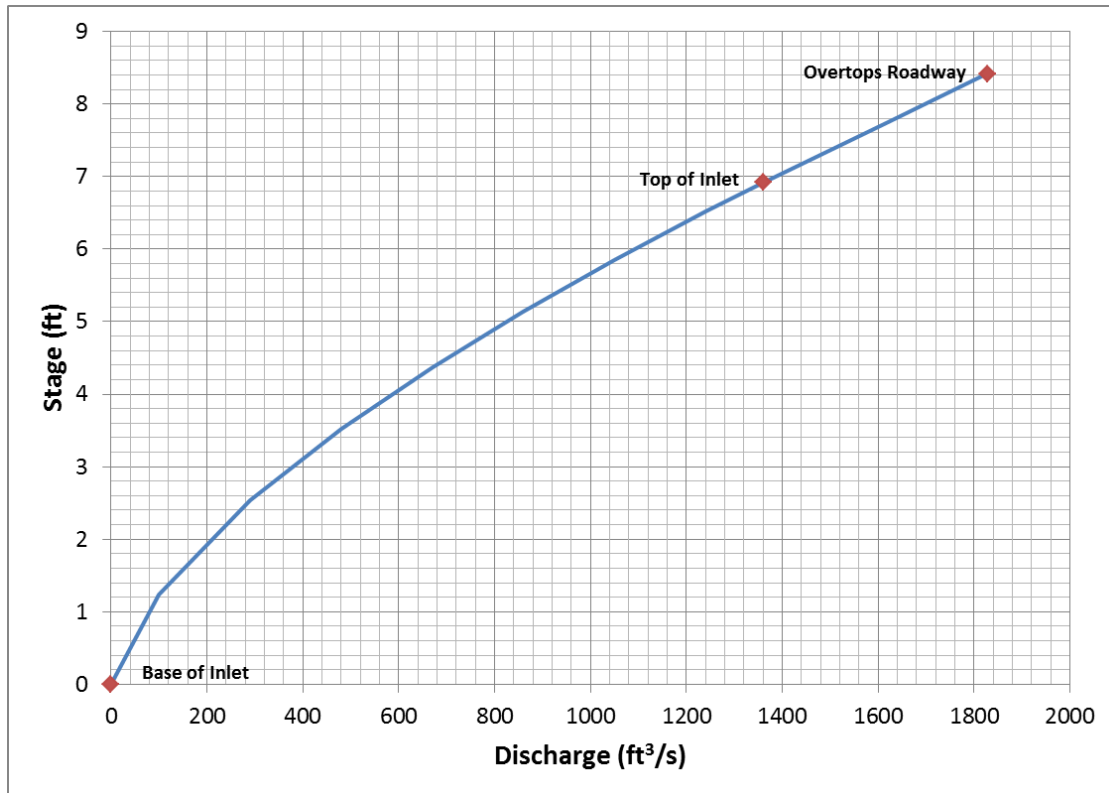


Figure 3: Stage-discharge rating for Station 28, Salvador Creek at Big Ranch Road.

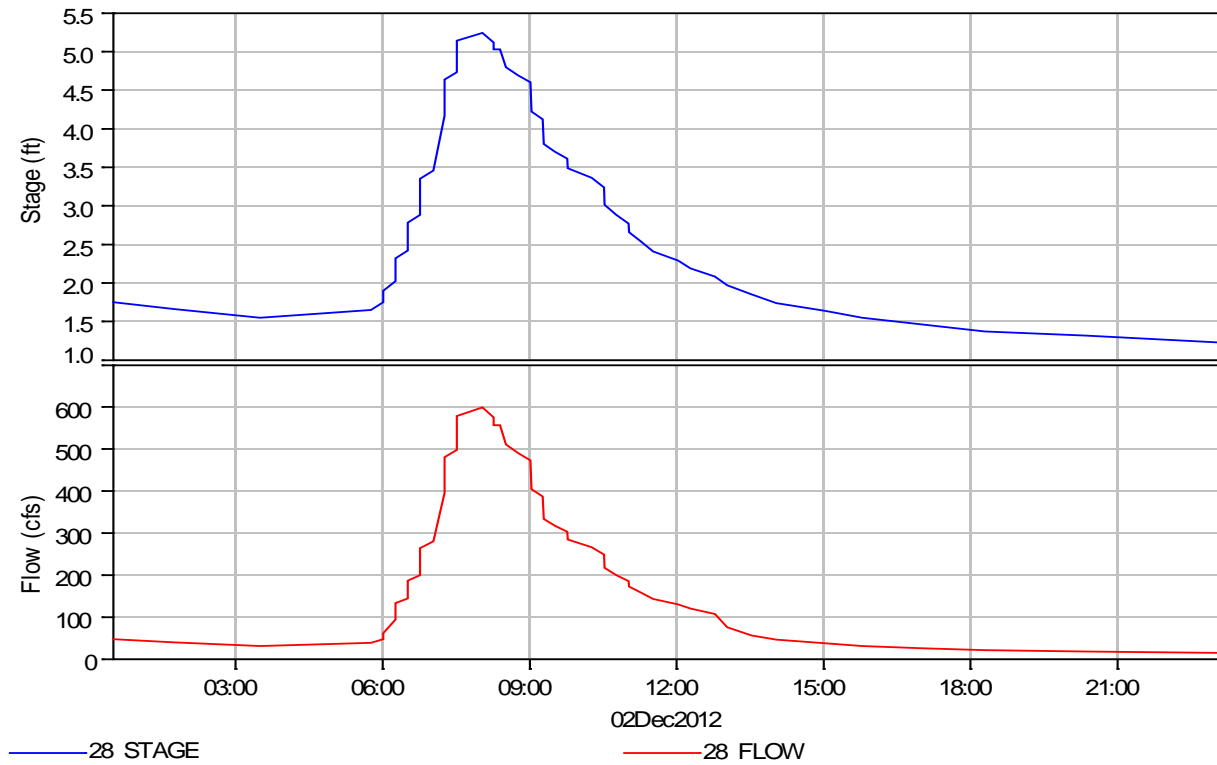
A preliminary discharge estimate for Reaches 1 and 2 can be obtained by decreasing the flow at Station 28 proportionally by the decrease in drainage area, which is 84% for Reach 1 and 87% for Reach 2. However, although this method gives a discharge estimate, it is not tied to stage within Reaches 1 or 2 which may be helpful for guidance of channel maintenance activities. In addition, constructing and long-term operation and maintenance of a streamgaging station will not be an option for assessment of other ungaged channels in the SMP. To demonstrate how a preliminary stage-discharge relationship for a channel can be developed in a simple manner using an existing culverted crossing, a rating curve from the output of the HY-8 analysis of the Trower Avenue culvert described above (Figure 3).



**Figure 4:** Stage-discharge rating for Reaches 1 and 2, Salvador Creek, HY-8 analysis of the Trower Avenue culvert.

This rating predicts discharge based on the headwater depth of the Trower Avenue culvert, and is a good estimate of discharge for other locations in the channel near the culvert. Due to the short length of the reaches, the absence of tributaries, and the small amount of additional contributing drainage area for Reach 2, this estimate is also reasonable for any location in Reaches 1 and 2 for many purposes, including guiding channel maintenance decisions. Water does enter Salvador Creek via storm drain outfalls in both reaches, which will give the Trower culvert discharge a high bias for Reach 1 locations upstream, and a low bias for Reach 2 locations.

**Figure 5:** Salvador Channel at Big Ranch Rd. (28) water level December 2, 2012



**Photo 1:** Trower St. bridge on 12-2-2012 at 9:34 am



**Photo 2:** Byway east bridge on 12-2-2012 at 9:44 am

## High Flow Monitoring

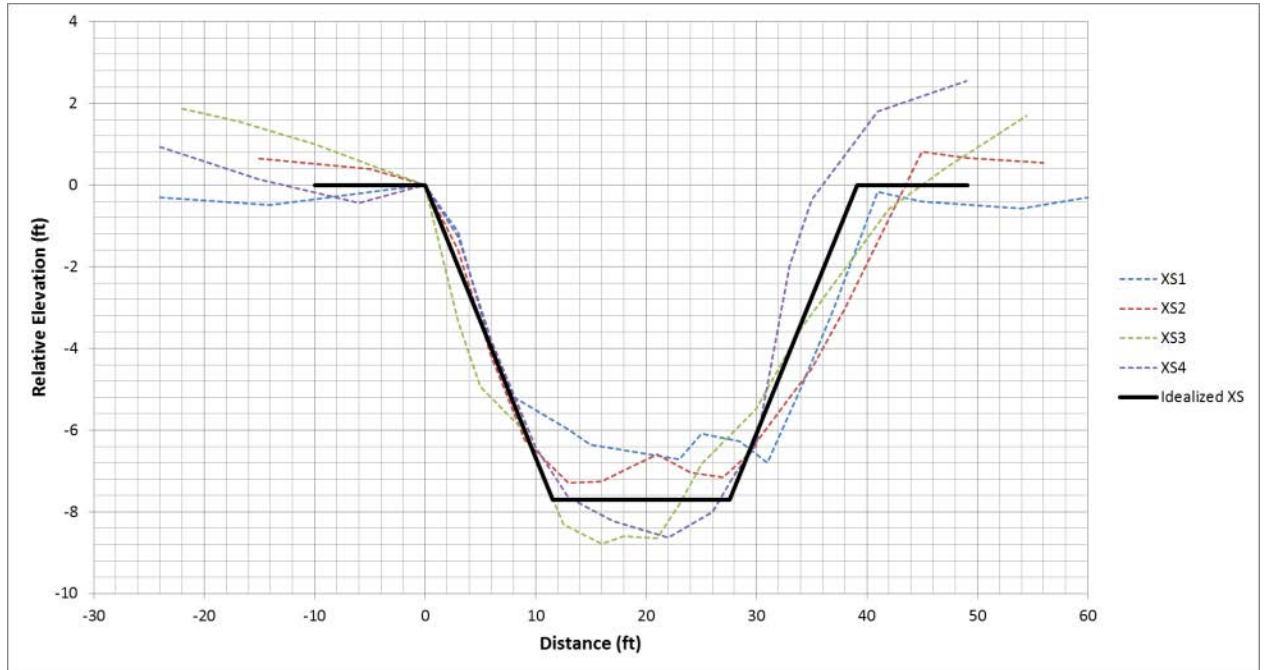
The District will carry out high flow monitoring during winter months for all flood control channels being assessed. The high flow monitoring photos will help the District develop a more accurate understanding of channel capacity and stage discharge relationships.

## Estimates of Quasi-Equilibrium Channel Dimensions

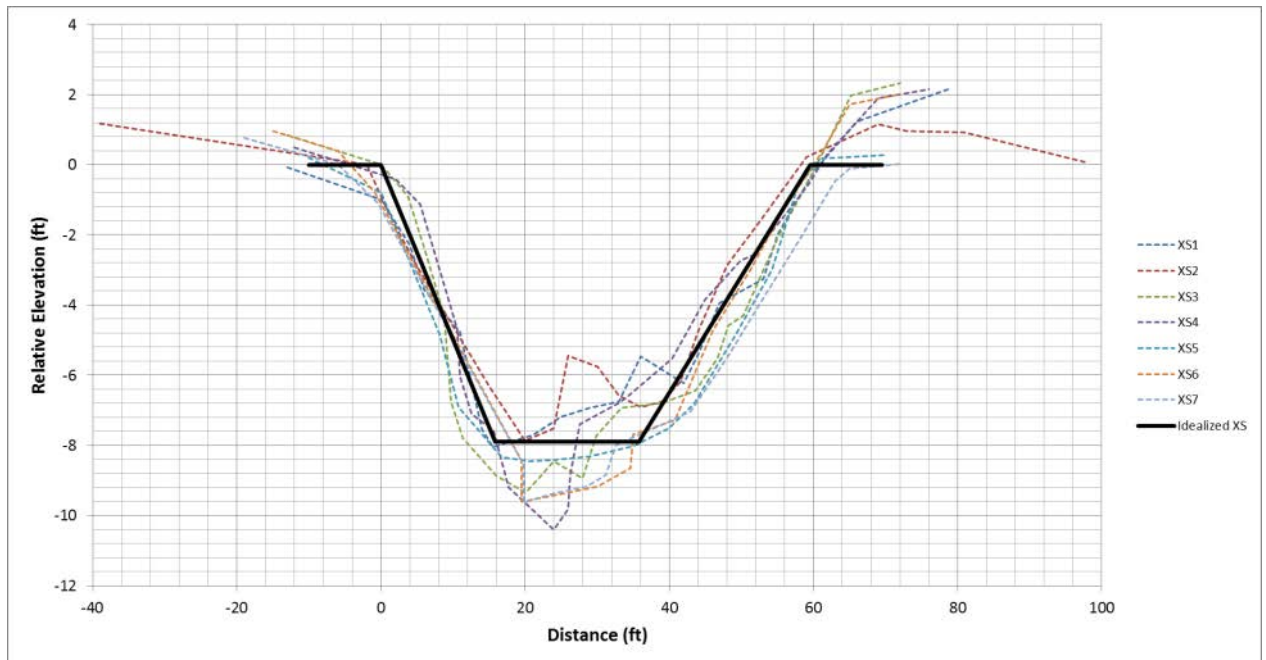
To develop estimates of quasi-equilibrium channel dimensions to avoid excessive erosion or deposition within each reach of Salvador Channel, channel cross section surveys were compiled as part of previous modeling efforts, and selected only those cross sections located in stable subreaches of the channel. These cross sections represent the channel in a quasi-equilibrium state. Cross-sectional area, bank slope, bottom width, and depth were calculated and averaged for each cross section to develop an idealized cross section for the reach. The number of cross sections used in each reach and the idealized channel dimensions are presented in Table 3. Figures 3 through 5 depict the idealized cross sections in relation to the surveyed cross sections. These ideal dimensions can be compared to cross sections measured at problem sites in the future to guide maintenance activities.

**Table 3:** Idealized channel dimensions, Salvador Creek.

Reach	No. of Cross Sections	Range of Cross Sectional Area (ft <sup>2</sup> )	Average Cross Sectional Area (ft <sup>2</sup> )	Idealized Channel Dimensions
1	4	192 – 231	211	Shape: Trapezoidal Bottom width (ft): 16.0 Left Bank Slope (H:1V): 1.5 Right Bank Slope (H:1V): 1.5 Depth (ft): 7.7 Area (ft <sup>2</sup> ): 212
2	7	245 – 372	314	Shape: Trapezoidal Bottom width (ft): 20.0 Left Bank Slope (H:1V): 2.0 Right Bank Slope (H:1V): 3.0 Depth (ft): 7.9 Area (ft <sup>2</sup> ): 314
3	3	196 – 256	222	Shape: Trapezoidal Bottom width (ft): 8.0 Left Bank Slope (H:1V): 1.0 Right Bank Slope (H:1V): 2.0 Depth (ft): 9.7 Area (ft <sup>2</sup> ): 223

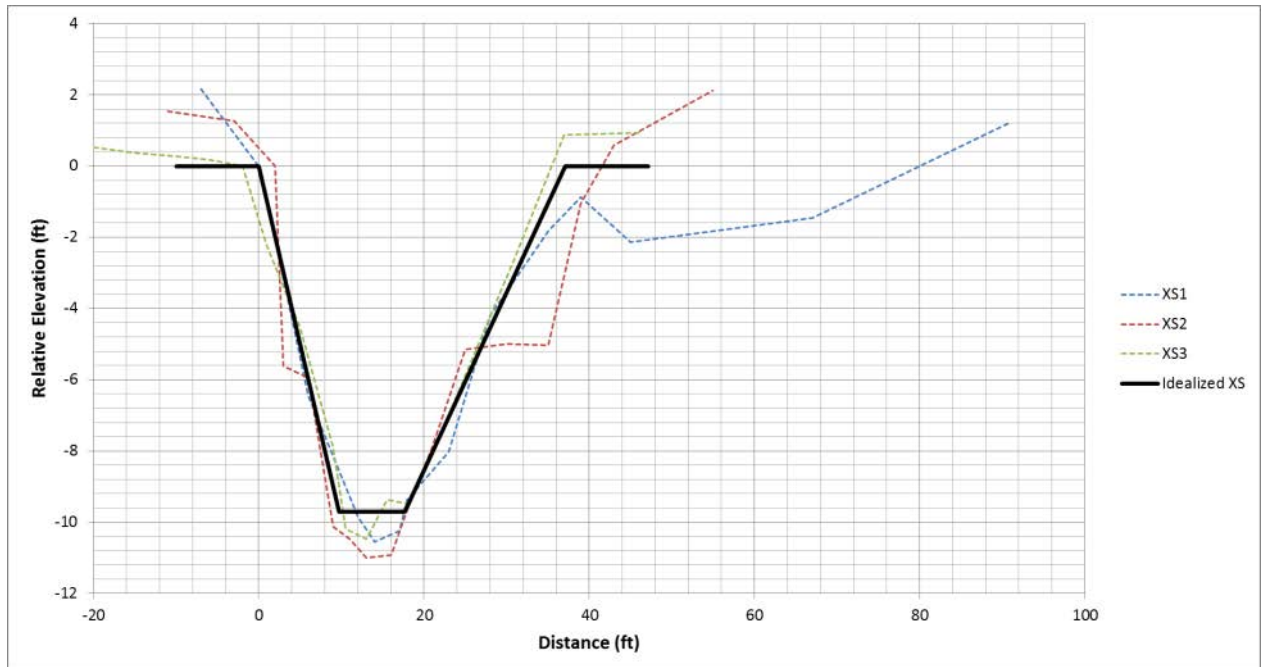


**Figure 6:** Reach 1 idealized cross section, Salvador Creek.



**Figure 7:** Reach 2 idealized cross section, Salvador Creek.





**Figure 8:** Reach 3 idealized cross section, Salvador Creek.

## Channel Roughness Objectives

Since the banks of Salvador Creek are unarmored for most of its length, growth of riparian vegetation is desirable to protect against bank erosion. In addition, riparian vegetation often enhances wildlife habitat and aesthetics. However, overgrowth of riparian vegetation will increase channel roughness and therefore decrease water velocity and channel capacity according to Manning's Equation. To develop objectives for roughness to help identify excessive overgrowth and trigger maintenance to maintain channel capacity, ideal channel roughness was back calculated using Manning's Equation, the idealized cross section for the reach, the average slope of the reach, and maximum channel capacity.

*Manning's Equation:*

$$Q = \frac{1.49 A R^{\frac{2}{3}} S^{\frac{1}{2}}}{n}$$

**Q** is the discharge in cfs, **A** is the cross sectional area in square feet, **R** is the hydraulic radius in feet, **S** is the slope in ft/ft, and **n** is the unitless Manning's roughness coefficient. The input values and calculated Manning's roughness results are shown in Table 4.

**Table 4:** Manning's equation input values and roughness results.

Reach	Q (ft <sup>3</sup> /s)	A (ft <sup>2</sup> )	R (ft)	S (ft/ft)	n
1	1,360	212	4.85	0.0026	<b>0.034</b>
2	1,410	314	5.01	0.0027	<b>0.050</b>
3	1,610	223	5.07	0.0063	<b>0.047</b>

For these calculations, RCD uses the slope of the streambed instead of the water surface slope, which is called for by Manning's Equation, but unknown for this channel. However, these calculations are being performed for very high channel capacity flows where water surface slope approaches the bed slope. It is common to use bed slope as an estimate of water surface slope. Slope values and roughness objectives could be refined in the future with high-water mark surveys performed following a large event.

These n values are estimates of the maximum channel roughness in each reach that will convey the channel capacity flow through the idealized cross section, and represent the roughness objectives for the reaches. RCD collected photographs of the three reaches to depict current roughness conditions for comparison to the roughness objectives. Figures 6, 7, and 8 show roughness conditions that are representative of Reaches 1, 2, and 3, respectively. Roughness estimates for each reach are provided in the figure captions.



**Photo 3:** Reach 1 looking upstream showing channel roughness.  $n=0.030-0.040$



**Photo 4:** Reach 2 looking downstream showing channel roughness.  $n=0.030-0.040$





**Photo 5:** Reach 3 looking downstream showing channel roughness.  $n=0.040-0.050$

### 3.2 Proposed Channel Assessment Work Plan

The District is proposing to carryout 2-3 channel assessments each year. The assessments will help the district identify roughness objectives, quasi equilibrium conditions, identify maintenance triggers and assist with the prioritization of maintenance prevention projects. The District is not proposing to carry out this level of assessment in drainage ditches because maintenance is typically limited to minor vegetation management.

**Table 5:** Channel Assessment Work Plan & Schedule

Creek	Channel Type	Assessment Schedule
Salvador Creek	Modified	2014-2015
Salvador Collector	Modified	2014-2015
Tulocay Creek	Semi-Modified	2015-2016
Camille Creek	Semi-Modified	2015-2016
Fagan Creek	Modified	2016-2017
Sheehy Creek	Modified	2016-2017
Conn Creek	Semi-Modified	2017-2018
Yountville Collector	Modified	2017-2018
Yountville Outfall	Modified	2017-2018

## 4.0 Channel Inventories

The District is responsible for maintaining flood control channels that are surrounded by private property and in most cases were not designed to convey a defined stormflow. The District recognizes that the vast majority of flood control easements and channels within the County are undersized. In an effort to better understand channel conditions and inform maintenance activities the District is carrying out multiple inventories in accordance with provision 43 of the WDR/WQC for flood control channels to assess and determine specific causes of maintenance related problems and to develop priority maintenance prevention projects.

### Provision 43

*The District shall submit the inventories note below. The purpose of the inventories is to guide assessments and determine specific causes of maintenance problems and to develop priority maintenance prevention projects. Each inventory and its associated support documentation shall be submitted to and approved by the Executive Officer.*

- a) *An inventory of engineered channels shall be submitted with the 2014 Annual Workplans. The inventory shall include a list of all areas and channels identified as engineered channels and all channels that are subject to routine maintenance activities including the specific locations of the areas and channels identified.*
- b) *Inventories of for the following type of projects shall be submitted with the Annual Workplans when these types of projects are included in the Annual Workplans.*
  - i. *An inventory of targeted sediment and vegetation removal areas.*
  - ii. *An inventory of localized sediment and vegetation removal areas where activities occur on an on-going basis. Localized projects that are newly-discovered and not listed in the inventory shall be included in the Annual Workplans for that year.*
- c) *The following inventories shall be submitted with the 2014 Workplans:*
  - i. *An inventory of the stream reaches with hydraulic constrictions (e.g., under-sized culverts, bridge abutments, railroad trestles, utility crossings, and other natural or human caused obstructions) potentially causing backwater conditions, increased water surface elevations, bank instabilities, or fish passage barriers.*
  - ii. *An inventory of stream reaches that are a priority based on chronic problems, such as sediment accumulation, flooding, or excessive erosion. The inventory should include an assessment of the causes of the chronic problems and a corrective action plan.*
  - iii. *An inventory of those reaches that potentially function as migration, spawning, or high flow refugia habitat for salmonids.*
  - iv. *An inventory of stream reaches that flow through alluvial fan landscapes.*

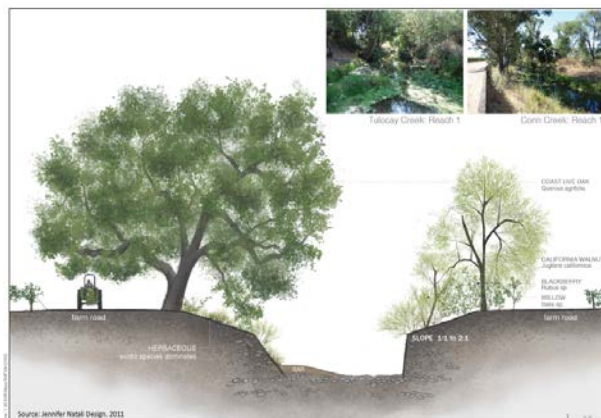


## Stream Maintenance Channel Inventories

The District developed channel inventories based on the framework outlined in provision 43 of the WDR/WQC. The District surveyed all flood control channels during the 2014 stream survey season and developed the following inventories, flood control channels, target and localized vegetation maintenance activities, hydraulic constrictions and chronic maintenance issues including localized and target sediment removal projects. The District included sediment maintenance activities in the chronic maintenance inventory because the majority of sediment removal projects are seen as chronic maintenance issues. The District then developed separate inventories for flood control channel that intersect with anadromous streams and alluvial fans. The District anticipates integrating these channel inventories and quantitative assessment into the SMP channel reach sheets to help inform annual maintenance activities.

**Table 6:** Inventory of Flood Control Channels

Channel Type	Maintenance Priority
<b>Drainage Ditches</b>	
Beard Ditch	Low
Solano Ditch	Low
Webber Ditch	Low
Mee Lane Ditch	Low
<b>Collector Channels</b>	
Yountville Collector	Moderate
Salvador Collector	Moderate
<b>Modified Channels</b>	
Salvador Creek	High
Sheehy Creek	Low
Fagan Creek	Moderate
Yountville Outfall	High
Conn Creek	High
Camille Creek	High
Tulocay Creek	High



**Figure 9:** Example of semi-modified channel



**Figure 10:** Example of modified channel

## Salvador Collector

### Vegetation Assessment

Vegetation Issue	Type (Target or Localized)	Corrective Action
Cattails	Localized	Annual vegetation management. Maintain planted trees along top of bank to create shade canopy.
Non-native Invasive Weeds	Localized	Annual mowing
Cattails	Localized	Annual vegetation management. Maintain planted trees along top of bank to create shade canopy.

### Hydraulic Assessment

Issue	Cause	Corrective Action
Hydraulic Constriction/Erosion	Stream bed erosion downstream of the box culvert	Monitor
Hydraulic Constriction	Rail road abutment & road culvert	Additional assessment

### Chronic Issues & Sediment

Issue	Cause	Corrective Action
NA	NA	NA



**Photo 6:** Salvador Collector cattails

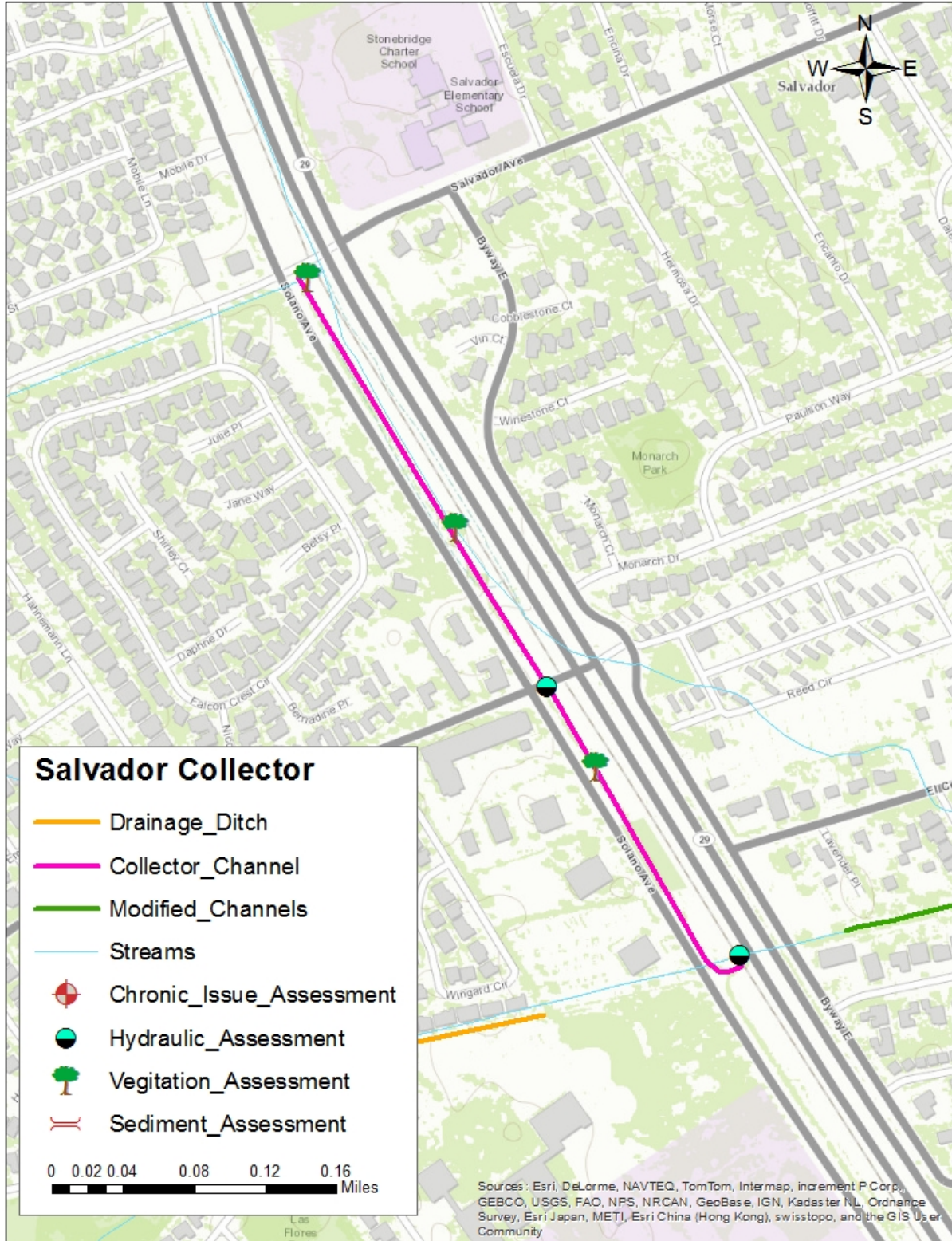


**Photo 7:** Wine Country Rd. box culvert



**Photo 8:** Wine Country Rd. box culvert





## Yountville Collector

### Vegetation Assessment

Vegetation Issue	Type (Target or Localized)	Corrective Action
Cattails	Localized	Annual vegetation management. Maintain planted trees along top of bank to create shade canopy.
Cattails	Localized	Annual vegetation management. Maintain planted trees along top of bank to create shade canopy.

### Hydraulic Assessment

Issue	Cause	Corrective Action
Hydraulic Constriction	Railroad abutment & box culvert	Monitor
Hydraulic Constriction	Road crossing/box culvert (Salano ave.)	Monitor
Hydraulic Constriction	Road crossing/box culvert (Salano ave.)	Monitor

### Chronic Issues & Sediment Assessment

Issue	Cause	Corrective Action
Invasive vegetation (Ludwigia)	Slow water	Sediment management, physical removal, and maintenance of planted trees to establish canopy.
Sediment	Confluence of South and North Yountville Collector	Sediment was removed in 2013, monitor sediment deposition.
Erosion	Drainage culvert causing bank erosion	Working with roads department on repair in 2014 or 2015.
Sediment	Box culvert & confluence	Sediment was removed in 2013, monitor sediment deposition.
Sediment	Box culvert & confluence	Sediment was removed in 2013, monitor sediment deposition.

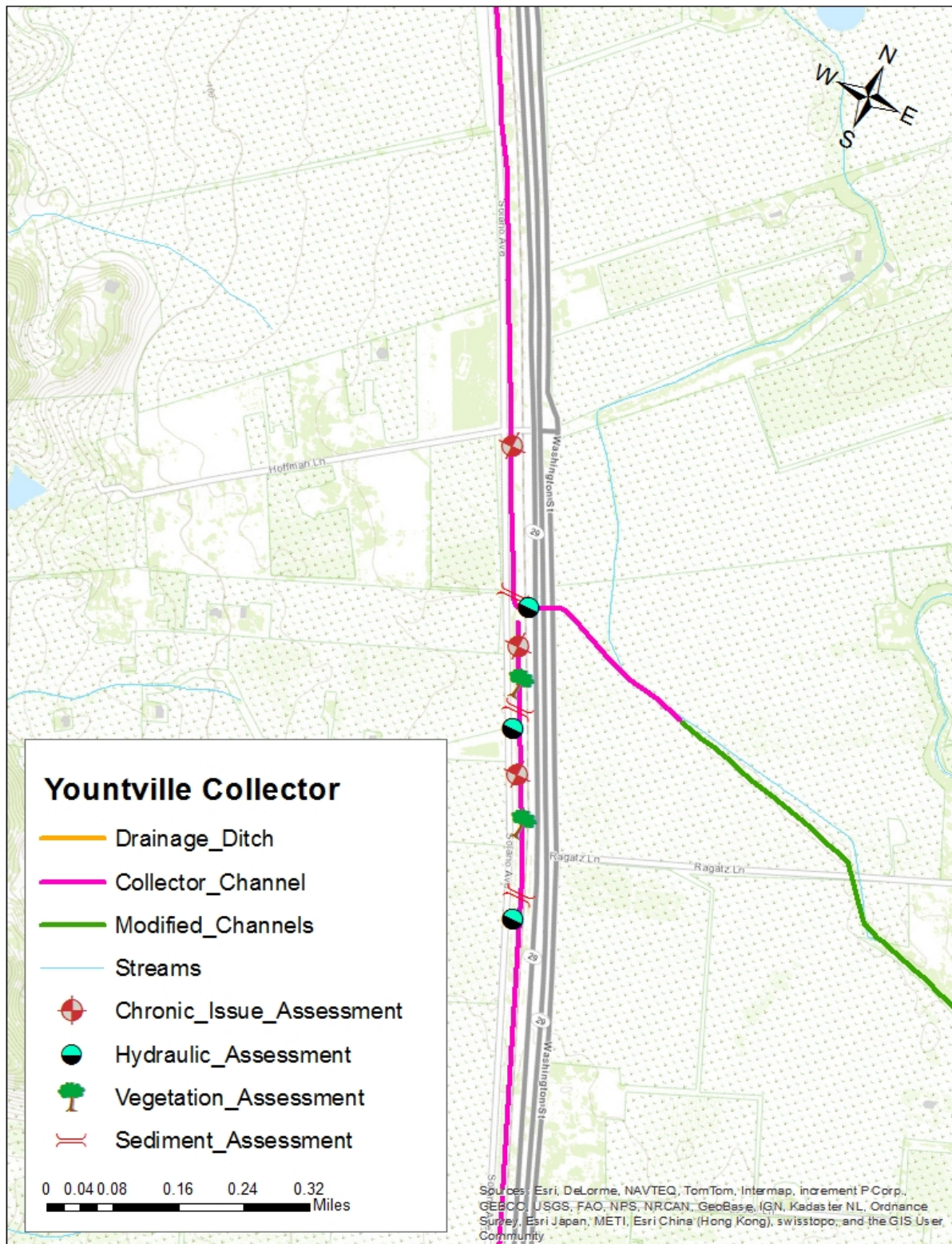


**Photo 9:** Confluence of south and north Yountville collectors upstream of railroad bridge and HWY 29, first winter after sediment removal project.



**Photo 10:** Confluence of upstream drainage and south Yountville collector, first winter after sediment removal project.







## Yountville Outfall

### Vegetation Assessment

Vegetation Issue	Type (Target or Localized)	Corrective Action
Willow Pruning	Target	Vegetation pruning every two years

### Hydraulic Assessment

Issue	Cause	Corrective Action
Hydraulic Constriction	Box Culvert and Rail Road Abutment at Highway 29	Monitor and additional assessment
Hydraulic Constriction	Agricultural Bridge Abutment	Monitor and additional assessment

### Chronic Issues & Sediment Assessment

Issue	Cause	Corrective Action
Sediment	Box culvert Outfall	Monitor/Sediment Management every 5-8 years
Invasive Vegetation	Ludwigia	Establish tree canopy through maintaining top of bank plantings, physical removal and treatment.
Sediment	Agricultural Bridge Abutment	Monitor/Sediment Management every 5-8 years
Sediment	Straightened Channel	Monitor/Sediment Management every 5-8 years



**Photo 11:** Agricultural bridge



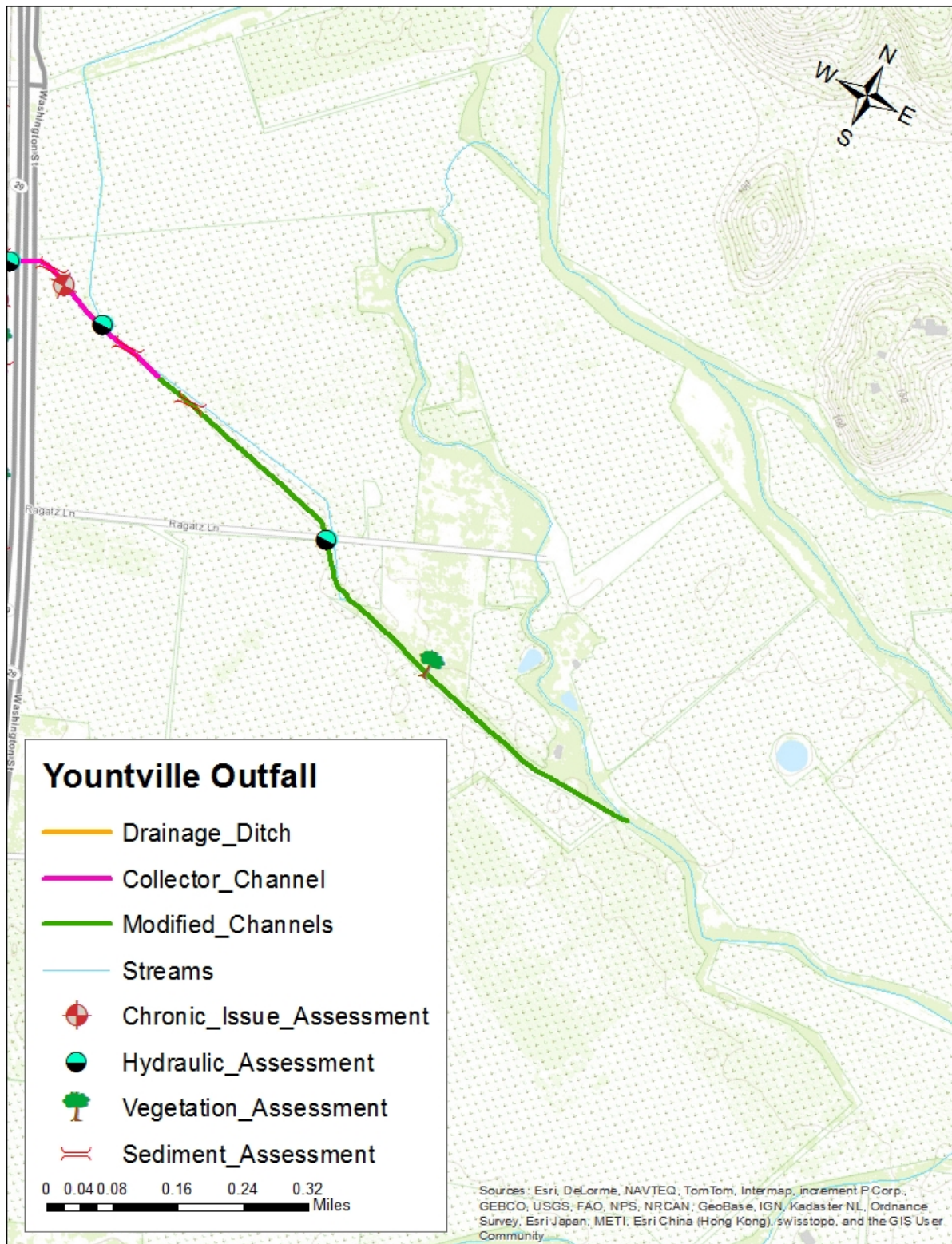
**Photo 12:** Ragatz lane bridge



**Photo 13:** Sediment deposition downs stream of agricultural bridge



**Photo 14:** Ragatz lane box culvert with invasive ludwigia colonizing channel upstream



## Salvador Creek

### Vegetation Assessment

Vegetation Issue	Type (Target or Localized)	Corrective Action
Willow Pruning	Localized	Prune annually to establish mature canopy over channel.
Invasive vegetation (ivy)	Target	Remove, treat, and revegetate
Invasive vegetation (blackberry)	Target	Remove, treat and revegetate

### Hydraulic Assessment

Issues	Cause	Corrective Action
Railroad abutment & box culvert	Rail and road crossing	Additional assessment
Bridge deck and piers	Agricultural bridge	Monitor
Bridge deck and piers	Agricultural bridge	Remove bridge deck and piers in 2014 maintenance season.
Box culverts	Road crossing	Monitor
Box culverts	Road crossing	Monitor
Box culverts	High school foot bridge	Monitor
Box culverts	High school foot bridge	Monitor
Box culverts	High school foot bridge	Monitor
Bridge deck and piers	Footbridge	Monitor
Bridge deck and piers	Footbridge	City of Napa to remove deck and instream piers as part of low income development project.

### Chronic Issues & Sediment

Issue	Cause	Corrective Action
Sediment	Box culvert	Sediment was removed in 2012, monitor sediment deposition.
Sediment	Box culvert	Sediment was removed in 2012, monitor sediment deposition.
Sediment	Box culvert	Sediment was removed in 2012, monitor sediment deposition.
Sediment	Box culvert	Sediment was removed in 2012, monitor sediment deposition.
Erosion	Top of bank drainage & foot traffic	Biotechnical bank repair
Invasive Vegetation	Accacia tree infestation	Annually remove trees starting at the upstream extent, monitor regrowth and revegetate with natives.





**Photo 15:** Agricultural bridge crossing Salvador creek



**Photo 16:** First Vintage High School footbridge and downstream beaver dam



**Photo 17:** Second Vintage High School footbridge with beaver dam upstream



**Photo 18:** Third Vintage High School footbridge with beaver dam upstream

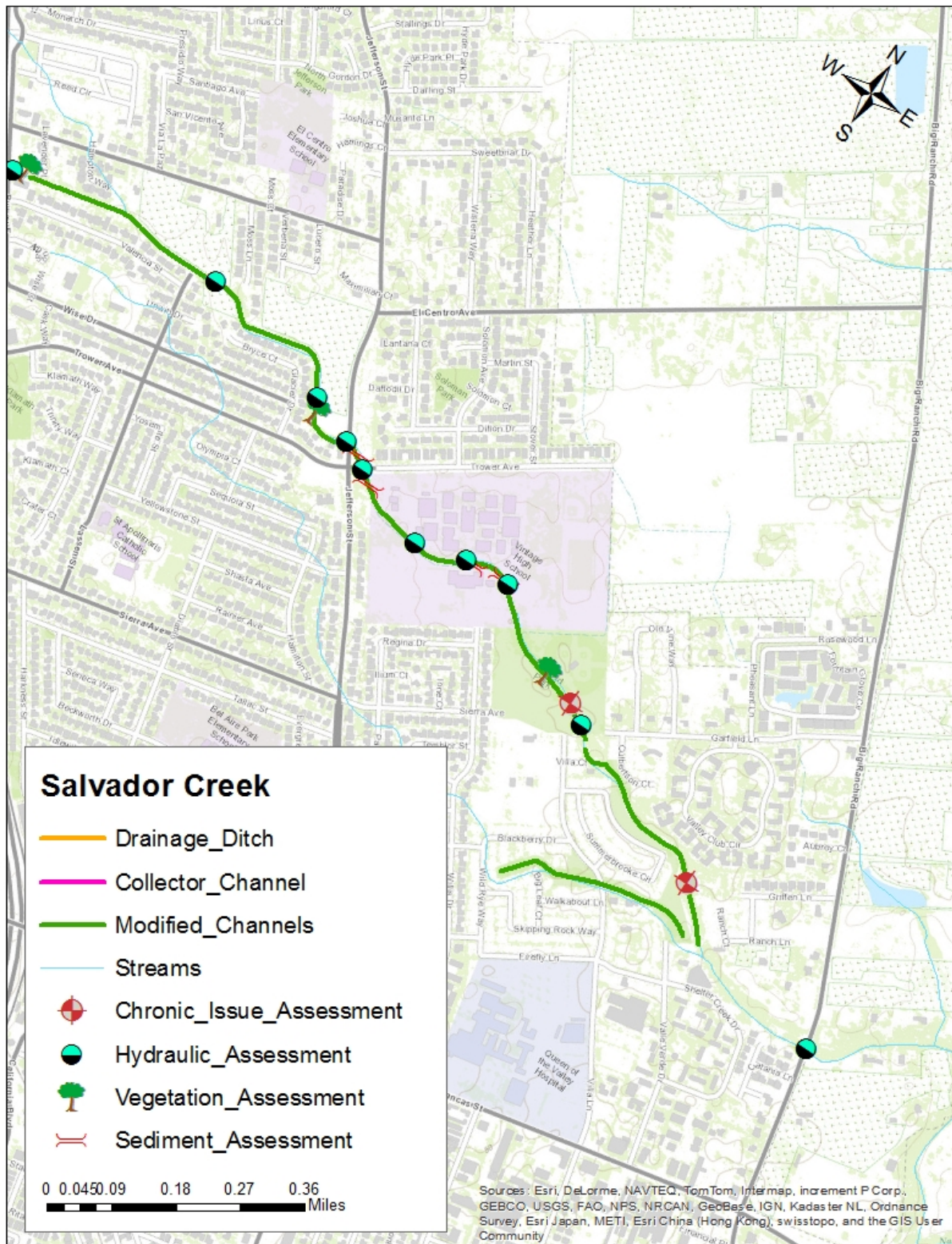


**Photo 19:** Non-native Accacia tree infestation degrading channel capacity and native plant diversity



**Photo 20:** Non-native blackberry scheduled to be removed during 2014 maintenance season







## Tulocay and Camille Creek

### Vegetation Assessment

Vegetation Issue	Type (Target or Localized)	Corrective Action
Tulocay Creek		
Willow Pruning	Target	Vegetation pruning every two years and annual monitoring.
Camille Creek		
Willow Pruning	Target	Vegetation pruning every two years and annual monitoring.

### Hydraulic Assessment

Issue	Cause	Corrective Action
Hydraulic Constriction	Box Culvert and Rail Road Abutment at Highway 29	Monitor and additional assessment
Hydraulic Constriction	Agricultural Bridge Abutment	Monitor and additional assessment

### Chronic Issues & Sediment

Issue	Cause	Corrective Action
Tulocay Creek		
Erosion	Further assessment	Outreach to property owner to provide Bank Stabilization Cost Share program and further assessment.
Erosion	Undercut tree slipped into channel	Implement Biotechnical bank repair project
Sediment	Confluence of Tulocay and Camille Creek	Monitor and manage cattails
Camille Creek		
Vegetation	Ivy	Banks infested with ivy and damaging trees should be removed, treated and revegetated with natives.



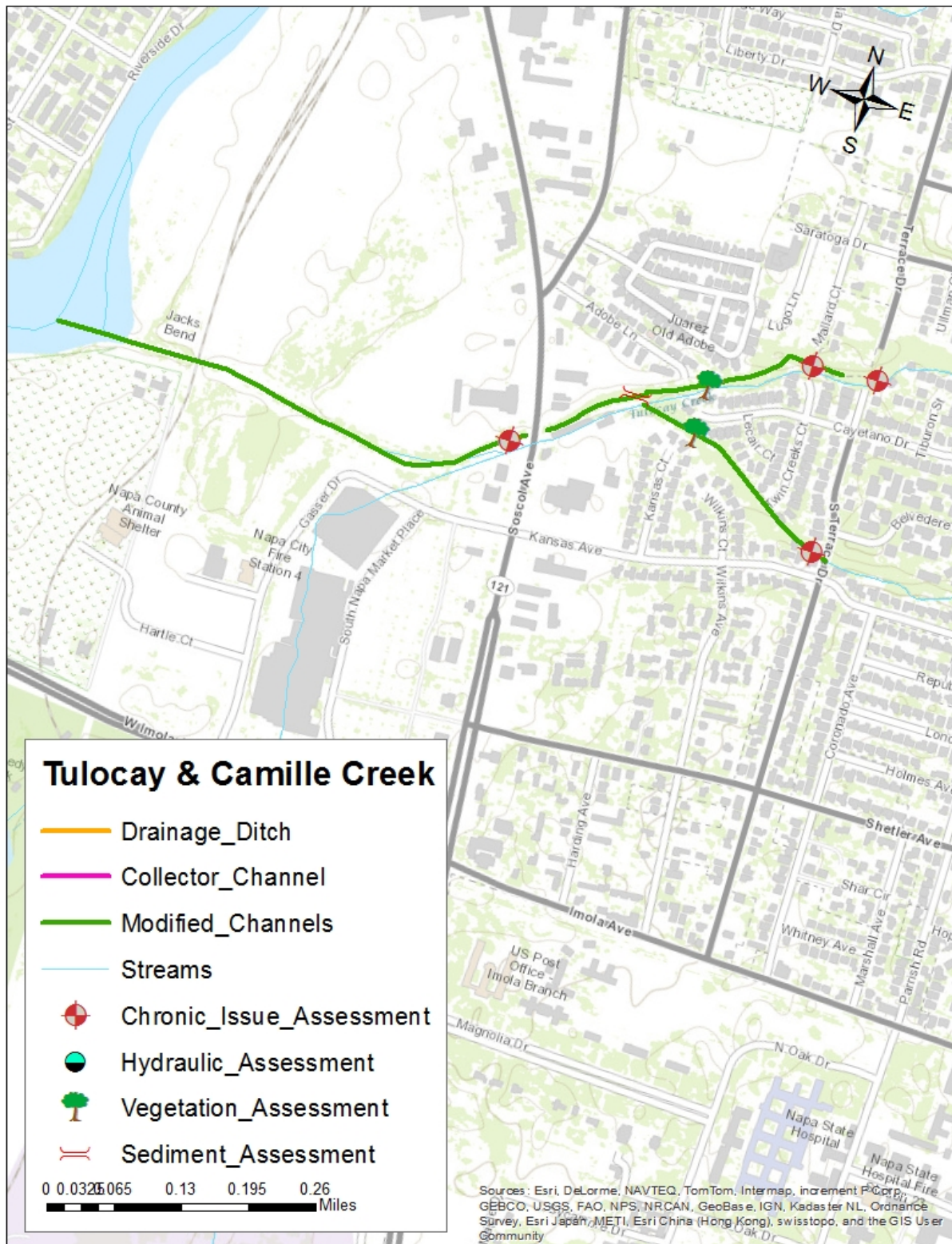
**Photo 21:** Invasive vegetation



**Photo 22:** Significant erosion outreaching to property owner



**Photo 23:** Erosion along bank due to fallen tree, repair





## Fagan and Sheehy Creek

### Vegetation Assessment

Vegetation Issue	Type (Target or Localized)	Corrective Action
Fagan Creek		
Non-native Blackberry	Target	Remove blackberry, treat and revegetate banks with native plants.
Willow Pruning	Target	Vegetation pruning every two years and annual monitoring.

### Hydraulic Assessment

Issues	Cause	Corrective Action
Fagan Creek		
Hydraulic Constriction	Culvert under airport runway	Monitor
Hydraulic Constriction	Box culvert under road crossing	Monitor and additional assessment
Hydraulic Constriction	Railroad abutment	Monitor
Sheehy Creek		
Hydraulic Constriction	Box culvert under road crossing	Monitor and additional assessment

### Chronic Issues & Sediment

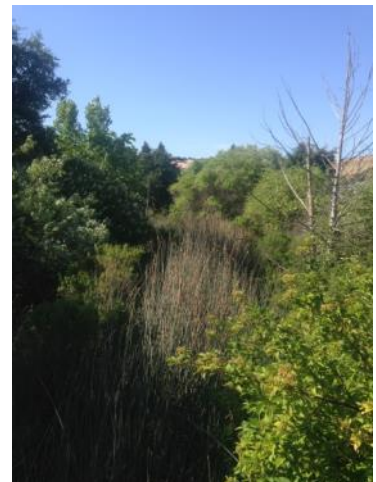
Issue	Cause	Corrective Action
Fagan Creek		
Erosion	Additional assessment	Monitor
Sediment	Straightened channel and drainage outfall	Monitor and manage sediment every 5 years
Sheehy Creek		
Flooding	Beaver dam upstream of box culvert	Annual monitoring prior to winter
Flooding	Beaver dam downstream of box culvert	Annual monitoring prior to winter
Flooding	Channel bend	Monitor vegetation and drainage outfalls
Vegetation	Cattails and bulrush	Establish tree canopy through maintaining top of bank plantings, physical removal and treatment.



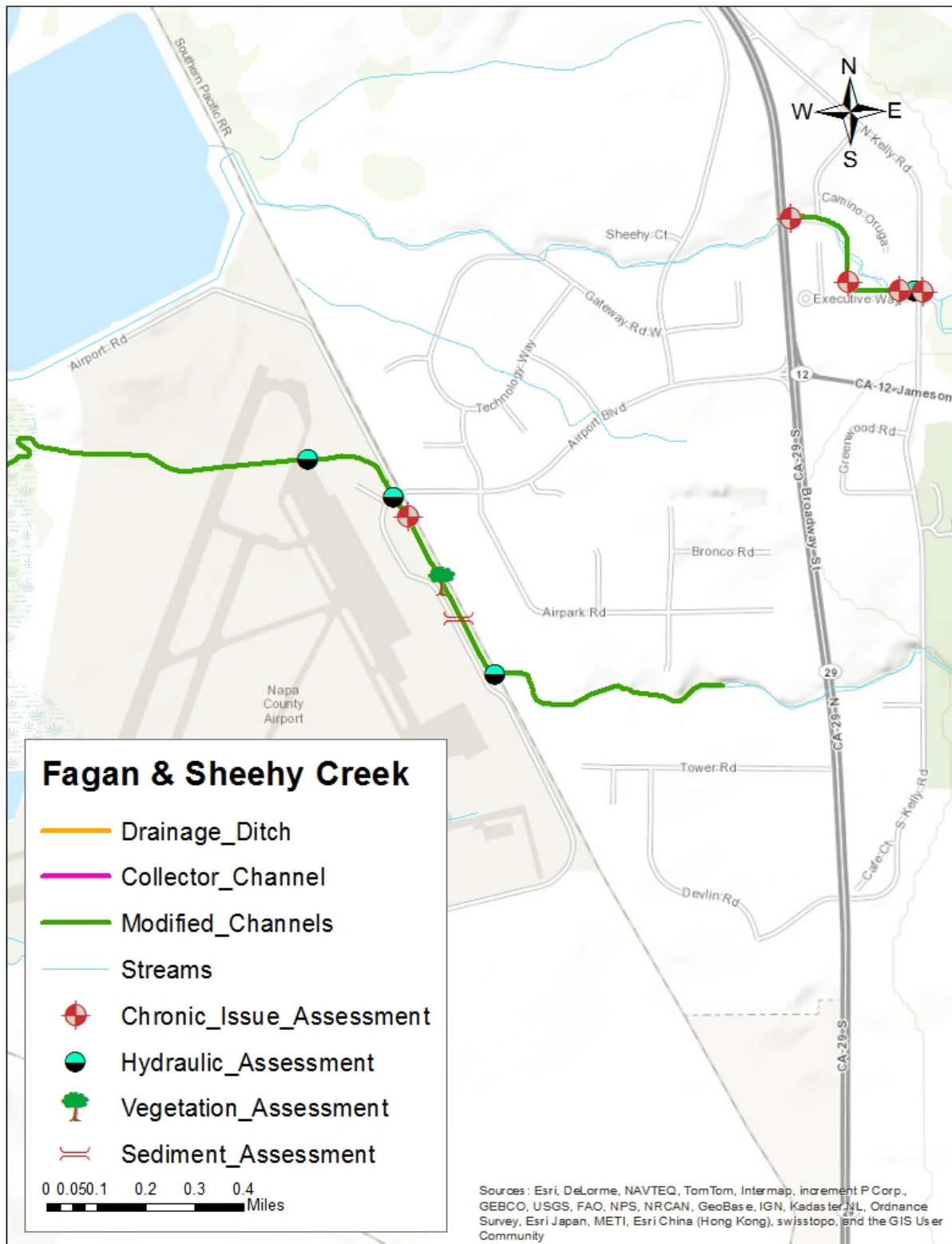
**Photo 24:** Box culvert with beaver dam upstream and downstream on Sheehy Creek



**Photo 25:** Vegetation blocking downstream box culvert on Sheehy Creek



**Photo 26:** Bulrush in Sheehy Creek





## Conn Creek

### Vegetation Assessment

Vegetation Issue	Type (Target or Localized)	Corrective Action
Non-Native Invasive Plants	Localized	Work with property owners to remove eucalyptus over multiple years and revegetate with native plants.
Non-Native Invasive Plants	Target	Remove and treat blackberry, vinca and Arundo dispersed throughout reach.
Non-Native Invasive Plants	Target	Remove and treat invasive non-natives.
Willow In Channel	Localized	Monitor and conduct annual pruning to minimize debris obstructions around bridge abutments.

### Hydraulic Assessment

Issues	Cause	Corrective Action
Hydraulic Constriction	Agricultural bridge	Additional assessment and annual monitoring
Hydraulic Constriction	Agricultural bridge	Monitor

### Chronic Issues & Sediment

Issue	Cause	Corrective Action
Debris	Debris racking on bridge abutments	Monitor and manage vegetation annually



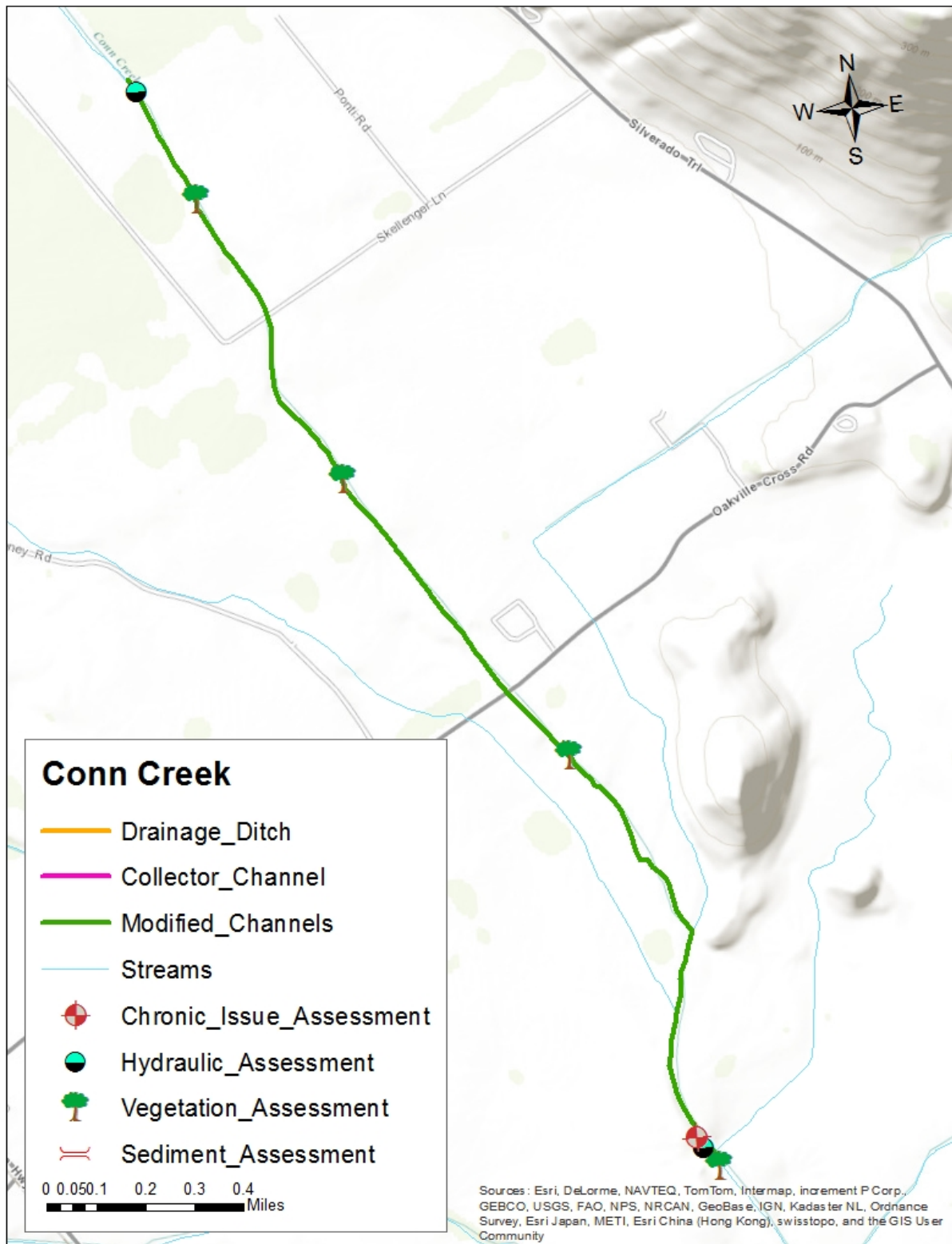
**Photo 27:** Downstream of Oakville Cross Rd. bridge sediment build



**Photo 28:** Upstream of Skellenger Rd. Eucalyptus along top of bank



**Photo 29:** Upstream of agricultural bridge



## 4.1 Anadromous Channels

Streams and drainages in the program area include tributaries to the Napa River and San Pablo Bay, and other smaller water conveyance features such as ditches and swales. The characteristics of the aquatic habitat associated with these features vary considerably. Several of the Napa River tributaries provide perennial aquatic habitat for fish and wildlife. Many smaller streams and drainages experience periods of low flow or no surface flow during summer and fall and provide poor quality habitat for salmonids.

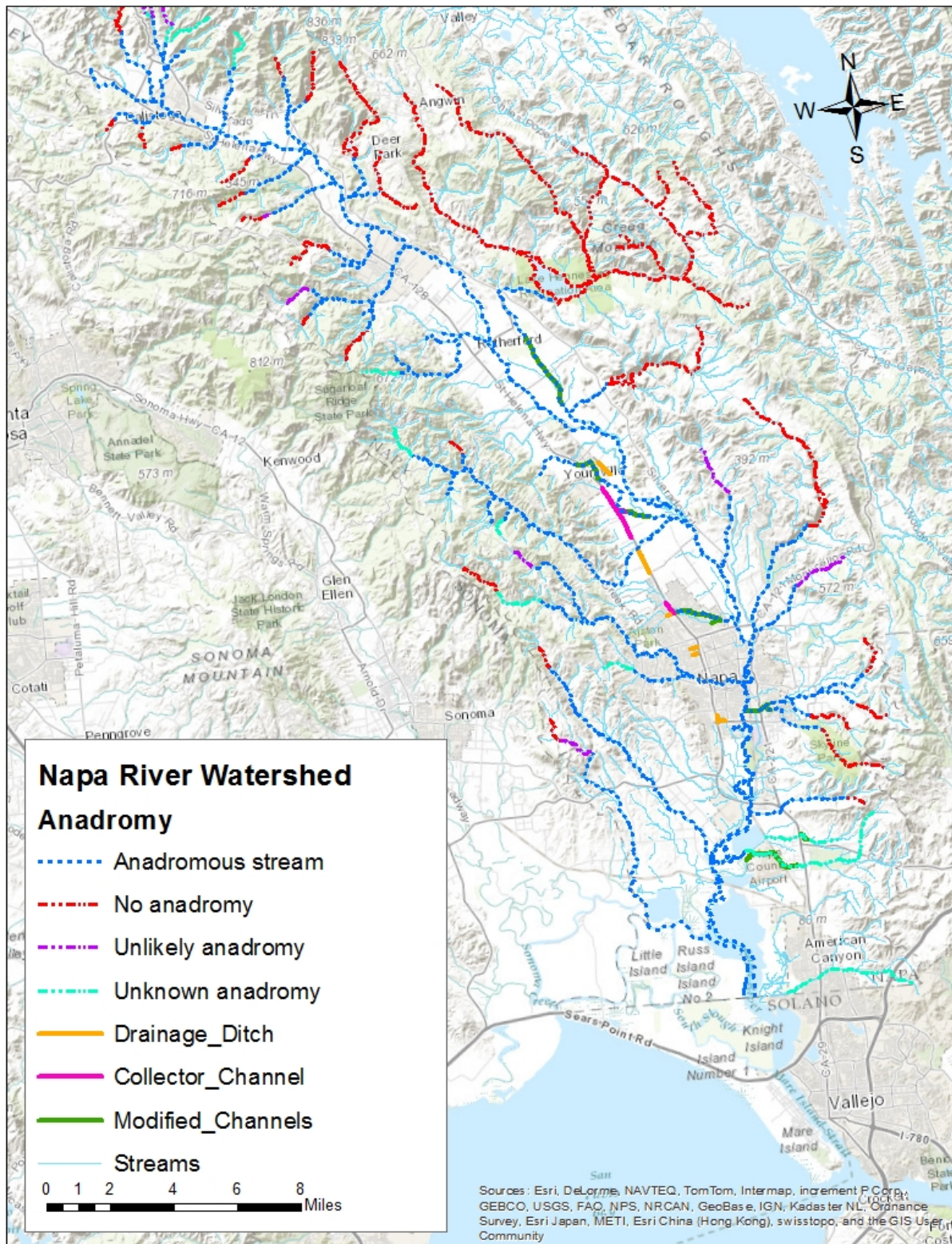
Steelhead are relatively widespread in Napa Valley streams (Ecotrust and Friends of Napa River 2001 and 2002, Stillwater Sciences and Dietrich 2002, Leidy et al. 2005, Koehler and Blank 2010), but current abundance is thought to be only a small fraction of historical levels. Fall-/late fall-run Chinook salmon also spawn and rear in the Napa River (Koehler and Edwards 2008, Koehler and Blank 2010). Annual observations in the Napa River of spawning adults and juvenile Chinook salmon by the Napa County Resource Conservation District from 2004–2010 indicate that successful spawning occurs in most years (Koehler and Blank 2010). Despite considerable habitat degradation and loss of anadromous fish habitat relative to historical conditions, the Napa River watershed still contains extensive areas of relatively high-quality spawning and rearing habitat for steelhead and salmon (Koehler and Blank 2010).

The Napa River Watershed Anadromy map below identifies where known anadromous stream reaches intersect with flood control channels. A summary table is also included, which provides additional details regarding the quality of migration, spawning and high flow refugia habitat for salmonids.

**Table 7:** Channel Anadromy

Stream	Habitat Quality
Tulocay Creek	Poor spawning habitat Moderate migration Poor high flow refugia
Camille Creek	Poor spawning habitat Moderate migration Poor high flow refugia
Salvador Creek	Poor spawning habitat Poor migration Moderate to poor high flow refugia
Yountville Outfall	Poor spawning habitat Moderate to poor migration Poor high flow refugia
Conn Creek	Poor spawning habitat Poor migration Poor high flow refugia
Sheehy Creek	Poor spawning habitat Poor migration Poor high flow refugia







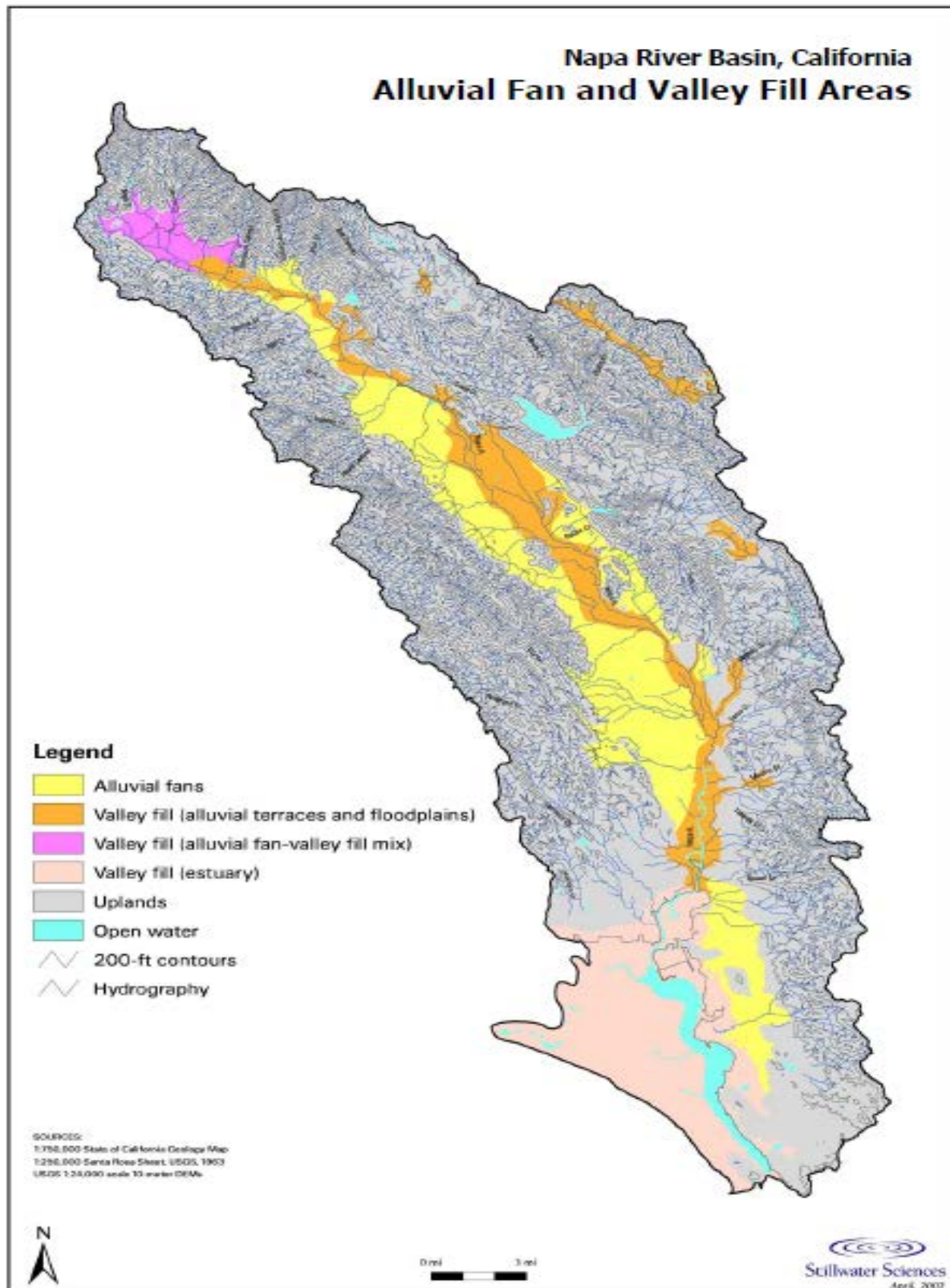
## 4.2 Channels & Alluvial Fans

The Napa River watershed structure and its stream network are relevant in considering sediment delivery and stream maintenance needs. The higher mountains that ring the Napa River watershed provide the headwater source areas for runoff and sediment that accumulate in the tributary and valley floor streams below. The steep canyons and headwater mountain streams deliver flows and sediment to the valley floors and often build characteristic alluvial fans at the base of the mountains. Historically, these alluvial fans functioned as depositional areas that stored sediments in the topographic transition between the higher and steeper headwater areas and the more gently sloping floodplain of the Napa Valley floor. Historically, during large flood events, streams migrated across these alluvial fan and valley floor floodplain and distributed sediments evenly across the surface. Over time, fans prograded downstream onto the valley floor at variable rates depending upon sediment sources, climatic conditions, and tectonic activity (earthquakes and motion along fault lines).

The topographic transition between mountain, fan, and plain is important in considering maintenance needs for the channels that the District maintains. As shown in the Alluvial Fan Map below, many of the maintenance channels begin in the historic alluvial fan zone, most often in the lower fan areas. Historically these were reaches that received abundant sediment from upstream sources. Over time these reaches may have stored this sediment in the channel, distributed and deposited it along the fan or floodplain surface, or carried it in the channel toward the next larger river confluence downstream. The table below provides a summary of the channels that intersect with alluvial fans.

**Table 8:** Inventory of Channels Flowing Through Alluvial Fans

Valley Fill (Alluvial terraces and floodplains)	
Collector Channels	Modified & Semi Modified Channels
Yountville Collector Salvador Collector	Salvador Creek Sheehy Creek Fagan Creek Yountville Outfall Conn Creek Camille Creek Tulocay Creek
Alluvial Fans	
NA	NA



## 5.0 Proposed Preventative Maintenance Projects

The District has identified a number of potential preventative maintenance projects that may reduce the frequency of routine maintenance activities and help to restore physical and biological processes within flood control channels. As the District continues to carry out subsequent quantitative assessments of flood control channels, inventories will be updated and refined and additional preventative maintenance project may be identified. Proposed preventative maintenance projects are outlined below.

**Table 28:** Preventative Maintenance Projects

Issue	Corrective Action	Implementation Schedule
<b>Yountville Collector</b>		
Erosion	Culvert replacement and installation of energy dissipation rock.	Working with roads department on repair in 2014 or 2015
<b>Yountville Outfall</b>		
Sediment	Sediment removal and revegetation of willow trees to help create channel canopy to minimize cattail growth	2015 maintenance season
<b>Salvador Creek</b>		
Hydraulic constriction caused by agricultural bridge	Remove bridge deck, piers, abutments, and install biotechnical bank stabilization elements.	2014 maintenance season
Erosion	Working with City of Napa to implement biotechnical bank repair and revegetate upper bank area	2014 maintenance season
Hydraulic constriction abandoned vehicle bridge	City of Napa Scheduled to remove bridge as part of low income development project	2015 or 2016
<b>Tulocay Creek</b>		
Erosion	Biotechnical bank repair	2014 Maintenance season
Erosion	Bank set back or biotechnical repair	Outreaching to property owner regarding Bank Stabilization Cost Share Program
<b>Fagan Creek</b>		
Sediment	Remove sediment and manage cattails to minimize deposition	2016 maintenance season
<b>Conn Creek</b>		
Sediment	Additional assessment including cross sections downstream of Oakville Cross rd. bridge	Conduct as part of quantitative assessment in 2017

## 5.0 References

- Ecotrust and FONR. 2002. Results of Hankin-Reeves standard uncalibrated *O. mykiss* survey of Napa River tributaries, Portland, Oregon.
- Ecotrust and Friends of the Napa River (FONR). 2001. Results of Hankin-Reeves standard uncalibrated *O. mykiss* survey of Napa River tributaries, Portland, Oregon.
- Koehler, J. and C. Edwards. 2008. Napa River salmon monitoring program spawning year 2007 report. Napa County Resource Conservation District.
- Koehler, J. and C. Edwards. 2009. Southern Napa River watershed restoration plan. Final Report. Prepared by the Napa County Resource Conservation District for California Department of Fish and Game, Contract # P0530429, Fisheries Restoration Grant Program. April 30.
- Koehler, J. and P. Blank. 2010. Napa River steelhead and salmon smolt monitoring program. Annual report – Year 2. Napa County Resource Conservation District.
- Leidy, R. A. 2007. Ecology, assemblage structure, distribution, and status of fishes in streams tributary to the San Francisco Estuary, California. San Francisco Estuary Institute, Contribution No. 530.
- Stillwater Sciences and W. E. Dietrich. 2002. Napa River watershed limiting factors analysis. Technical Report. Prepared by Stillwater Sciences and U.C. Berkeley, Berkeley, California, for the San Francisco Regional Water Quality Control Board and the California State Coastal Conservancy.
- Stillwater Sciences. 2007. Napa River tributary steelhead growth analysis. Final report. Prepared by Stillwater Sciences, Berkeley, California for U.S. Army Corps of Engineers, San Francisco, California.





## Napa County Resource Conservation District

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### MEMORANDUM

**Date:** August 14, 2015  
**To:** Shaun Horne, Napa County Flood Control and Water Conservation District  
**From:** Paul Blank, Napa County Resource Conservation District  
**RE:** **Tulucay and Camille Creek Channel Assessments, Stream Maintenance Program**

At the request of the Napa County Flood Control and Water Conservation District (FCWCD), Napa County Resource Conservation District (RCD) conducted assessments of Tulucay and Camille Creeks, modified stream channels in Napa County's Stream Maintenance Program (SMP). The purpose of the assessments was to assist in development of science-based channel maintenance objectives to guide maintenance activities. Specifically, FCWCD requested that RCD:

- Develop channel capacity objectives and estimates of stage-discharge relationships for the two reaches of Tulucay Creek and single reach of Camille Creek;
- Develop estimates of channel dimensions for best establishing quasi-equilibrium conditions to avoid future excessive erosion or deposition within the channels; and,
- Develop roughness objectives to determine the tolerance for loss of freeboard in the creeks.

### TULUCAY CREEK

Tulucay Creek is tributary of the Napa River that drains a 12.75 square mile watershed. It has several named tributaries including Camille Creek, Kreuse Creek, Spencer Creek, and Murphy Creek. The maintained reaches of Tulucay Creek are located in the urbanized areas at the outlet of the watershed. Reach 1 begins at Twin Creeks Court and ends 1,620 feet downstream at the Soscol Avenue bridge. Camille Creek enters Tulucay Creek from the southeast in the approximate middle of Reach 1. The tops of both stream banks in Reach 1 are closely lined with residential and commercial structures. Reach 2 begins at the Soscol Avenue bridge and ends 1,980 feet downstream at the railroad bridge. Reach 2 has been leveed to constrain high flows to the channel and reclaim adjacent land, which is currently mostly vacant, but zoned for commercial use.

Significant previous work, including a HEC-RAS hydraulic model, is available for Tulucay Creek. The model was originally developed for a FEMA map revision, and subsequently updated by WEST Consultants, Inc. in 2013 to inform the design of a proposed pedestrian bridge. The model was constructed using 23 cross sections that span the entirety of Reaches 1 and 2.

## Channel Capacity and Stage-Discharge Relationships

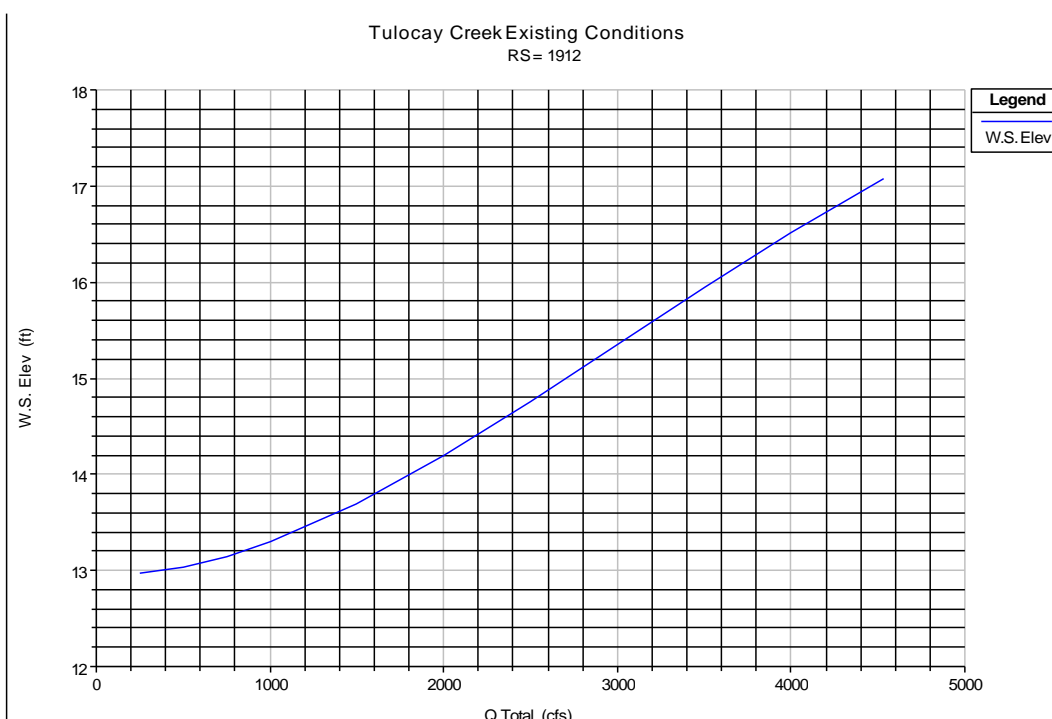
Ideally, in an urban or residential setting, stream channels and crossing structures should be sized and maintained to safely convey the 1% chance exceedance discharge, also called the 100-year peak flood event (Q100). Although some stream discharge monitoring has been conducted in the Tulucay Creek watershed, the resulting data are insufficient for statistical analysis that would produce a high-confidence Q100 value. However, indirect methods have produced estimates over the years, and the current estimate of 4,530 cfs has been accepted by FCWCD and the Army Corp of Engineers.

Since the Q100 estimate has been revised upward in recent years, the channel was designed and constructed to convey a lesser discharge; therefore, the Q100 is not an appropriate channel capacity objective. At the request of FCWCD, WEST computed channel capacities of both reaches of Tulucay Creek using the HEC-RAS model. The capacity of the upper portion of Reach 1, and all of Reach 2, was determined to be approximately 3,500 cfs; however, at this flow, the model indicates overtopping of the left bank of the channel in the lower portion of Reach 1, just upstream of the Soscol Avenue bridge. The estimated capacity of this subreach of Reach 1, according to the model, is approximately 1,000 cfs, but there appears to be potential accuracy issues at this location in the model due to incomplete representation of a flood wall along the south bank. Since the true capacity of this subreach is unknown, RCD recommends setting the channel capacity objective for stream maintenance purposes for the entirety of Reaches 1 and 2 at 3,500 cfs.

The HEC-RAS analysis was also used to generate stage-discharge ratings for both reaches (Figures 1 and 2). Ratings are associated with a particular cross section location on a stream, so RCD selected cross sections from the model that represented the reach. For Reach 1, RCD selected the downstream-most cross section that was above the poorly-represented “flood wall” subreach described above. For Reach 2, RCD selected a cross section near the top of the reach which represents the minimum capacity of the channel.



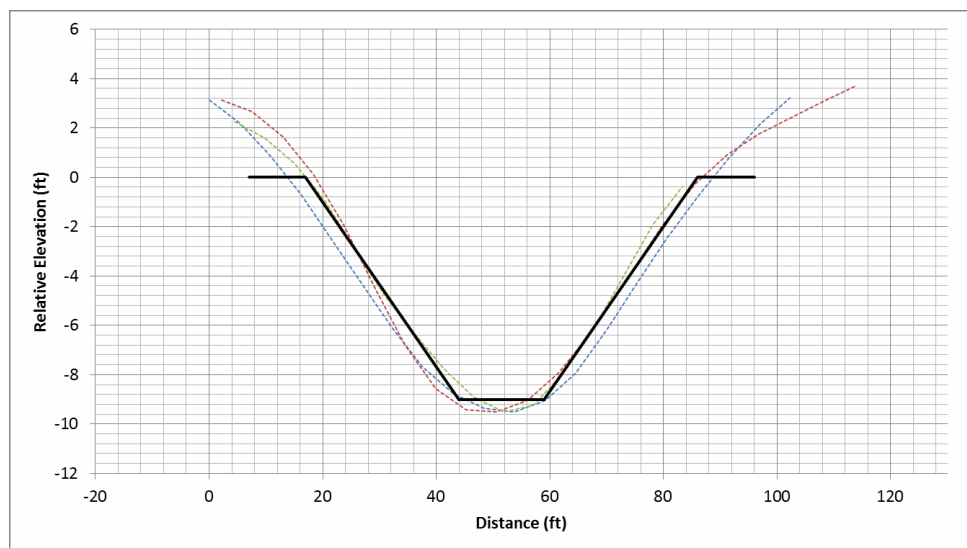
**Figure 1.** Stage-discharge rating for Tulucay Creek Reach 1, obtained from HEC-RAS analysis.



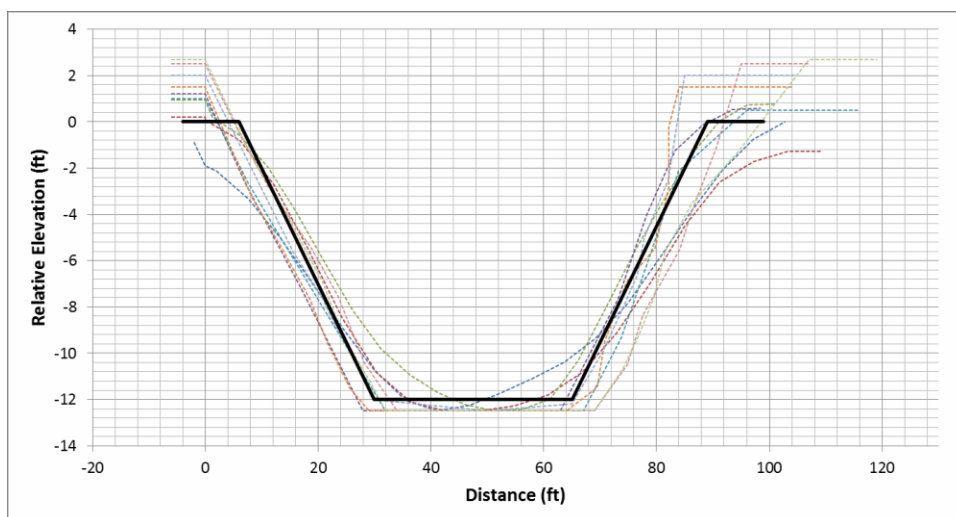
**Figure 2.** Stage-discharge rating for Tulucay Creek Reach 2, obtained from HEC-RAS analysis.

### Estimates of Quasi-Equilibrium Channel Dimensions

The HEC-RAS model was built with many cross sections of Tulucay Creek, including 8 in Reach 1 and 9 in Reach 2. RCD overlaid the cross sections for each reach and fit idealized trapezoidal cross sections to the plot (Figures 3 and 4). The 5 downstream-most cross sections in Reach 1 were omitted due to incomplete representation of a flood wall in this area. These idealized cross sections depict the average channel dimensions, and since the channels appear to be stable based on visual assessment, they also represent the channel in a quasi-equilibrium state. The idealized channel dimensions are summarized in Table 1.



**Figure 3.** Idealized cross section, Tulucay Creek Reach 1, based on measured cross sections.



**Figure 4.** Idealized cross section, Tulucay Creek Reach 2, based on measured cross sections.

Idealized Channel Dimensions		
Reach	Reach 1	Reach 2
Shape	Trapezoidal	Trapezoidal
Bottom Width (ft)	15	35
Left Bank Slope (H:1V)	3	2
Right Bank Slope (H:1V)	3	2
Depth (ft)	9.0	12.0
Area (ft <sup>2</sup> )	378	708

**Table 1.** Idealized channel dimensions, Tulucay Creek.

## Channel Roughness

Since the banks of Tulucay Creek are unarmored for most of its length, and the surrounding land is developed or zoned for future development, right up to the top-of-bank, growth of riparian vegetation is necessary to protect against bank and levee erosion. In addition, riparian vegetation enhances wildlife habitat and aesthetics. However, overgrowth of riparian vegetation will increase channel roughness and therefore decrease water velocity and channel capacity according to Manning's Equation.

RCD conducted a visual assessment of roughness in Tulucay Creek Reaches 1 and 2, collected photographs, and estimated Manning's roughness coefficients. Figures 5 through 8 depict roughness conditions representative of each reach. Estimated Manning's roughness coefficients are provided in the figure captions.





**Figure 5.** The upstream portion of Tulucay Creek Reach 1, looking downstream, showing channel roughness and inundation from beaver activity.  $n=0.04-0.05$



**Figure 6.** The downstream portion of Tulucay Creek Reach 1 looking downstream showing channel roughness and inundation from beaver activity.  $n=0.04-0.05$

As evident from Figures 1 and 2, Reach 1 has been completely inundated with backwater from a beaver dam located just upstream of the Soscol Avenue bridge. Beavers are common in the Napa River system and seem to be increasing in population. In general, local beaver activity is not known to lead to significant channel capacity decreases and potential stream flooding issues due to the large size and intensity of local winter



storm flows, which tend to wash out the dams on an annual basis; however, this particular dam appears to be quite resilient. It seems to have withstood a medium-size flow on December 11, 2014, estimated (roughly) at approximately 800 cfs, with little damage, or at least in a condition in which it could be quickly repaired. It is still assumed that larger flows would wash out beaver dams and restore full channel capacity.



**Figure 7.** Tulucay Creek Reach 2 looking downstream from Soscol Avenue bridge showing channel roughness.  $n=0.1-0.15$



**Figure 8.** Tulucay Creek Reach 2 looking upstream from the railroad bridge at the downstream boundary of the reach, showing channel roughness.  $n=0.04-0.045$

RCD's selection of Manning's Roughness Coefficients for Reach 1 (n=0.04 to 0.05) closely agree with those used by WEST in the HEC-RAS analysis (n=0.045). Since the analysis indicated that the reach will convey the channel capacity objective flow under these roughness conditions, the channel roughness objective for Reach 1 should be set at 0.045.

RCD's selection of roughness coefficients for Reach 2 (n=0.04 to 0.15) agree with those used by WEST in the HEC-RAS analysis (n=0.04) except in the upper portion of the reach. Overgrowth in this area (Figure 3) is likely recent and due to extended drought conditions, and RCD recommends active clearing be considered to reduce roughness and maintain channel capacity. Regardless, the HEC-RAS analysis indicates that a Manning's Roughness Coefficient of 0.04 is required to achieve the channel capacity objective, and therefore, the channel roughness objective for Reach 2 should be set at 0.04.

## CAMILLE CREEK

Camille Creek, also called Cayetano Creek or Marie Creek, is a tributary of Tulucay Creek that drains a 3.13 square mile area, 25% of the Tulucay Creek watershed. The maintained reach of Camille Creek begins at the South Terrace Drive culvert and ends 1,250 feet downstream where it empties into Tulucay Creek in the approximate middle of Reach 1. The tops of both stream banks in the reach are closely lined with residential structures. RCD is not aware of previous hydraulic analyses or discharge monitoring efforts for Camille Creek.

### Channel Capacity and Stage-Discharge Relationships

To develop a channel capacity objective for the reach, RCD first determined the maximum capacity of the South Terrace Drive culvert. Stream crossing structures, especially culverts, are often the most constricted points in a reach; and therefore the maximum discharge conveyed by these structures often represents a suitable capacity objective for the reach.

During June 2015, RCD measured the dimensions of the South Terrace Drive culvert, recorded the inlet configuration, surveyed the inlet and outlet elevations, and measured a channel cross section at the tailwater control with a theodolite and stadia rod relative to NGVD29 (City of Napa Benchmark 87-A). These data were input into HY-8, a culvert analysis program developed by the Federal Highway Administration (FHWA). HY-8 analysis input data and results are provided as an attachment to this memorandum. The results of the analysis indicate that the capacity of the culvert is 695 cfs at the top of the inlet, and 815 cfs at the point at which it overtops and spills onto the roadway. The analysis also generated a stage-discharge rating for the culvert that will predict discharge based on headwater elevation. The rating is provided and discussed below.

The Camille Creek watershed is an ungaged basin and therefore the Q100 is not known. RCD estimated the Q100 by adjusting the current Q100 estimate for Tulucay Creek (4,530 cfs) based on drainage area according the following equation:

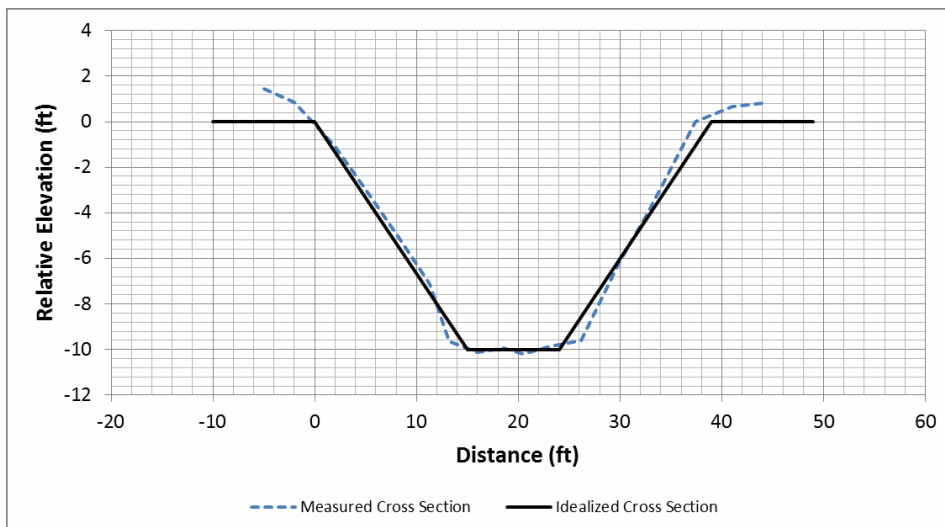
$$Q_u = Q_g \left( \frac{A_u}{A_g} \right)^{0.87}$$

where  $Q_u$  is the discharge for the ungaged site,  $Q_g$  is the discharge for the gaged site,  $A_u$  is the drainage area of the ungaged site, and  $A_g$  is the drainage area of the gaged site. This adjustment method is described in the June 1977 USGS report *Magnitude and Frequency of Floods in California* by A.O. Waananen and J.R. Crippen. This method results in a Q100 estimate for Camille Creek of 1,350 cfs.

It should be noted that this estimate is based on previous work done for Tulucay Creek, which is also an estimate based on indirect methods, and there may be significant error associated with the Q100 estimates for both creeks. For comparison purposes, RCD computed a second estimate of the Camille Creek Q100 using USGS's National Streamflow Statistics (NSS) program, which uses regional flood-frequency regression equations. Based on drainage area and mean annual precipitation, NSS predicts a Q100 of 800 cfs for Camille Creek. For this assessment, RCD selected the greater value of 1,350 cfs as the estimated Q100 because it has a local basis and is more conservative.

Comparison of the culvert capacity to the Q100 reveals that the culvert would be overtopped should this flow occur. In this case, the culvert capacity is not a suitable objective for the reach and the capacity of the channel itself must be estimated and compared to the Q100. To do this, RCD began with a visual assessment of the reach to evaluate channel shape and condition. The channel is incised but appears to have stabilized. Significant areas of erosion and/or deposition were not observed. The streambanks are not armored but are generally well vegetated. The reach does not maintain a consistent shape along its length. In the downstream direction, the stream banks become lower and shallower. A stable location in the most-contracted subreach of the creek was selected for measurement of a cross section. A stable location was selected because this indicates that it represents the channel in a quasi-equilibrium state. The most-contracted subreach, with the smallest cross-sectional area, was selected because it will control the capacity.

RCD measured the cross section by stretching a tape between the tops of the banks perpendicular to the channel centerline. Elevations were measured with a theodolite and stadia rod relative to NGVD29. The measured cross section was plotted and an idealized cross section was fit to the plot (Figure 9). This idealized cross section represents the most-contracted, yet stable, configuration of the channel. The capacity of the actual channel, which widens downstream, will be greater.



**Figure 9.** Idealized cross section, Camille Creek, based on a measured cross section at a carefully selected location.

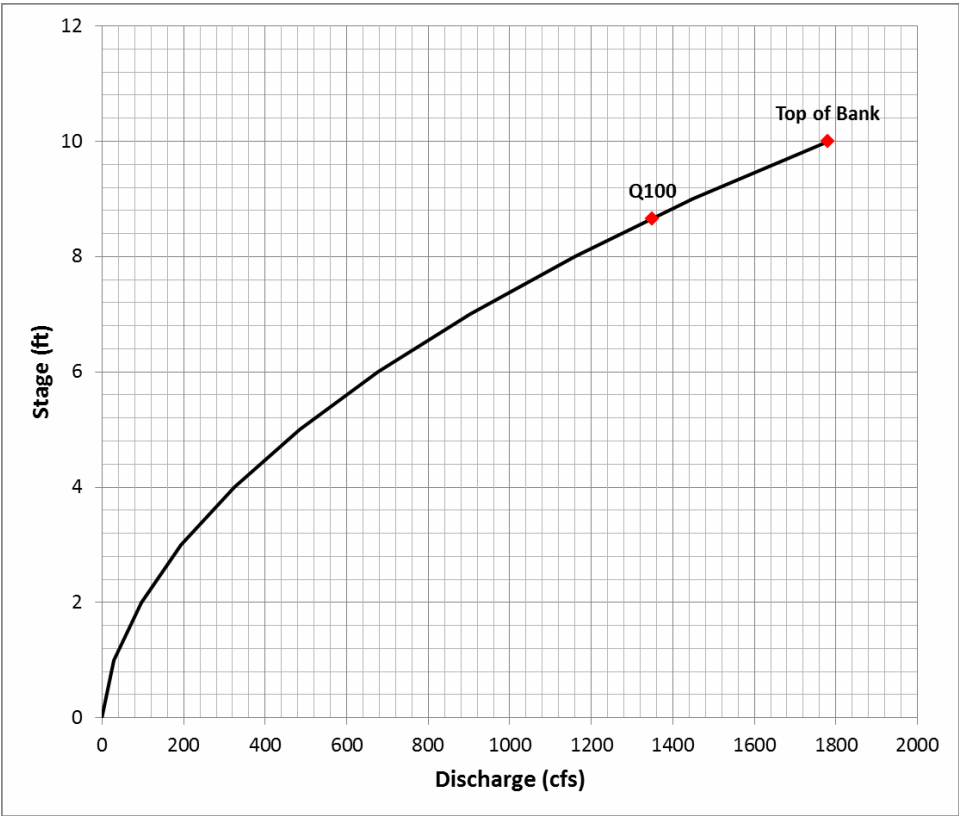
RCD performed a channel analysis using the idealized cross section, the bed slope of the reach, roughness estimates, and Manning's Equation. The analysis resulted in a general stage-discharge relationship, or rating, for the reach. The stage-discharge rating is shown in Figure 10.

The rating indicates that the capacity of the channel is 1,780 cfs at the top of bank. Although there is a wide-margin of error associated with this result, it is well above the Q100, indicating that the channel, even at its narrowest location, will safely convey the Q100. It should be noted that HY-8 analysis of the South Terrace Drive culvert indicates roadway flooding and culvert inundation at this flow. In addition, although the channel

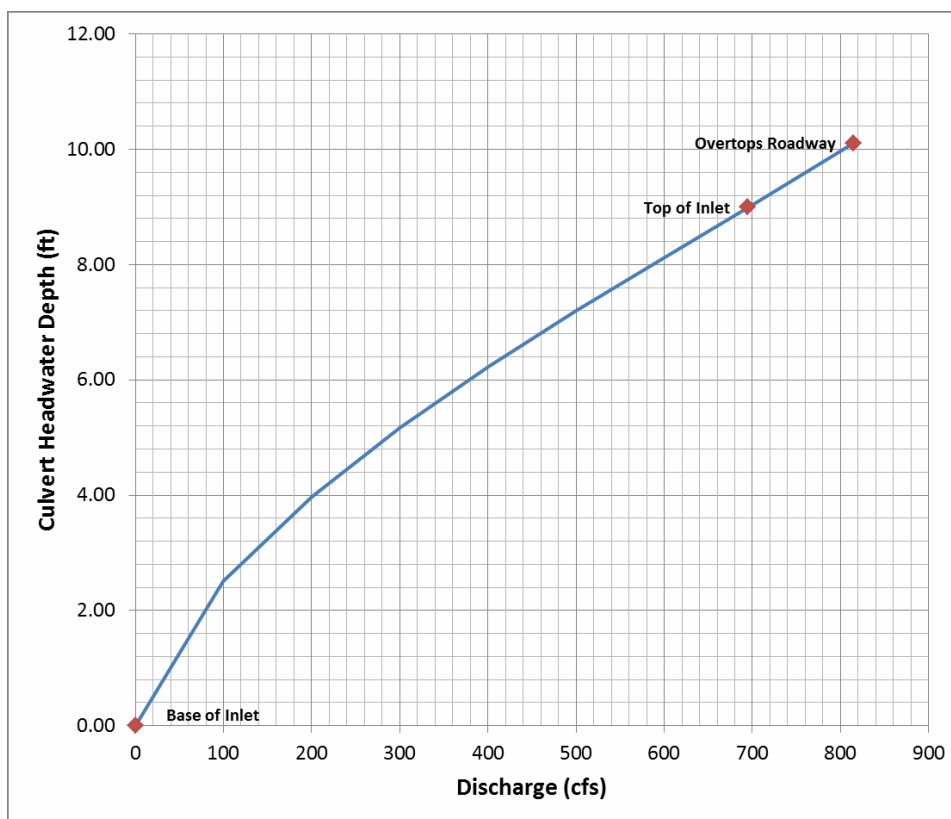


should contain and convey the Camille Creek Q100, in an extreme high-water scenario, backwater from Tulucay Creek may cause flooding in the lower part of the reach.

This rating, though useful for estimating channel capacity and specifically for comparison of channel capacity to the Q100, is based on generalizations and applies to the reach as a whole, not to stage at a specific location. To estimate the discharge associated with an observed stage in the reach, the headwater elevation to discharge rating from the HY-8 analysis of the South Terrace Drive culvert is provided as Figure 11. This rating predicts discharge based on the headwater depth of the South Terrace Drive culvert. Due to the short length of the reach, the absence of tributaries, and the small amount of additional contributing drainage area, this estimate is also applicable to any location in the maintained reach for many purposes, including guiding channel maintenance decisions.



**Figure 10.** Stage-discharge rating for Camille Creek, obtained from channel analysis using idealized cross section.



**Figure 11.** Headwater depth – discharge rating for South Terrace Drive culvert, obtained from HY-8 analysis.

## Estimates of Quasi-Equilibrium Channel Dimensions

The idealized cross section constructed to estimate channel capacity represents the channel at a quasi-equilibrium condition, yet at its most susceptible to potential change because it has the steepest bank slopes and experiences the highest velocities due to its having the minimum cross-sectional area in the reach. Therefore, the dimensions of this cross section represent the extremes that should not be exceeded in any subreach, and therefore comparison of future channel conditions to these dimensions can indicate a problem and guide channel maintenance activities. Cross-sectional area, bank slope, bottom width, and depth were calculated to develop idealized channel dimensions for the reach (Table 2).

Idealized Channel Dimensions	
Shape	Trapezoidal
Bottom width (ft)	9
Left Bank Slope (H:1V)	1.5
Right Bank Slope (H:1V)	1.5
Depth (ft)	10.0
Area (ft <sup>2</sup> ):	240

**Table 2.** Idealized channel dimensions, Camille Creek.

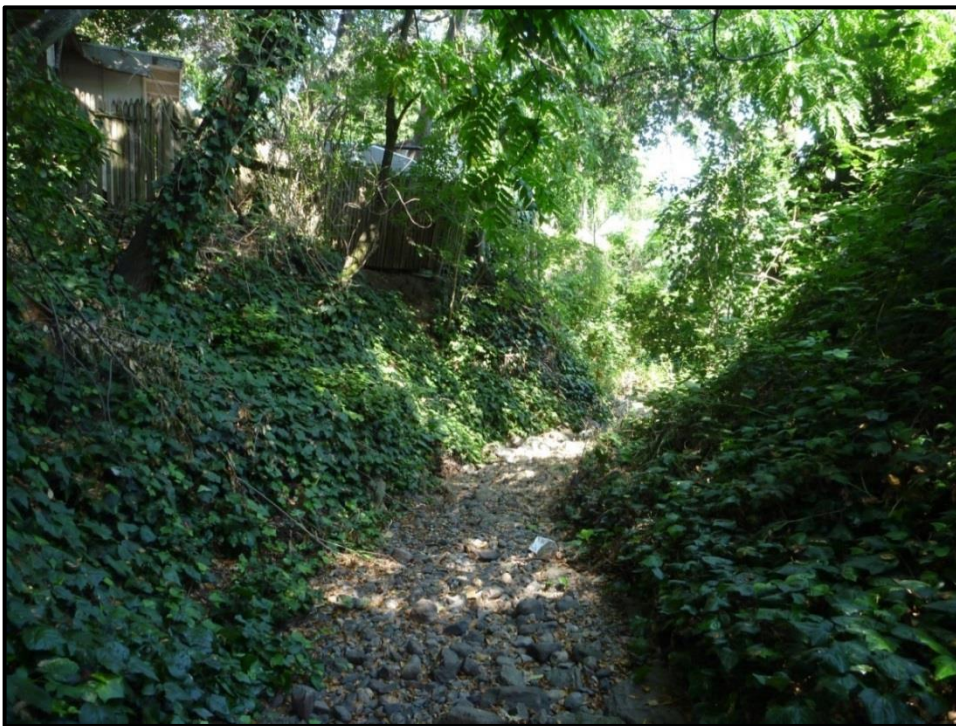
## Channel Roughness

Since the banks of Camille Creek are unarmored for most of its length, and the surrounding land is developed right up to the top-of-bank, growth of riparian vegetation is necessary to protect against bank erosion. In addition, riparian vegetation enhances wildlife habitat and aesthetics. However, overgrowth of riparian

vegetation will increase channel roughness and therefore decrease water velocity and channel capacity according to Manning's Equation.

Based on visual assessment of the maintenance reach of Camille Creek, RCD estimates the Manning's Roughness Coefficient of the active scour channel and the stream bank slopes to be 0.04 and 0.1, respectively. When composited using the Lotter Method, this equates to an overall channel roughness of approximately 0.05 at all high stages. Roughness coefficients were selected based on reference documents provided by USGS and others, and on local experience and professional judgement. A photograph depicting the typical roughness conditions of the maintained reach of Camille Creek is provided as Figure 12.

RCD considers the current condition of the channel to be stable and in a quasi-equilibrium state, and analysis reveals that the most-confined portion of the reach will convey the Q100 under the current roughness conditions. Therefore, the current roughness conditions should be maintained to ensure continued conveyance of the Q100, and the Channel Roughness Objective should be set at 0.05.



**Figure 12.** Camille Creek looking downstream showing channel roughness. RCD selected an overall Manning's Roughness Coefficient of 0.05 for the reach.

## **Summary and Channel Maintenance Objectives**

Visual assessment of Tulucay Creek Maintenance Reaches 1 and 2 indicates that the channel is in a quasi-equilibrium condition. RCD compiled several channel cross sections measured throughout the reach as part of a previous HEC-RAS analysis, and defined idealized channel dimensions for each reach that should be maintained in order to preserve channel capacity. HEC-RAS analysis used weighted Manning's roughness coefficients of 0.045 and 0.040 for Reaches 1 and 2, respectively, and indicated a maximum channel capacity of 3,500 cfs under these conditions. RCD considers these values to be reasonable and should be used as the roughness and capacity objectives for the reaches; however, visual assessment of the upper portion of Reach 2 revealed increased roughness due to vegetation overgrowth and active clearing should be considered in this area to maintain channel maintenance objectives. The HEC-RAS analysis also provided stage-discharge relationships for both reaches.

Visual assessment of the maintained reach of Camille Creek indicates that the channel is currently in a quasi-equilibrium condition, and capacity analyses indicate that the channel will currently convey the 100-year peak flood event, although overtopping and roadway flooding at the South Terrace Drive culvert is expected to occur at this flow. Therefore, current channel dimensions and roughness conditions should be maintained in the future to maintain adequate channel capacity. Stage-discharge relationships were estimated for Camille Creek, and discharges up to approximately 800 cfs can be estimated in the field by measuring headwater depth at the South Terrace Drive culvert.

Channel maintenance objectives for Camille Creek and both reaches of Tulucay Creek are summarized in Table 3.

Channel Characteristic	Tulucay Creek Reach 1	Tulucay Creek Reach 2	Camille Creek
Capacity	Maintain channel to convey a flow of 3,500 cfs.	Maintain channel to convey a flow of 3,500 cfs.	Maintain channel to convey the 1% chance exceedance flow (100-year peak flood event) of 1,350 cfs.
Quasi-Equilibrium Dimensions	Maintain bank slopes of approximately 3H:1V. Maintain an approximate minimum cross sectional area of 380 ft <sup>2</sup> at the top-of-bank.	Maintain bank slopes of approximately 2H:1V. Maintain an approximate minimum cross sectional area of 700 ft <sup>2</sup> at the top-of-bank.	Maintain bank slopes of 1.5H:1V or shallower. Maintain a minimum cross sectional area of 240 ft <sup>2</sup> at the top-of-bank.
Roughness	Maintain overall channel roughness of 0.045 as shown in Figures 5 and 6.	Maintain overall channel roughness of 0.04 as shown in Figure 8.	Maintain overall channel roughness of 0.05 as shown in Figure 12.

**Table 3.** Tulucay and Camille Creek channel maintenance objectives.

Attachment: HY-8 Culvert Analysis Report, South Terrace Drive Culvert, Camille Creek.



**ATTACHMENT**

**HY-8 CULVERT ANALYSIS REPORT  
SOUTH TERRACE DRIVE CULVERT  
CAMILLE CREEK**

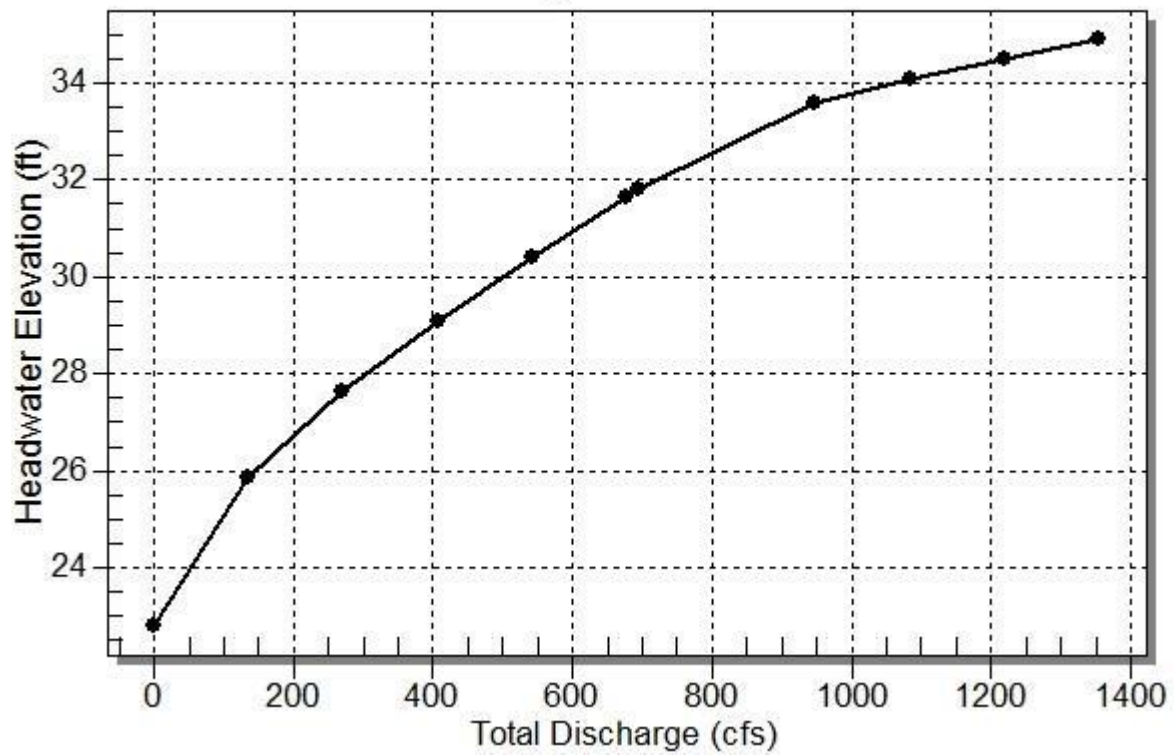
**Table 1 - Summary of Culvert Flows at Crossing: S Terrace Dr**

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
22.81	0.00	0.00	0.00	1
25.86	135.40	135.40	0.00	1
27.64	270.80	270.80	0.00	1
29.09	406.20	406.20	0.00	1
30.40	541.60	541.60	0.00	1
31.64	677.00	677.00	0.00	1
31.81	695.00	695.00	0.00	1
33.57	947.80	883.95	63.82	5
34.07	1083.20	934.33	148.84	4
34.50	1218.60	977.39	241.18	4
34.90	1354.00	1015.84	337.84	3
32.92	815.54	815.54	0.00	Overtopping

Rating Curve Plot for Crossing: S Terrace Dr

Total Rating Curve

Crossing: S Terrace Dr



**Table 2 - Culvert Summary Table: Culvert 1**

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	22.81	0.000	0.0*	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
135.40	135.40	25.86	3.053	0.0*	1-S2n	1.377	1.789	1.507	2.316	8.983	4.602
270.80	270.80	27.64	4.831	0.0*	1-S2n	2.228	2.841	2.459	3.348	11.014	5.742
406.20	406.20	29.09	6.284	0.0*	1-S2n	2.967	3.722	3.280	4.169	12.383	6.441
541.60	541.60	30.40	7.589	0.0*	1-S2n	3.652	4.509	4.028	4.873	13.445	6.932
677.00	677.00	31.64	8.831	0.0*	1-S2n	4.294	5.232	4.722	5.499	14.336	7.304
695.00	695.00	31.81	8.995	0.0*	1-S2n	4.379	5.325	4.813	5.577	14.441	7.347
947.80	883.95	33.57	10.762	0.0*	5-S2n	5.241	6.251	5.718	6.593	15.460	7.846
1083.20	934.33	34.07	11.256	0.0*	5-S2n	5.467	6.486	5.949	7.083	15.706	8.056
1218.60	977.39	34.50	11.691	11.551	5-S1t	5.656	6.684	7.584	7.544	12.888	8.239
1354.00	1015.84	34.90	12.089	11.767	5-S1t	5.824	6.858	8.020	7.980	12.666	8.401

\* theoretical depth is impractical. Depth reported is corrected.

\*\*\*\*\*

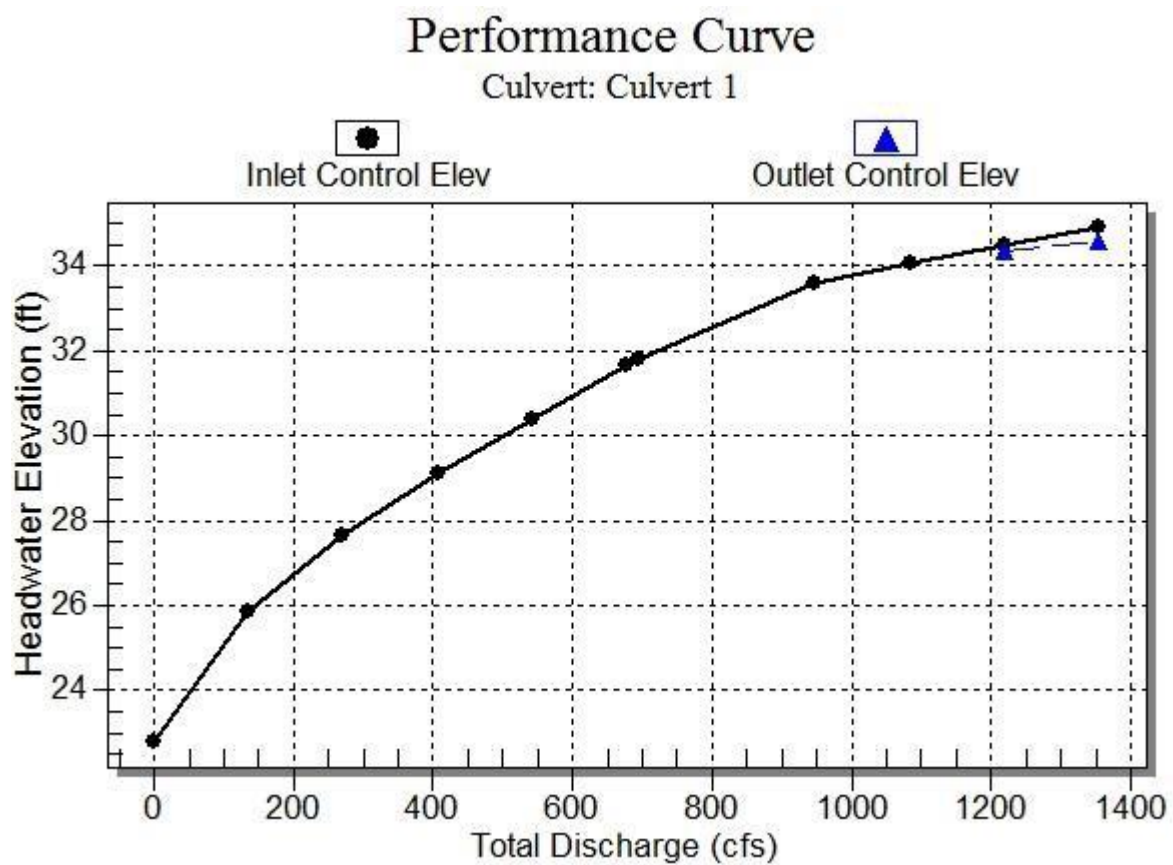
Inlet Elevation (invert): 22.81 ft,      Outlet Elevation (invert): 22.52 ft

Culvert Length: 55.00 ft,      Culvert Slope: 0.0053

\*\*\*\*\*



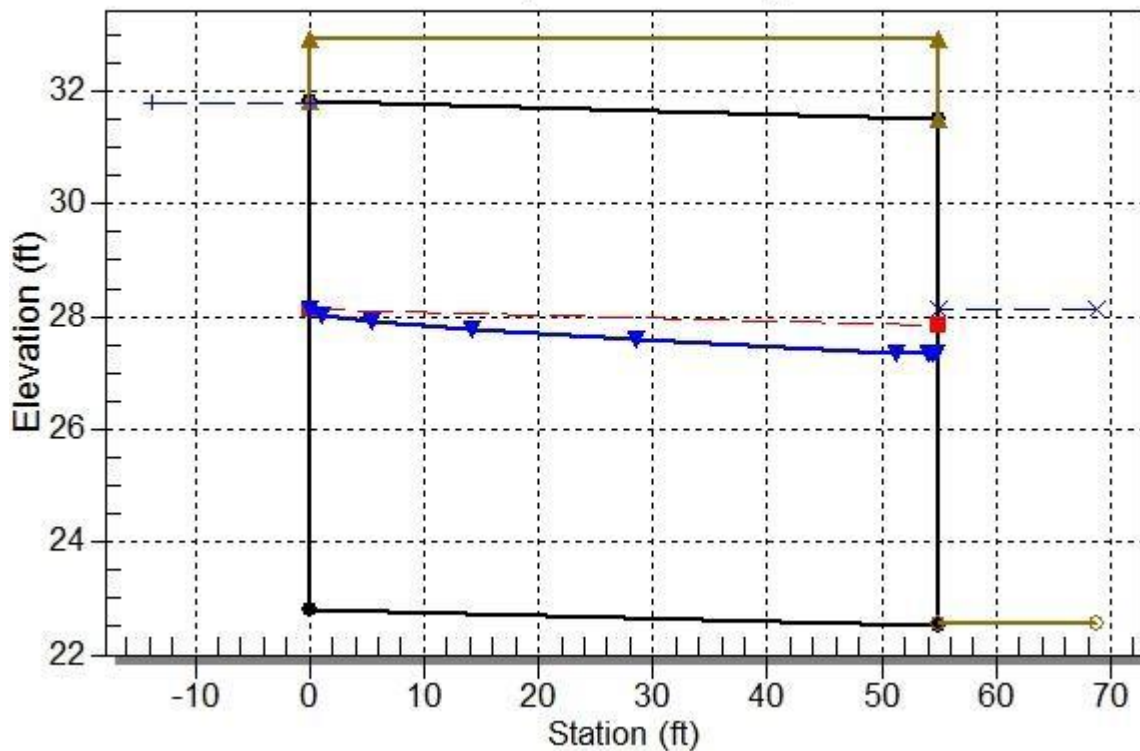
## Culvert Performance Curve Plot: Culvert 1



## Water Surface Profile Plot for Culvert: Culvert 1

Crossing - S Terrace Dr, Design Discharge - 695.0 cfs

Culvert - Culvert 1, Culvert Discharge - 695.0 cfs



### Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 22.81 ft

Outlet Station: 55.00 ft

Outlet Elevation: 22.52 ft

Number of Barrels: 1

### Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box

Barrel Span: 10.00 ft

Barrel Rise: 9.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge (90°) Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: S Terrace Dr)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	22.56	0.00	0.00	0.00	0.00
135.40	24.88	2.32	4.60	1.01	0.60
270.80	25.91	3.35	5.74	1.46	0.63
406.20	26.73	4.17	6.44	1.82	0.65
541.60	27.43	4.87	6.93	2.13	0.65
677.00	28.06	5.50	7.30	2.40	0.66
695.00	28.14	5.58	7.35	2.44	0.66
947.80	29.15	6.59	7.85	2.88	0.66
1083.20	29.64	7.08	8.06	3.09	0.65
1218.60	30.10	7.54	8.24	3.30	0.65
1354.00	30.54	7.98	8.40	3.49	0.65

**Tailwater Channel Data - S Terrace Dr**

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.0070

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	33.62	0.1000
2	4.00	31.70	0.1000
3	7.00	29.78	0.1000
4	10.20	27.74	0.1000
5	13.30	25.64	0.1000
6	15.20	23.11	0.0400
7	18.00	22.63	0.0400
8	20.60	22.82	0.0400
9	22.50	22.56	0.0400
10	25.10	22.90	0.0400
11	28.20	23.17	0.1000
12	32.00	26.62	0.1000
13	34.70	28.73	0.1000
14	39.40	32.76	0.0000

**Roadway Data for Crossing: S Terrace Dr**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 40.00 ft

Crest Elevation: 32.92 ft

Roadway Surface: Paved

Roadway Top Width: 55.00 ft

Napa County Flood Control and  
Water Conservation District

## **Stream Maintenance Program Channel Quantitative Assessment Report**

Prepared for:



***Waste Discharge Requirements & Water Quality Certification  
Order No. R2-2012-0063***

Napa County Flood Control  
& Water Conservation District  
804 First Street  
Napa, CA. 94559-2623

**April 17, 2017**







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# Quantitative Assessment Report

## 1.0 Introduction

The Napa County Flood Control and Water Conservation District is responsible for maintaining the hydrological capacity of flood control channels and natural streams to minimize flooding. The District sees itself not merely as a flood management bureau, but more broadly as a resource management agency with a duty to integrate environmental benefits (such as habitat protection and enhancement) into stream maintenance activities.

The District has maintenance responsibilities for flood control channels that the District owns in fee title, as well as other channels for which the District has a maintenance agreement or easement. The location and channel ownership types for District maintenance are presented in the Stream Maintenance Manual (SMM). The District's staff surveys flood control channels and easements annually and prescribes maintenance activities based on existing conditions. The stream maintenance program has four primary activities: vegetation management, downed tree management, erosion protection and bank stabilization, and sediment and debris management.

The District also provides discretionary maintenance in other county channels, maintains instream facilities for their proper functioning, responds to public requests for maintenance activities at other stream and channel locations and is involved in the maintenance of ongoing restoration projects. In recent years, the District has been collaborating with private landowners and other local entities on the implementation of riparian and stream restoration projects as well as on the long term monitoring and maintenance of such projects.

In 2012 the District finalized the SMM to guide maintenance activities and to expand the programs permit coverage. The objective of the SMM is to provide clearly articulated guidance to avoid and minimize environmental impacts while conducting maintenance. As part of the District's Stream Maintenance Program (SMP) permit with the RWQCB WQC/WDR the District was required to develop an inventory of engineered channels and develop quantitative assessment of flood control channels. To complete the channel quantitative assessment work the District collaborated with the Napa County Resource Conservation District to complete the necessary field work and to develop this quantitative assessment report.

## 1.1 Quantitative Assessment

The District submitted the Quantitative Assessment Work Plan and Channel Inventories to the RWQCB on May 30, 2014. As part of this effort and in accordance with provision 26 of the WDR/WQC, the District has been carrying out quantitative assessment on flood control channels over the last five years. As outlined in the submitted work plan the District is schedule to complete channel assessment for Conn Creek and Yountville Collector during the 2018 maintenance season. The District will submit these final channel assessment reports by August of 2017.

## Provision 26

*The District shall develop a workplan and an implementation schedule for developing channel capacity objectives and estimates of flood stage-discharge relationships. The Development of this information will guide the selection of annual maintenance locations needed for flood protection as reported in the Annual Workplans. Channel dimensions objectives that facilitate stream equilibrium conditions, address excessive erosion and deposition problems, and promote sustainable habitat conditions, shall be developed and used to guide channel grading and enhancements activities.*

- A. The District shall develop roughness objectives for all major channels contained in the SMP Manual and determine the tolerance for loss of freeboard in engineered flood controls channels.*
- B. The District shall provide preliminary estimates of stage-discharge relationships for channel reaches most likely subject to maintenance (including those areas and channels identified in the inventories for targeted and localized sediment and vegetation removal projects). These estimates should be based on field measurements. For those channels lacking sufficient high flow data, the District shall implement a program for developing stage-discharge relationships for larger magnitude flows.*
- C. The District shall develop estimates of channel dimensions for best establishing quasi equilibrium conditions to avoid future excessive erosion of or deposition within an active channel. These dimensions can be established using a combination of information from regional stream restoration curves, reference reach data, computation of effective discharges, shear stresses and other assessments. These estimations of active channel dimension should guide the management approaches contained in the maintenance plans and be used in implementing the maintenance activities in order to achieve more sustainable channel shapes and floodplains.*

## 1.2 Channel Assessment Work Plan

The District work plan proposed a schedule which included 2-3 channel assessments per year. The assessments were carried out to help the District identify roughness objectives, quasi equilibrium conditions, identify maintenance triggers and assist with the prioritization of maintenance prevention projects. The District limited these assessments to flood control channels that the District owns in fee title or has a maintenance agreement or easement on. The channel assessment work plan schedule is outlined below in Table 1-1.

**Table 1-1:** Channel Assessment Work Plan & Schedule

Creek	Channel Type	Assessment Schedule
Salvador Creek	Modified	2014-2015
Salvador Collector	Modified	2014-2015
Tulocay Creek	Semi-Modified	2015-2016
Camille Creek	Semi-Modified	2015-2016
Fagan Creek	Modified	2016-2017
Sheehy Creek	Modified	2016-2017
Conn Creek	Semi-Modified	2017-2018
Yountville Collector	Modified	2017-2018
Yountville Outfall	Modified	2017-2018

## 2.0 Salvador Creek Channel Assessment

The Napa County Stream Maintenance Manual divides Salvador Channel into three reaches (Reaches 1 through 3). General reach characteristics were computed for each reach using geographic information systems (GIS) methods, as summarized in Table 2-1. Reaches 1 through 3 are located between Highway 29 and Big Ranch Road. Stream crossings include two major street crossings (Jefferson Street and Trower Avenue culverts), three small private vehicular bridges, and five pedestrian bridges.

**Table 2-1:** Reach characteristics, Reaches 1 through 3, Salvador Creek.

Reach	Length (ft)	Drainage Area (mi <sup>2</sup> )	Slope (ft/ft)
1	3,750	4.71	0.0026
2	2,850	4.88	0.0027
3	3,170	5.59	0.0063

Reach slope was calculated from topographic profiles extracted from the LIDAR digital elevation model (DEM) for Napa County. There were short sections near the middle of Reaches 1 and 2 that had greater slopes, 0.0056 and 0.0080, respectively, but the lesser slope was selected for the reaches to be most conservative.

### 2.1 Channel Capacity

The Jefferson Street and Trower Avenue culverts are located approximately 200-feet apart at the downstream end of Reach 1. Of these two culverts, the one with the smallest capacity will control the discharge and establish the capacity objective for the upstream reach. The District visited the culvert sites and collected culvert dimensions, inverts, and roadway elevations, and performed analyses of the culverts using the HY-8 software developed by the Federal Highway Administration (FHWA). The analyses revealed that the Trower Avenue culvert has the smaller capacity, conveying 1,360 cubic feet per second (cfs) at the top of the inlet. Therefore, the upstream channel, Reach 1, should convey a maximum of 1,360 cfs at the top-of-bank without spilling onto its floodplain.

The channel capacity objectives for Reaches 2 and 3 were computed by increasing the capacity flow for Reach 1 proportionally by the increase in drainage area. The channel capacity objectives for Salvador Creek are listed in Table 2-2.



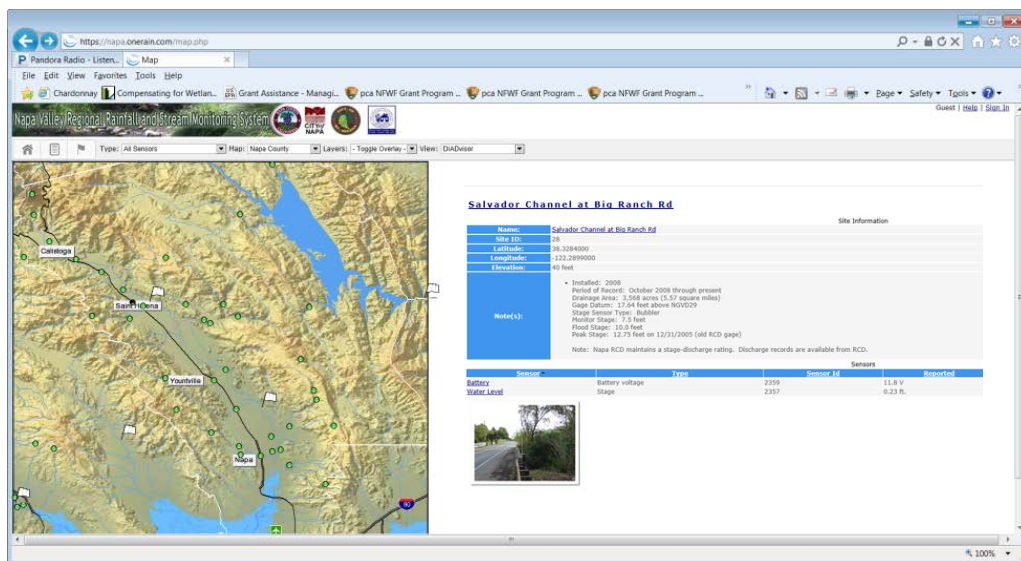
**Table 2-2:** Channel capacity objectives Salvador Creek.

Reach	Channel Capacity Objective (cfs)
1	1,360
2	1,410
3	1,610

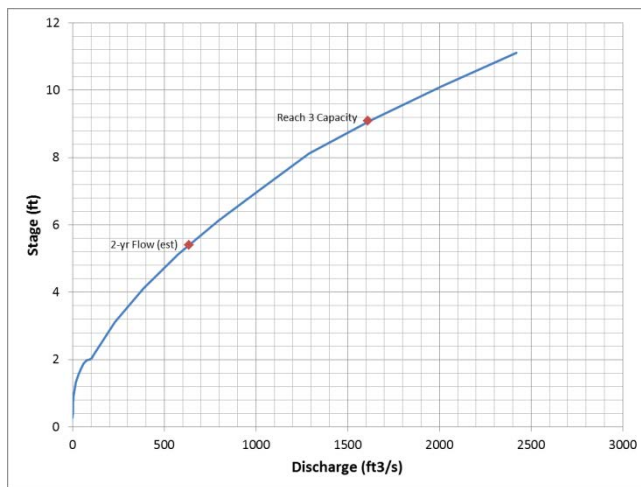
Channel capacity objectives are often reported in terms of peak-flow estimates; however, peak flows for Salvador Creek are not well understood and it is currently unknown what return period event corresponds to these capacity flows. The watershed is highly urbanized and common stormflow events such as the 1- and 2-years floods are known to nearly fill the channel. For example, the USGS regression equations, a common tool for estimating peak flows, predicts a 2-year flow of 324 cfs for Salvador Creek, but 9 of 10 years of stream gaging data collected at Station 28 have recorded flows well above that level, and indicate a 2-year flow of 635 cfs. Continued operation of Station 28 will eventually result in a more robust dataset which will help with frequency analysis of higher flows.

## 2.2 Stage-Discharge Relationships

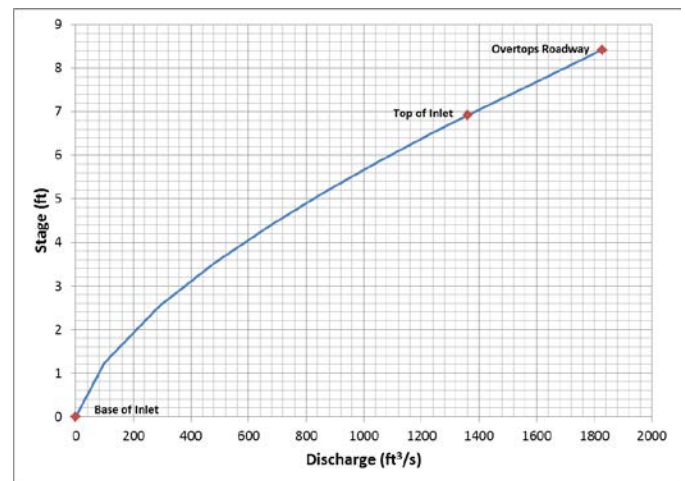
Salvador Creek at the Big Ranch Road crossing is the location of ALERT flood warning Station 28, and a stage-discharge rating for this station has been developed over the past several years. The discharge at Station 28 is a reasonable estimate of discharge for all locations in Reach 3. The Station 28 rating is included as Figure 2, and discharge data is publically available in real-time on [napa.onerain.com](https://napa.onerain.com). Water enters Reach 3 via storm drain outfalls which may give the Station 28 discharge a high bias for upstream locations.



**Figure 2-1:** Napa One Rain Stream and Rain Gauge Website



**Figure 2-2:** Stage-discharge rating for Station 28, Salvador Creek at Big Ranch Road.



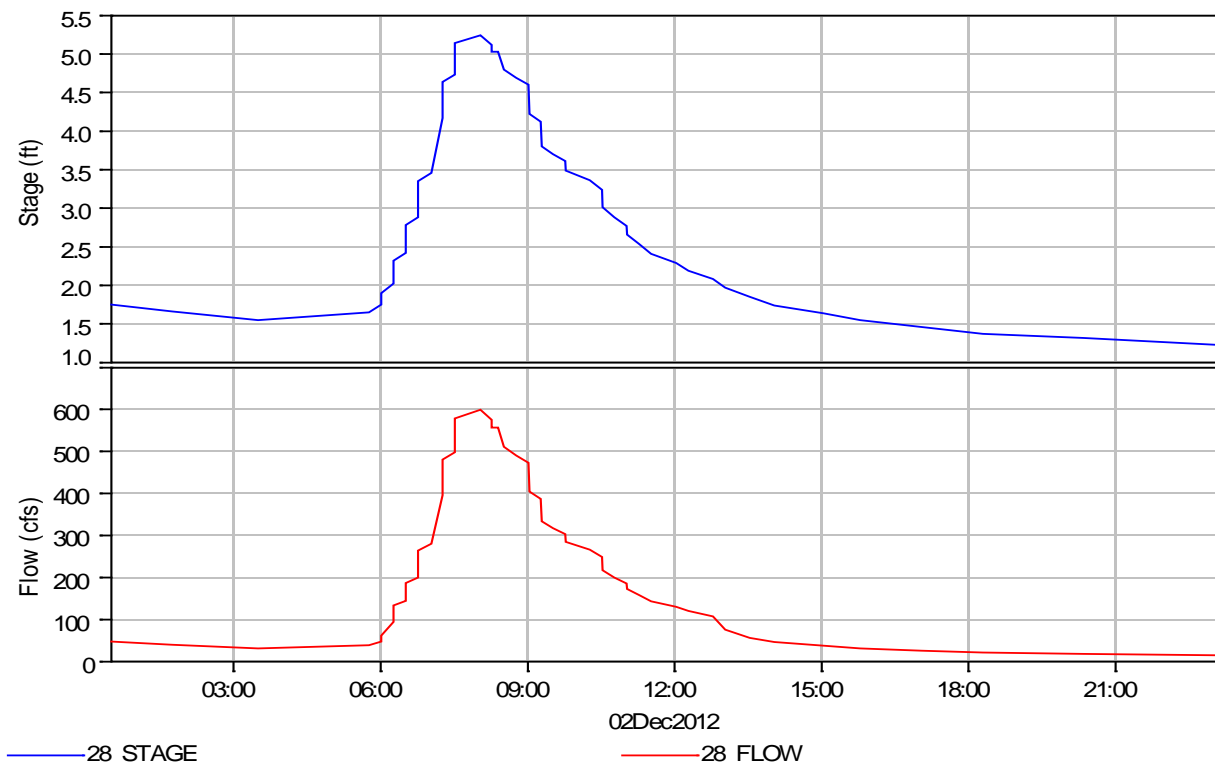
**Figure 2-3:** Stage-discharge rating for Reaches 1 and 2, Salvador Creek, HY-8 analysis of the Trower Avenue culvert.

A preliminary discharge estimate for Reaches 1 and 2 can be obtained by decreasing the flow at Station 28 proportionally by the decrease in drainage area, which is 84% for Reach 1 and 87% for Reach 2. However, although this method gives a discharge estimate, it is not tied to stage within Reaches 1 or 2 which may be helpful for guidance of channel maintenance activities. In addition, constructing and long-term operation and maintenance of a streamgaging station will not be an option for assessment of other ungaged channels in the SMP. To demonstrate how a preliminary stage-discharge relationship for a channel can be developed in a simple manner using an existing culverted crossing, a rating curve from the output of the HY-8 analysis of the Trower Avenue culvert described above (Figure 2-3).

This rating predicts discharge based on the headwater depth of the Trower Avenue culvert, and is a good estimate of discharge for other locations in the channel near the culvert. Due to the short length of the reaches, the absence of tributaries, and the small amount of additional contributing drainage area for Reach 2, this estimate is also reasonable for any location in Reaches 1 and 2 for many purposes, including guiding channel maintenance decisions. Water does enter Salvador Creek via storm drain outfalls in both reaches, which will give the Trower culvert discharge a high bias for Reach 1 locations upstream, and a low bias for Reach 2 locations.

The District will carry out high flow monitoring during winter months for all flood control channels being assessed. The high flow monitoring photos will help the District develop a more accurate understanding of channel capacity and stage discharge relationships.

**Figure 2-4:** Salvador Channel at Big Ranch Rd. (28) water level December 2, 2012



**Photo 2-1:** Trower St. bridge on 12-2-2012 at 9:34 am



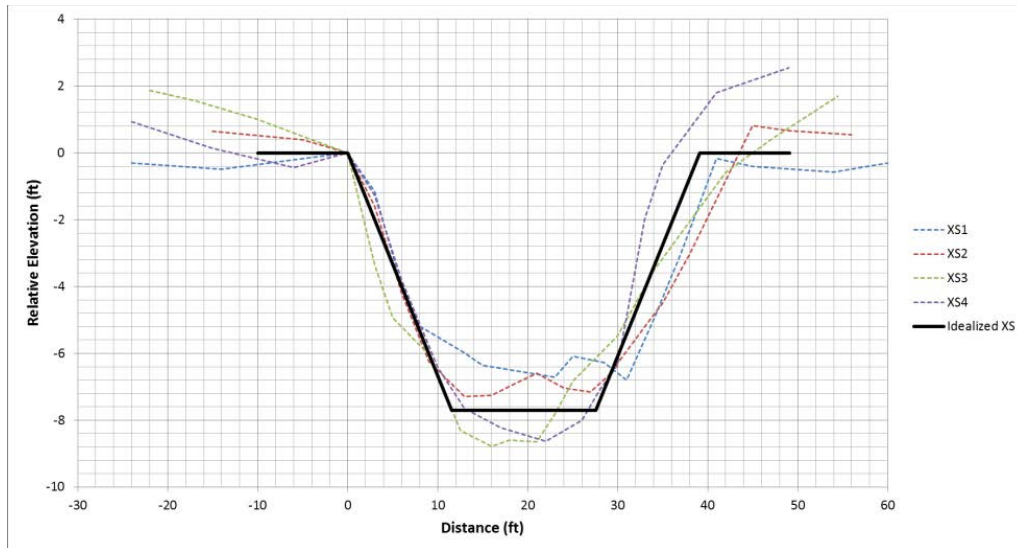
**Photo 2-2:** Byway east bridge on 12-2-2012 at 9:44 am

## 2.3 Estimates of Quasi-Equilibrium Channel Dimensions

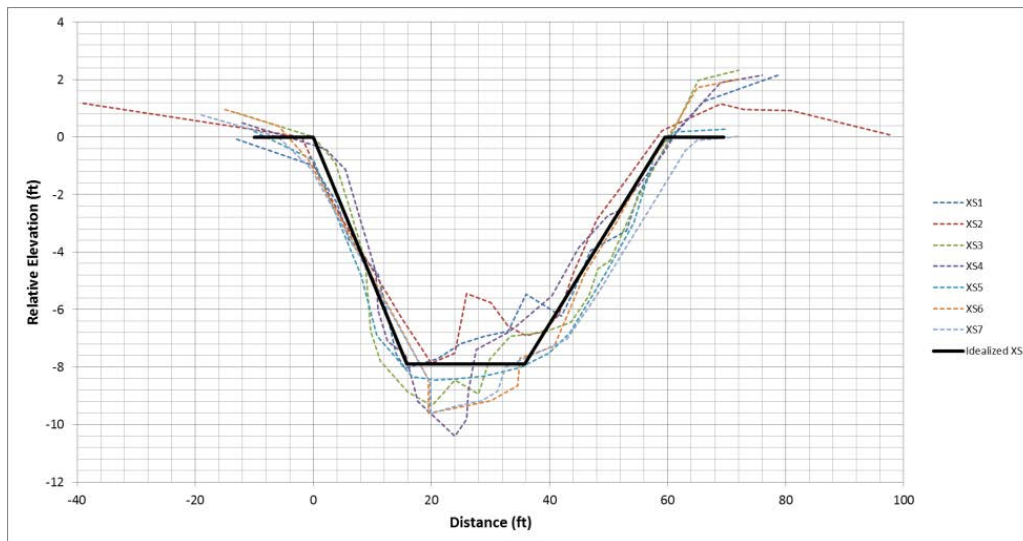
To develop estimates of quasi-equilibrium channel dimensions to avoid excessive erosion or deposition within each reach of Salvador Channel, channel cross section surveys were compiled as part of previous modeling efforts, and selected only those cross sections located in stable subreaches of the channel. These cross sections represent the channel in a quasi-equilibrium state. Cross-sectional area, bank slope, bottom width, and depth were calculated and averaged for each cross section to develop an idealized cross section for the reach. The number of cross sections used in each reach and the idealized channel dimensions are presented in Table 3. Figures 2-5 through 2-7 depict the idealized cross sections in relation to the surveyed cross sections. These ideal dimensions can be compared to cross sections measured at problem sites in the future to guide maintenance activities.

**Table 2-3:** Idealized channel dimensions, Salvador Creek.

Reach	No. of Cross Sections	Range of Cross Sectional Area (ft <sup>2</sup> )	Average Cross Sectional Area (ft <sup>2</sup> )	Idealized Channel Dimensions
1	4	192 – 231	211	<b>Shape:</b> Trapezoidal <b>Bottom width (ft):</b> 16.0 <b>Left Bank Slope (H:1V):</b> 1.5 <b>Right Bank Slope (H:1V):</b> 1.5 <b>Depth (ft):</b> 7.7 <b>Area (ft<sup>2</sup>):</b> 212
2	7	245 – 372	314	<b>Shape:</b> Trapezoidal <b>Bottom width (ft):</b> 20.0 <b>Left Bank Slope (H:1V):</b> 2.0 <b>Right Bank Slope (H:1V):</b> 3.0 <b>Depth (ft):</b> 7.9 <b>Area (ft<sup>2</sup>):</b> 314
3	3	196 – 256	222	<b>Shape:</b> Trapezoidal <b>Bottom width (ft):</b> 8.0 <b>Left Bank Slope (H:1V):</b> 1.0 <b>Right Bank Slope (H:1V):</b> 2.0 <b>Depth (ft):</b> 9.7 <b>Area (ft<sup>2</sup>):</b> 223

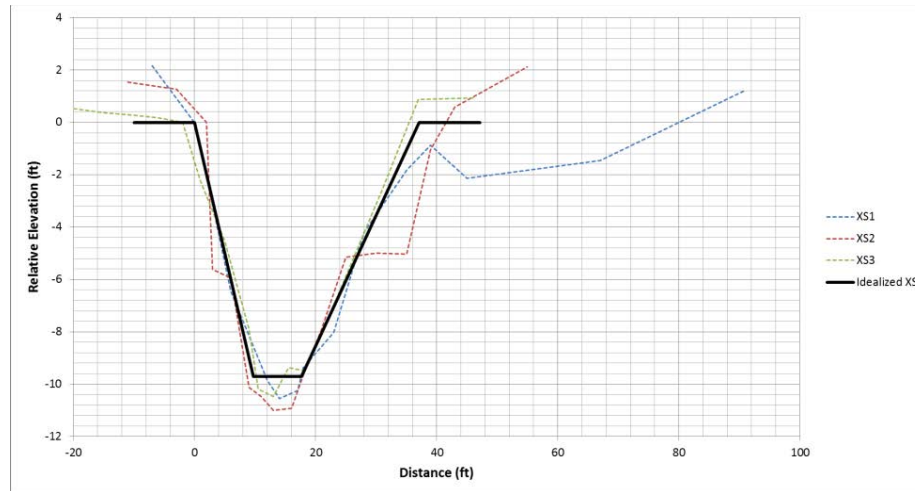


**Figure 2-5:** Reach 1 idealized cross section, Salvador Creek.



**Figure 2-6:** Reach 2 idealized cross section, Salvador Creek.





**Figure 2-7:** Reach 3 idealized cross section, Salvador Creek.

## 2.4 Channel Roughness Objectives

Since the banks of Salvador Creek are unarmored for most of its length, growth of riparian vegetation is desirable to protect against bank erosion. In addition, riparian vegetation often enhances wildlife habitat and aesthetics. However, overgrowth of riparian vegetation will increase channel roughness and therefore decrease water velocity and channel capacity according to Manning's Equation. To develop objectives for roughness to help identify excessive overgrowth and trigger maintenance to maintain channel capacity, ideal channel roughness was back calculated using Manning's Equation, the idealized cross section for the reach, the average slope of the reach, and maximum channel capacity.

*Manning's Equation:*

$$Q = \frac{1.49 A R^{\frac{2}{3}} S^{\frac{1}{2}}}{n}$$

**Q** is the discharge in cfs, **A** is the cross sectional area in square feet, **R** is the hydraulic radius in feet, **S** is the slope in ft/ft, and **n** is the unitless Manning's roughness coefficient. The input values and calculated Manning's roughness results are shown in Table 4

**Table 2-4:** Manning's equation input values and roughness results.

Reach	Q (ft <sup>3</sup> /s)	A (ft <sup>2</sup> )	R (ft)	S (ft/ft)	n
1	1,360	212	4.85	0.0026	<b>0.034</b>
2	1,410	314	5.01	0.0027	<b>0.050</b>
3	1,610	223	5.07	0.0063	<b>0.047</b>

For these calculations, RCD uses the slope of the streambed instead of the water surface slope, which is called for by Manning's Equation, but unknown for this channel. However, these calculations are being performed for very high channel capacity flows where water surface slope approaches the bed slope. It is common to use bed slope as an estimate of water surface slope. Slope values and roughness objectives could be refined in the future with high-water mark surveys performed following a large event.

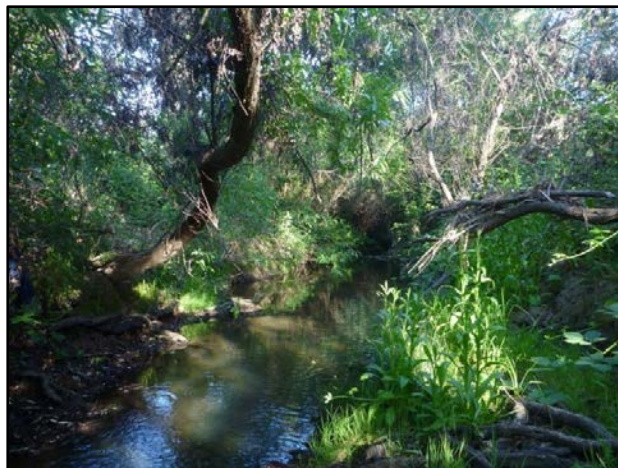
These  $n$  values are estimates of the maximum channel roughness in each reach that will convey the channel capacity flow through the idealized cross section, and represent the roughness objectives for the reaches. RCD collected photographs of the three reaches to depict current roughness conditions for comparison to the roughness objectives. Photos 2-3, 2-4, and 2-5 show roughness conditions that are representative of Reaches 1, 2, and 3, respectively. Roughness estimates for each reach are provided in the figure captions.



**Photo 2-3:** Reach 1 looking upstream showing channel roughness.  $n=0.030-0.040$



**Photo 2-4:** Reach 2 looking downstream showing channel roughness.  $n=0.030-0.040$



**Photo 2-5:** Reach 3 looking downstream showing channel roughness.  $n=0.040-0.050$

### 3.0 Tulucay Creek Channel Assessment

Tulucay Creek is tributary of the Napa River that drains a 12.75 square mile watershed. It has several named tributaries including Camille Creek, Kreuse Creek, Spencer Creek, and Murphy Creek. The maintained reaches of Tulucay Creek are located in the urbanized areas at the outlet of the watershed. Reach 1 begins at Twin Creeks Court and ends 1,620 feet downstream at the Soscol Avenue bridge. Camille Creek enters Tulucay Creek from the southeast in the approximate middle of Reach 1. The tops of both stream banks in Reach 1 are closely lined with residential and commercial structures. Reach 2 begins at the Soscol Avenue bridge and ends 1,980 feet downstream at the railroad bridge. Reach 2 has been leveed to constrain high flows to the channel and reclaim adjacent land, which is currently mostly vacant, but zoned for commercial use.

Significant previous work, including a HEC-RAS hydraulic model, is available for Tulucay Creek. The model was originally developed for a FEMA map revision, and subsequently updated by WEST Consultants, Inc. in 2013 to inform the design of a proposed pedestrian bridge. The model was constructed using 23 cross sections that span the entirety of Reaches 1 and 2.

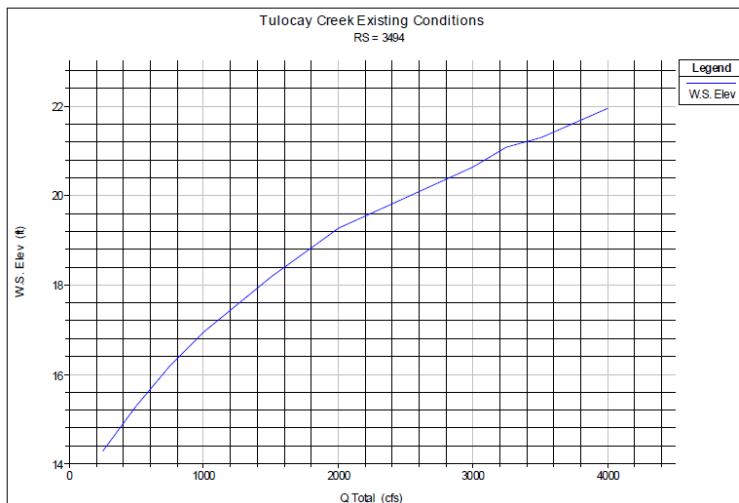
#### 3.1 Channel Capacity and Stage-Discharge Relationships

Ideally, in an urban or residential setting, stream channels and crossing structures should be sized and maintained to safely convey the 1% chance exceedance discharge, also called the 100-year peak flood event (Q100). Although some stream discharge monitoring has been conducted in the Tulucay Creek watershed, the resulting data are insufficient for statistical analysis that would produce a high-confidence Q100 value.

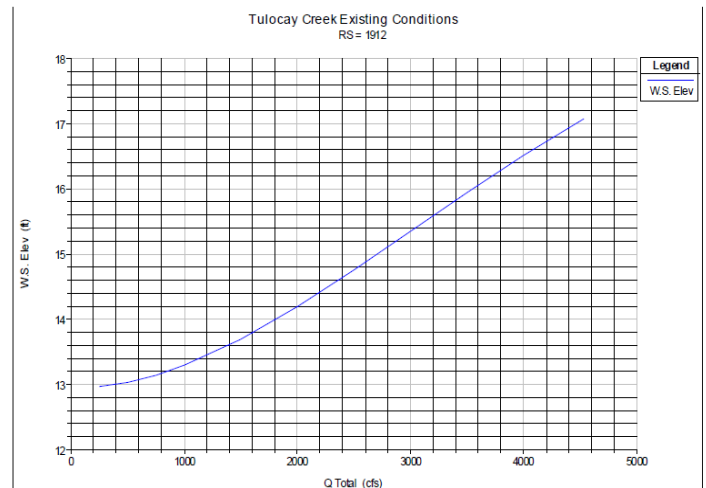
However, indirect methods have produced estimates over the years, and the current estimate of 4,530 cfs has been accepted by FCWCD and the Army Corp of Engineers.

Since the Q100 estimate has been revised upward in recent years, the channel was designed and constructed to convey a lesser discharge; therefore, the Q100 is not an appropriate channel capacity objective. At the request of FCWCD, WEST computed channel capacities of both reaches of Tulucay Creek using the HEC-RAS model. The capacity of the upper portion of Reach 1, and all of Reach 2, was determined to be approximately 3,500 cfs; however, at this flow, the model indicates overtopping of the left bank of the channel in the lower portion of Reach 1, just upstream of the Soscol Avenue bridge. The estimated capacity of this subreach of Reach 1, according to the model, is approximately 1,000 cfs, but there appears to be potential accuracy issues at this location in the model due to incomplete representation of a flood wall along the south bank. Since the true capacity of this subreach is unknown, RCD recommends setting the channel capacity objective for stream maintenance purposes for the entirety of Reaches 1 and 2 at 3,500 cfs.

The HEC-RAS analysis was also used to generate stage-discharge ratings for both reaches (Figures 1 and 2). Ratings are associated with a particular cross section location on a stream, so RCD selected cross sections from the model that represented the reach. For Reach 1, RCD selected the downstream-most cross section that was above the poorly-represented “flood wall” subreach described above. For Reach 2, RCD selected a cross section near the top of the reach which represents the minimum capacity of the channel.



**Figure 3-1:** Stage-discharge rating for Tulucay Creek Reach 1, obtained from HEC-RAS analysis.



**Figure 3-2:** Stage-discharge rating for Tulucay Creek Reach 1, obtained from HEC-RAS analysis.

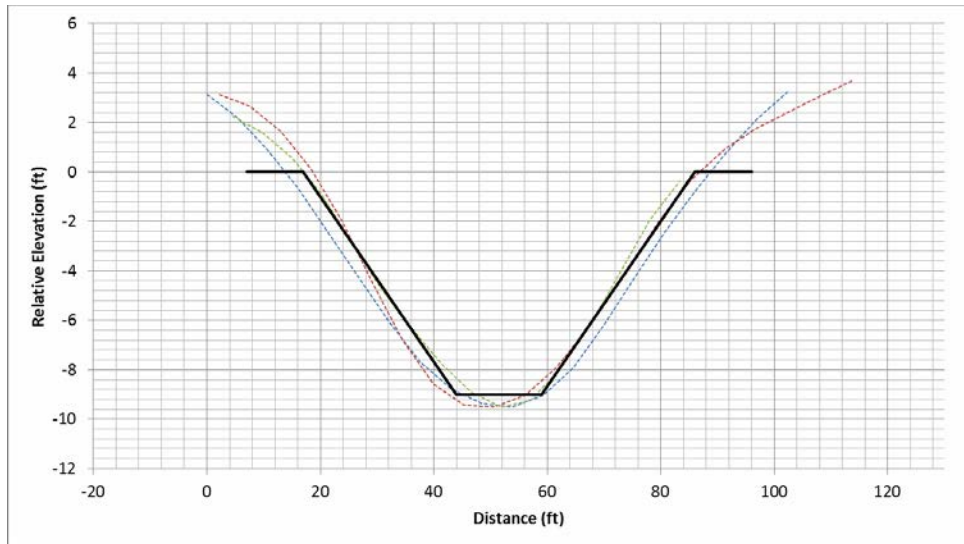
### 3.2 Estimates of Quasi-Equilibrium Channel Dimensions

The HEC-RAS model was built with many cross sections of Tulucay Creek, including 8 in Reach 1 and 9 in Reach

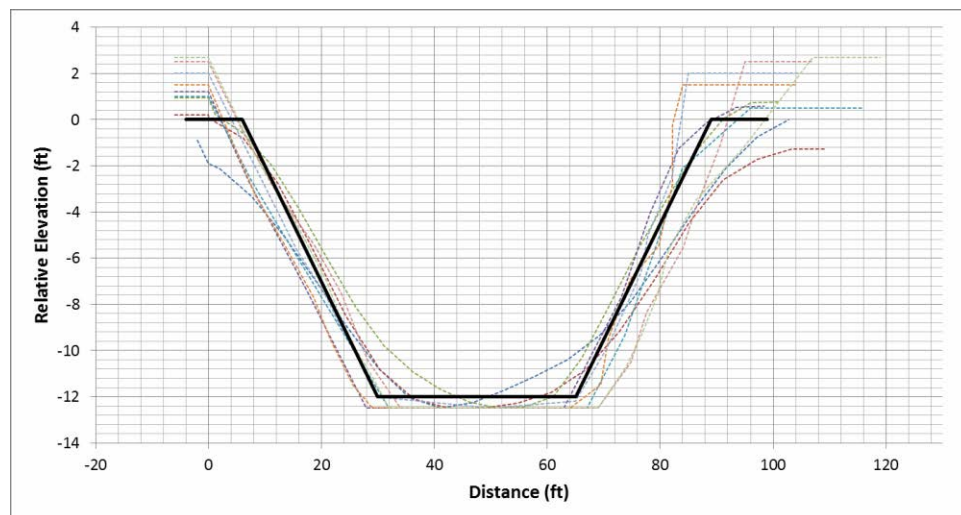
2. RCD overlaid the cross sections for each reach and fit idealized trapezoidal cross sections to the plot (Figures 3-3 and 3-4). The 5 downstream-most cross sections in Reach 1 were omitted due to incomplete representation of a flood wall in this area. These idealized cross sections depict the average channel dimensions, and since the channels appear to be stable based on visual assessment, they also represent the channel in a quasi-equilibrium state. The idealized channel dimensions are summarized in Table 3-1.

**Table 3-1:** Idealized channel dimensions, Tulucay Creek.

Idealized Channel Dimensions		
Reach	Reach 1	Reach 2
Shape	Trapezoidal	Trapezoidal
Bottom Width (ft)	15	35
Left Bank Slope (H:1V)	3	2
Right Bank Slope (H:1V)	3	2
Depth (ft)	9.0	12.0
Area (ft <sup>2</sup> )	378	708



**Figure 3-3 :** Idealized cross section, Tulucay Creek Reach 1, based on measured cross sections.



**Figure 3-4:** Idealized cross section, Tulucay Creek Reach 2, based on measured cross sections.

### 3.3 Channel Roughness

Since the banks of Tulucay Creek are unarmored for most of its length, and the surrounding land is developed or zoned for future development, right up to the top-of-bank, growth of riparian vegetation is necessary to protect against bank and levee erosion. In addition, riparian vegetation enhances wildlife habitat and aesthetics. However, overgrowth of riparian vegetation will increase channel roughness and therefore decrease water velocity and channel capacity according to Manning's Equation.



RCD conducted a visual assessment of roughness in Tulucay Creek Reaches 1 and 2, collected photographs, and estimated Manning's roughness coefficients. Photos 3-1 through 3-4 depict roughness conditions representative of each reach. Estimated Manning's roughness coefficients are provided in the figure captions.



**Photo 3-1:** The upstream portion of Tulucay Creek Reach 1, looking downstream, showing channel roughness and inundation from beaver activity.  $n=0.04-0.05$



**Photo 3-2:** The downstream portion of Tulucay Creek Reach 1 looking downstream showing channel roughness and inundation from beaver activity.  $n=0.04-0.05$

As evident from Figures 1 and 2, Reach 1 has been completely inundated with backwater from a beaver dam located just upstream of the Soscol Avenue bridge. Beavers are common in the Napa River system and seem to be increasing in population. In general, local beaver activity is not known to lead to significant channel capacity decreases and potential stream flooding issues due to the large size and intensity of local winter storm flows, which tend to wash out the dams on an annual basis; however, this particular dam appears to be quite resilient. It seems to have withstood a medium-size flow on December 11, 2014, estimated (roughly) at approximately 800 cfs, with little damage, or at least in a condition in which it could be quickly repaired. It is still assumed that larger flows would wash out beaver dams and restore full channel capacity.



**Photo 3-3:** Tulucay Creek Reach 2 looking downstream from Soscol Avenue bridge showing channel roughness.  $n=0.1-0.15$



**Photo 3-4:** Tulucay Creek Reach 2 looking upstream from the railroad bridge at the downstream boundary of the reach, showing channel roughness.  $n=0.04-0.045$

RCD's selection of Manning's Roughness Coefficients for Reach 1 ( $n=0.04$  to  $0.05$ ) closely agree with those used by WEST in the HEC-RAS analysis ( $n=0.045$ ). Since the analysis indicated that the reach will convey the channel capacity objective flow under these roughness conditions, the channel roughness objective for Reach 1 should be set at  $0.045$ .

RCD's selection of roughness coefficients for Reach 2 ( $n=0.04$  to  $0.15$ ) agree with those used by WEST in the HEC-RAS analysis ( $n=0.04$ ) except in the upper portion of the reach. Overgrowth in this area (Figure 3) is likely recent and due to extended drought conditions, and RCD recommends active clearing be considered to reduce roughness and maintain channel capacity. Regardless, the HEC-RAS analysis indicates that a Manning's Roughness Coefficient of  $0.04$  is required to achieve the channel capacity objective, and therefore, the channel roughness objective for Reach 2 should be set at  $0.04$ .

### 3.4 Tulucay Creek Channel Assessment Summary

Visual assessment of Tulucay Creek Maintenance Reaches 1 and 2 indicates that the channel is in a quasi-equilibrium condition. RCD compiled several channel cross sections measured throughout the reach as part of a previous HEC-RAS analysis, and defined idealized channel dimensions for each reach that should be maintained in order to preserve channel capacity. HEC-RAS analysis used weighted Manning's roughness coefficients of  $0.045$  and  $0.040$  for Reaches 1 and 2, respectively, and indicated a maximum channel capacity of  $3,500$  cfs under these conditions. RCD considers these values to be reasonable and should be used as the roughness and capacity objectives for the reaches; however, visual assessment of the upper portion of Reach 2 revealed increased roughness due to vegetation overgrowth and active clearing should be considered in this area to maintain channel maintenance objectives. The HEC-RAS analysis also provided stage-discharge relationships for both reaches.

**Table 3-2:** Tulucay Creek Channel Maintenance Objectives

Channel Characteristic	Tulucay Creek Reach 1	Tulucay Creek Reach 2
Capacity	Maintain channel to convey a flow of $3,500$ cfs.	Maintain channel to convey a flow of $3,500$ cfs.
Quasi-Equilibrium Dimensions	Maintain bank slopes of approximately $3H:1V$ . Maintain an approximate minimum cross sectional area of $380$ ft <sup>2</sup> at the top-of-bank.	Maintain bank slopes of approximately $2H:1V$ . Maintain an approximate minimum cross sectional area of $700$ ft <sup>2</sup> at the top-of-bank.
Roughness	Maintain overall channel roughness of $0.045$ as shown in Figures 5 and 6.	Maintain overall channel roughness of $0.04$ as shown in Figure 8.

## 4.0 Camille Creek Channel Assessment

Camille Creek, also called Cayetano Creek or Marie Creek, is a tributary of Tulucay Creek that drains a 3.13 square mile area, 25% of the Tulucay Creek watershed. The maintained reach of Camille Creek begins at the South Terrace Drive culvert and ends 1,250 feet downstream where it empties into Tulucay Creek in the approximate middle of Reach 1. The tops of both stream banks in the reach are closely lined with residential structures. RCD is not aware of previous hydraulic analyses or discharge monitoring efforts for Camille Creek.

### 4.1 Channel Capacity and Stage-Discharge Relationships

To develop a channel capacity objective for the reach, RCD first determined the maximum capacity of the South Terrace Drive culvert. Stream crossing structures, especially culverts, are often the most constricted points in a reach; and therefore the maximum discharge conveyed by these structures often represents a suitable capacity objective for the reach.

During June 2015, RCD measured the dimensions of the South Terrace Drive culvert, recorded the inlet configuration, surveyed the inlet and outlet elevations, and measured a channel cross section at the tailwater control with a theodolite and stadia rod relative to NGVD29 (City of Napa Benchmark 87-A). These data were input into HY-8, a culvert analysis program developed by the Federal Highway Administration (FHWA). HY-8 analysis input data and results are provided as an attachment to this memorandum. The results of the analysis indicate that the capacity of the culvert is 695 cfs at the top of the inlet, and 815 cfs at the point at which it overtops and spills onto the roadway. The analysis also generated a stage-discharge rating for the culvert that will predict discharge based on headwater elevation. The rating is provided and discussed below.

The Camille Creek watershed is an ungaged basin and therefore the Q100 is not known. RCD estimated the Q100 by adjusting the current Q100 estimate for Tulucay Creek (4,530 cfs) based on drainage area according the following equation:

$$Q_u = Q_g \left( \frac{A_u}{A_g} \right)^{0.87}$$

where  $Q_u$  is the discharge for the ungaged site,  $Q_g$  is the discharge for the gaged site,  $A_u$  is the drainage area of the ungaged site, and  $A_g$  is the drainage area of the gaged site. This adjustment method is described in the June 1977 USGS report *Magnitude and Frequency of Floods in California* by A.O. Waananen and J.R. Crippen. This method results in a Q100 estimate for Camille Creek of 1,350 cfs.

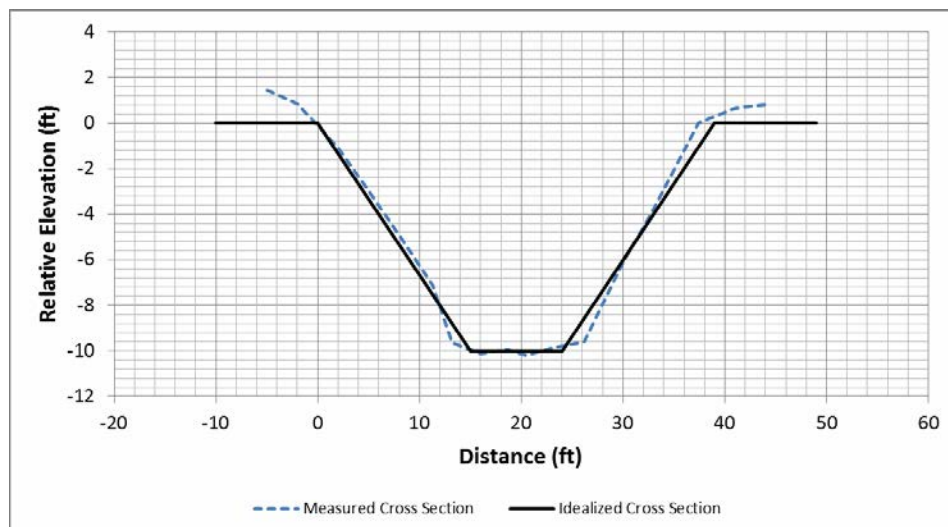
It should be noted that this estimate is based on previous work done for Tulucay Creek, which is also an estimate based on indirect methods, and there may be significant error associated with the Q100 estimates for both creeks. For comparison purposes, RCD computed a second estimate of the Camille Creek Q100 using USGS's National Streamflow Statistics (NSS) program, which uses regional flood-frequency regression equations. Based on drainage area and mean annual precipitation, NSS predicts a Q100 of 800 cfs for Camille Creek. For this assessment, RCD selected the greater value of 1,350 cfs as the estimated Q100 because it has a local basis and is more conservative.

Comparison of the culvert capacity to the Q100 reveals that the culvert would be overtopped

should this flow occur. In this case, the culvert capacity is not a suitable objective for the reach and the capacity of the channel itself must be estimated and compared to the Q100. To do this, RCD began with a visual assessment of the reach to evaluate channel shape and condition. The channel is incised but appears to have stabilized.

Significant areas of erosion and/or deposition were not observed. The streambanks are not armored but are generally well vegetated. The reach does not maintain a consistent shape along its length. In the downstream direction, the stream banks become lower and shallower. A stable location in the most-contracted subreach of the creek was selected for measurement of a cross section. A stable location was selected because this indicates that it represents the channel in a quasi-equilibrium state. The most-contracted subreach, with the smallest cross-sectional area, was selected because it will control the capacity.

RCD measured the cross section by stretching a tape between the tops of the banks perpendicular to the channel centerline. Elevations were measured with a theodolite and stadia rod relative to NGVD29. The measured cross section was plotted and an idealized cross section was fit to the plot (Figure 4-1). This idealized cross section represents the most-contracted, yet stable, configuration of the channel. The capacity of the actual channel, which widens downstream, will be greater.



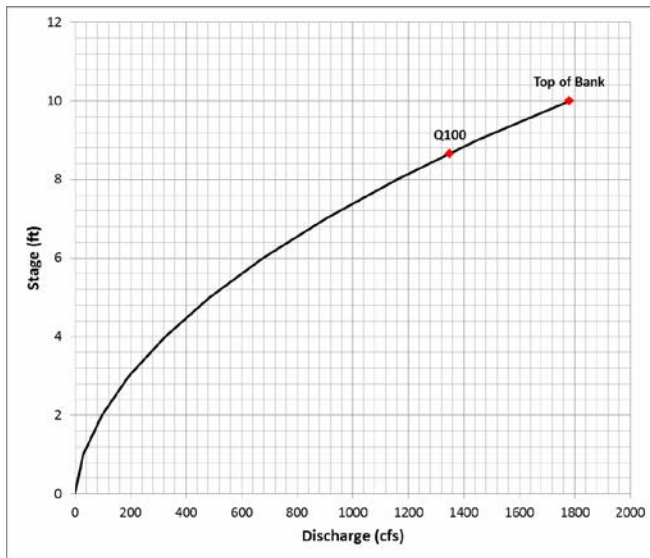
**Figure 4-1:** Idealized cross section, Camille Creek, based on a measured cross section at a carefully selected location.

RCD performed a channel analysis using the idealized cross section, the bed slope of the reach, roughness estimates, and Manning's Equation. The analysis resulted in a general stage-discharge relationship, or rating, for the reach. The stage-discharge rating is shown in Figure 4-2.

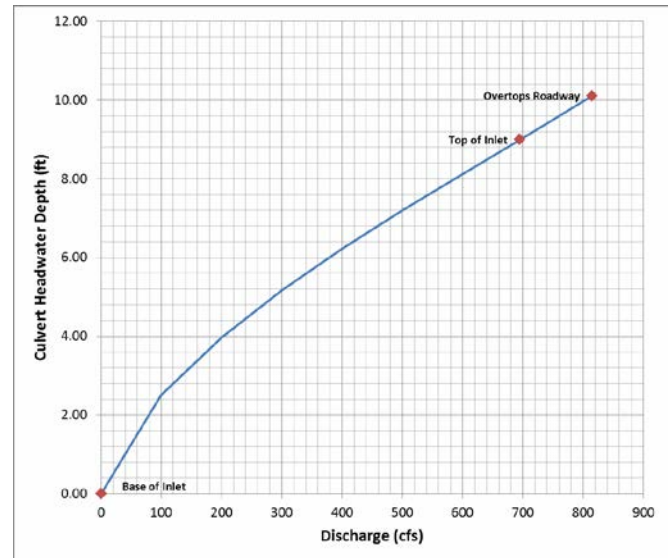
The rating indicates that the capacity of the channel is 1,780 cfs at the top of bank. Although there is a wide margin of error associated with this result, it is well above the Q100, indicating that the channel, even at its narrowest location, will safely convey the Q100. It should be noted that HY-8 analysis of the South Terrace Drive culvert indicates roadway flooding and culvert inundation at this flow. In addition, although the channel should contain and convey the Camille Creek Q100, in an extreme high-water scenario, backwater from Tulucay Creek may cause flooding in the lower part of the reach.



This rating, though useful for estimating channel capacity and specifically for comparison of channel capacity to the Q100, is based on generalizations and applies to the reach as a whole, not to stage at a specific location. To estimate the discharge associated with an observed stage in the reach, the headwater elevation to discharge rating from the HY-8 analysis of the South Terrace Drive culvert is provided as Figure 4-3. This rating predicts discharge based on the headwater depth of the South Terrace Drive culvert. Due to the short length of the reach, the absence of tributaries, and the small amount of additional contributing drainage area, this estimate is also applicable to any location in the maintained reach for many purposes, including guiding channel maintenance decisions.



**Figure 4-2:** Stage-discharge rating for Camille Creek, obtained from channel analysis using idealized cross section.



**Figure 4-3:** Headwater depth – discharge rating for South Terrace Drive culvert, obtained from HY-8 analysis.

## 4.2 Estimates of Quasi-Equilibrium Channel Dimensions

The idealized cross section constructed to estimate channel capacity represents the channel at a quasi- equilibrium condition, yet at its most susceptible to potential change because it has the steepest bank slopes and experiences the highest velocities due to its having the minimum cross-sectional area in the reach.

Therefore, the dimensions of this cross section represent the extremes that should not be exceeded in any subreach, and therefore comparison of future channel conditions to these dimensions can indicate a problem and guide channel maintenance activities. Cross-sectional area, bank slope, bottom width, and depth were calculated to develop idealized channel dimensions for the reach (Table 4-1).



**Table 4-1:** Idealized channel dimensions, Camille Creek

Idealized Channel Dimensions	
Shape	Trapezoidal
Bottom width (ft)	9
Left Bank Slope (H:1V)	1.5
Right Bank Slope (H:1V)	1.5
Depth (ft)	10.0
Area (ft <sup>2</sup> ):	240

### 4.3 Channel Roughness

Since the banks of Camille Creek are unarmored for most of its length, and the surrounding land is developed right up to the top-of-bank, growth of riparian vegetation is necessary to protect against bank erosion. In addition, riparian vegetation enhances wildlife habitat and aesthetics. However, overgrowth of riparian vegetation will increase channel roughness and therefore decrease water velocity and channel capacity according to Manning's Equation.

Based on visual assessment of the maintenance reach of Camille Creek, RCD estimates the Manning's Roughness Coefficient of the active scour channel and the stream bank slopes to be 0.04 and 0.1, respectively. When composited using the Lotter Method, this equates to an overall channel roughness of approximately

0.05 at all high stages. Roughness coefficients were selected based on reference documents provided by USGS and others, and on local experience and professional judgement. A photograph depicting the typical roughness conditions of the maintained reach of Camille Creek is provided as Photo 4-1.

RCD considers the current condition of the channel to be stable and in a quasi-equilibrium state, and analysis reveals that the most-confined portion of the reach will convey the Q100 under the current roughness conditions. Therefore, the current roughness conditions should be maintained to ensure continued conveyance of the Q100, and the Channel Roughness Objective should be set at 0.05



**Photo 4-1:** Camille Creek looking downstream showing channel roughness. RCD selected an overall Manning's Roughness Coefficient of 0.05 for the reach.

## 4.4 Camille Creek Channel Assessment Summary

Visual assessment of the maintained reach of Camille Creek indicates that the channel is currently in a quasi- equilibrium condition, and capacity analyses indicate that the channel will currently convey the 100-year peak flood event, although overtopping and roadway flooding at the South Terrace Drive culvert is expected to occur at this flow. Therefore, current channel dimensions and roughness conditions should be maintained in the future to maintain adequate channel capacity. Stage-discharge relationships were estimated for Camille Creek, and discharges up to approximately 800 cfs can be estimated in the field by measuring headwater depth at the South Terrace Drive culvert. Channel maintenance objectives for Camille Creek and both reaches of Tulucay Creek are summarized in Table 4-2.

**Table 4-2:** Tulucay Creek Channel Maintenance Objectives

Channel Characteristic	Camille Creek
Capacity	Maintain channel to convey the 1% chance exceedance flow (100-year peak flood event) of 1,350 cfs.
Quasi-Equilibrium Dimensions	Maintain bank slopes of 1.5H:1V or shallower. Maintain a minimum cross sectional area of 240 ft <sup>2</sup> at the top-of-bank.
Roughness	Maintain overall channel roughness of 0.05 as shown in Figure 12.

## 5.0 Fagan Creek Channel Assessment

Fagan Creek is a tributary of the Napa River that drains a 6.56 square mile watershed and empties into Fagan Slough, a tidal slough in the Napa River marshes. Land use in the upper watershed is mostly grassland with small areas of riparian forest. The lower watershed is developed with vineyards, a golf course, an industrial park, and an airport. The maintained reach of Fagan Creek is located at the outlet of the watershed. The reach begins at the railroad tracks and continues as an open channel for 3,400 feet where it enters a 1,300-foot culverted section that carries flow beneath an airport runway, and followed again by a short reach of open channel before discharging to Fagan Slough (Figure 5-1). The tops of both stream banks in the reach are closely lined with industrial and airport developments. The channel, except for the culverted portion, is mostly grass-lined and devoid of overstory. RCD is not aware of previous hydraulic analyses or discharge monitoring efforts for Fagan Creek.



Figure 5- 1: Map of maintained reach of Fagan Creek

### 5.1 Peak Flow Estimates

Ideally, in a developed setting, stream channels and crossing structures should be sized and maintained to safely convey the 1% chance exceedance discharge, also called the 100-year peak flood event (Q100). The Fagan Creek watershed is an ungaged basin and therefore the Q100 is not known. To estimate the Q100, RCD analyzed the Fagan Creek watershed using USGS's National Streamflow Statistics (NSS) program, which uses regional flood-frequency regression equations based on drainage area and mean annual precipitation. The drainage area of 6.56 square miles at the outlet of the creek was measured using the Napa County GIS watershed layer. The mean annual precipitation of 24.6 inches was obtained for the approximate centroid of the watershed from the Prism Climate Group's 30-Year Normals (1981-2010) dataset. The NSS peak flow estimates for Fagan Creek are listed in Table 5-1. The Q100 estimate for the outlet of Fagan Creek is 1,470 cubic feet per second (cfs).

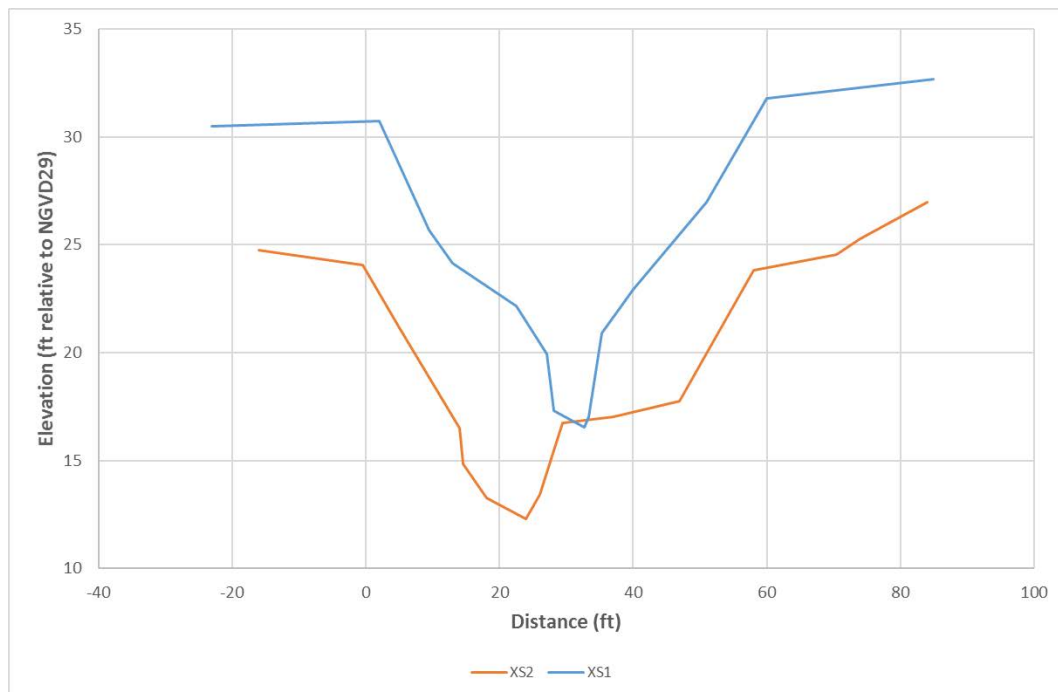
**Table 5-1:** Peak streamflow estimates for Fagan Creek

Annual Exceedance Probability	Recurrence Interval (yrs)	Discharge Estimate (cfs)
0.5	2	232
0.2	5	510
0.1	10	720
0.04	25	1,010
0.02	50	1,230
0.01	100	1,470

## 5.2 Channel Assessment

Prior to a field visit, RCD completed a GIS analysis to measure drainage area, reach lengths, culvert and structure lengths, and channel slope. RCD also examined historical aerial photos to identify potential significant changes to the channel.

RCD visited the maintained reach of Fagan Creek in July 2016 and surveyed two channel cross sections (XS1 and XS2) at locations carefully selected to represent each respective subreach. The cross sections are shown in Figure 5-2. Surveying was performed with a theodolite and stadia rod relative to NGVD29 (Napa County benchmark A-C). Lateral distance was measured with a tape. RCD surveyed the configurations of stream crossings and other structures in the reach. Structures included the Airport Road bridge, a concrete grade-control weir, and the 1,300-foot runway culvert. RCD also performed a visual assessment of the bed and banks and collected data for an assessment of roughness conditions in the channel.



**Figure 5-2** Fagan Creek channel cross sections XS1 and XS2, shown looking downstream.



Immediately apparent was a trench-like low-flow channel running along the bottom of the main channel from the upstream end of the reach to the inlet of the runway culvert. The depth of the trench ranges from approximately 5 feet at the upstream end to near zero, and is present on both sides of the grade-control weir. Assuming the channel was originally constructed with a trapezoidal cross-sectional shape, this trench feature may be evidence of an erosional adjustment of the channel. Air photo review reveals that this feature existed in similar condition at least as far back as 2002, which would indicate that it has stabilized. Deposition of sediment on the streambed was only apparent in the immediate upstream vicinity of the grade-control weir, and appeared to be minor. The stream banks appear to be stable and in good condition.

The Airport Road bridge has vertical concrete abutments and a straight horizontal deck with no center pier, and resembles a large box culvert in shape although it has a natural channel bottom. The grade-control weir is located 250 feet downstream of the bridge, and is assumed to have been installed to help stabilize the channel and protect the bridge abutments. The weir controls the stage of the pool beneath the bridge. The runway culvert inlet is 870 feet downstream of the weir. Beaver activity downstream of the outlet of the culvert has backwatered the channel through the entire length of the culvert and for several hundred feet upstream. This can be expected to affect culvert capacity to an unknown degree if these conditions persist during the storm flow season.

RCD estimates roughness by visually assessing and photographing channel conditions, and then employing the procedure outlined in *Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains* (USGS 1989). For the maintained reach of Fagan Creek, RCD noted firm soil substrate, low irregularity, gradual variation in cross section, negligible obstructions, low degree of meandering, and medium to large amounts of vegetation. Figures 5-1 through 5-3 depict roughness conditions in the reach.



**Photo 5-1:** The upstream portion of the Fagan Creek maintenance reach, looking obliquely upstream from the right bank, showing channel roughness.



**Photo 5-2:** The upstream portion of the Fagan Creek maintenance reach, looking obliquely upstream from the right bank, showing channel roughness.





**Photo 5-3:** Fagan Creek maintenance reach, looking upstream from the inlet of the runway culvert, showing channel roughness.

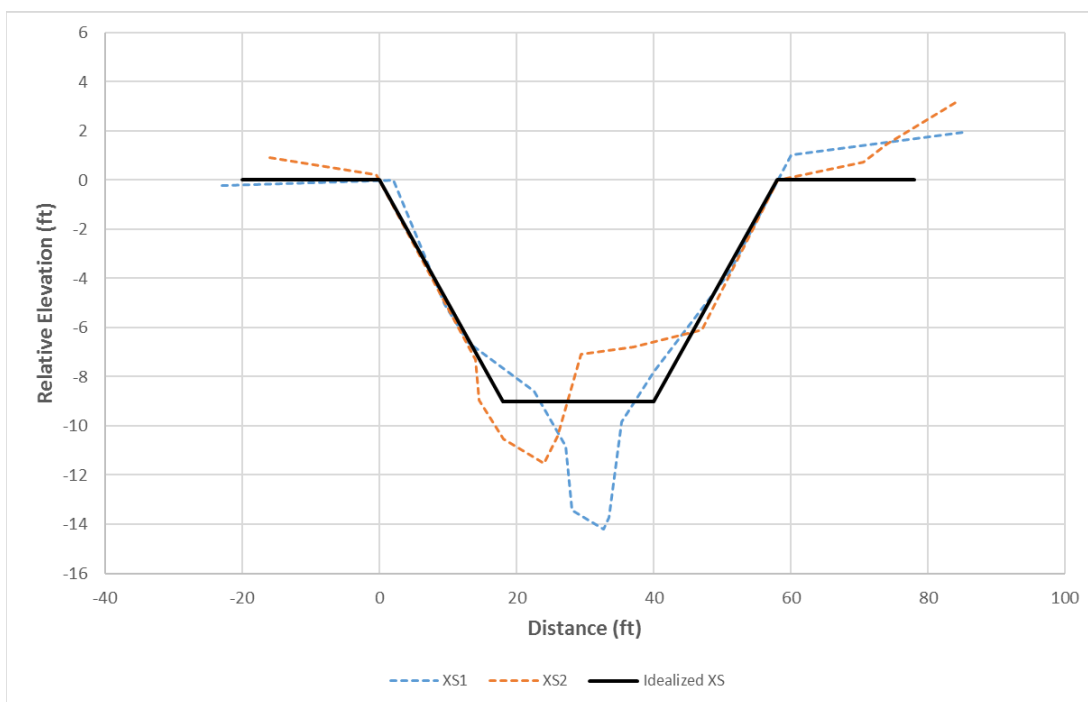
Data collected in the field were used to compute channel dimensions and channel and structure capacities. RCD analyzed the channel and crossing structures with software developed by the Federal Highways Administration (FHWA), Hydraulic Toolbox and HY-8. The Airport Road bridge has many similarities to a box culvert in hydraulic function and was modeled as a box culvert in order to use the simple analysis tools included in the scope of this assessment. The actual capacity of the bridge should be greater than the computed result. Due to inundation at the outlet of the runway culvert from beaver activity, RCD was unable to collect tailwater survey data. The capacity analysis for the runway culvert assumes inlet control and no backwatering from the beaver dam, which may or may not be the condition during the storm season. The results of channel and structure analyses are summarized in Table 5-2.

**Table 5-2.** Results of Fagan Creek stream channel assessment. Culvert capacities shown are for headwater elevation at the top of the inlet. The overtopping capacity of the runway culvert is included in parentheses.

Parameter	Result
Channel Slope (ft/ft)	0.003
Left Bank Slope (H:1V)	2
Right Bank Slope (H:1V)	2
Channel Depth (ft)	9 – 15
Cross Sectional Area (ft <sup>2</sup> )	360 – 382
Manning's Roughness Estimate	0.05
Channel Capacities (cfs)	
XS1	2,020
XS2	1,820
Airport Rd Bridge	1,965
Grade-Control Weir	1,875
Runway Culvert	926 (Overtopping 1,100)

## 5.3 Channel Dimension Objectives

The channel assessment identified a low-flow trench in the bottom of the channel of the maintained reach of Fagan Creek that appeared to have been created by erosion. The banks of the channel appeared to be well-vegetated and stable. A review of historical air photos indicated that the trench existed in similar condition in 2002, indicating that erosion of the streambed has stabilized since channel construction. Therefore, the current dimensions of the channel, and not the original dimensions, should be maintained. To determine objectives for channel dimensions, RCD used the approximate bank slopes from cross sections XS1 and XS2 and computed the required width and depth of an idealized trapezoidal channel that would convey the Q100 under current roughness conditions and channel slope (Figure 5-2). The dimensions of this idealized channel cross section were used to set the channel dimension objectives (Table 5-3).



**Figure 5-3:** Idealized trapezoidal channel cross section for the maintained reach of Fagan Creek, overlaid on cross sections XS1 and XS2, shown looking downstream.

**Table 5-3:** Channel Dimension Objectives for the maintained reach of Fagan Creek.

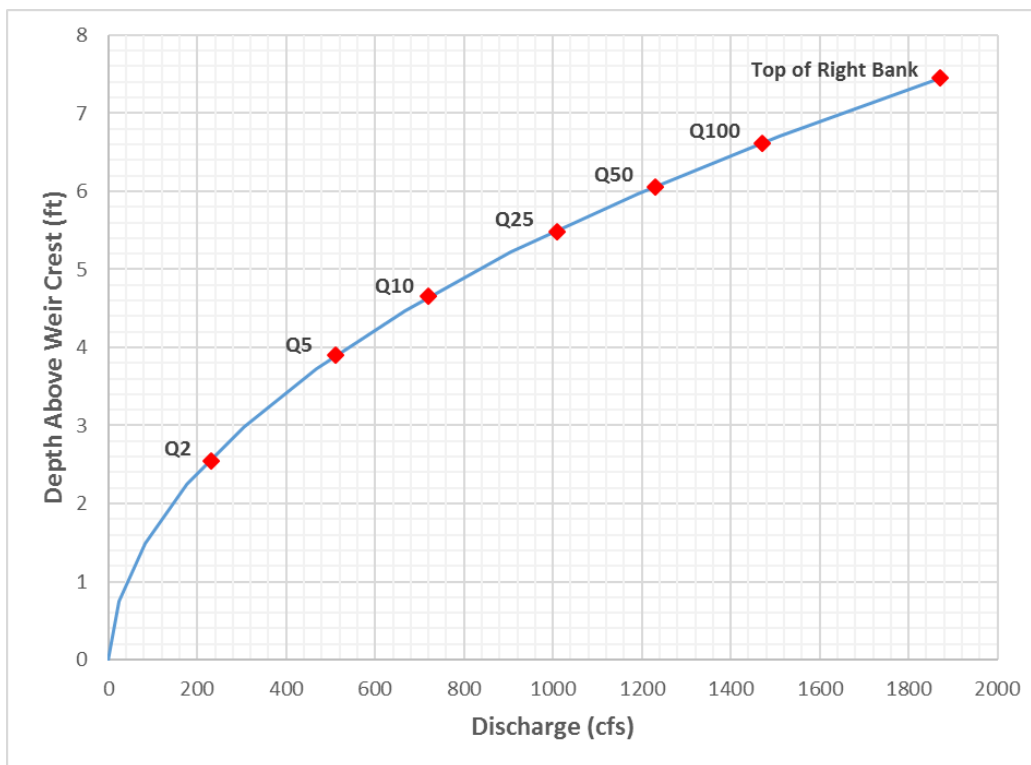
Dimension	Objective
Left Bank Slope (H:1V)	2
Right Bank Slope (H:1V)	2
Minimum Average Depth (ft)	9
Minimum Cross Sectional Area (ft <sup>2</sup> )	360

## 5.4 Channel Capacity Objective and Stage-Discharge Relationships

Based on the results of this channel assessment, all elements of the maintenance reach of Fagan Creek, with the exception of the runway culvert, will convey the Q100 under RCD's best estimate of normal roughness conditions. Therefore, the channel capacity objective for the reach should be set at the Q100 of 1,470 cfs.

Analysis reveals that the runway culvert will convey 926 cfs at the top of the culvert inlet, and will be overtopped at 1,100 cfs, and flooding can be expected to occur during storms that cause larger flows. RCD's analysis of the runway culvert assumes inlet control and does not include effects of the backwatering from downstream beaver activity. More rigorous analysis of this culvert should be completed to calculate precise capacities.

The analysis also generated stage-discharge ratings for the concrete weir that is providing grade control and also controlling the tailwater elevation for the Airport Road bridge (Figure 5-4). This rating assumes that all sediment and vegetation are cleared from the weir.



**Figure 5-4:** Stage-discharge rating for Fagan Creek concrete weir, obtained from Hydraulic Toolbox analysis. The red points show the water depth at the estimated recurrence interval peak flows.

## 5.5 Fagan Creek Channel Assessment Summary

The maintained reach of Fagan Creek has sufficient capacity to convey the Q100 (100-year peak flood event), with the exception of the runway culvert, and should therefore be maintained to convey this flow. In order to do this, the current channel slope of 0.003 and the current bank slopes of 2H:1V should be preserved. An average minimum depth of 9 feet and minimum cross sectional area of 360 ft<sup>2</sup> should be maintained. The current Manning's roughness of 0.05 should be maintained as well. Analyses indicate that flooding of the channel may occur during the Q100 if roughness exceeds 0.063.

This preliminary assessment indicates that the runway culvert may overtop and flood during the largest storm events. More rigorous analysis of this culvert should be performed to answer further questions about the runway culvert. Currently, the culvert is backwatered by downstream beaver activity, which may further decrease culvert capacity if it persists in the storm season.

## 6.0 Sheehy Creek Channel Assessment

Sheehy Creek is a tributary of the Napa River that drains a 4.24 square mile watershed and empties into the Napa River Marshes. Land use in the upper watershed is mostly grassland, wastewater spray fields, vineyards, and a wastewater treatment plant. The lower watershed is largely developed with industrial park, wastewater spray fields, and vacant industrial parcels. The maintained reach of Sheehy Creek is located in the approximate center of the watershed. The reach begins at a culvert beneath North Kelly Road and continues for approximately 2,000 feet where it enters a culvert and runs beneath Highway 29 (Figure 6-1). The tops of both streambanks are closely lined with industrial developments. The channel is vegetated with a single row of widely-spaced mature trees along the tops-of-bank providing some overstory. RCD is not aware of previous hydraulic analyses or discharge monitoring efforts for Sheehy Creek.



Figure 6-1: Map of maintained reach of Sheehy Creek.

### 6.1 Peak Flow Estimates

The Sheehy Creek watershed is an ungaged basin and therefore the Q100 is not known. To estimate the Q100, RCD analyzed the Sheehy Creek watershed using NSS. The drainage area of 2.39 square miles at the downstream end of the maintained reach of the creek was measured using the Napa County GIS watershed layer. The mean annual precipitation of 24.3 inches was obtained for the approximate centroid of the watershed from the Prism Climate Group's 30-Year Normals (1981-2010) dataset. The NSS peak flow estimates for Sheehy Creek are listed in Table 6-1. The Q100 estimate for Sheehy Creek at the Hwy 29 culvert is 608 cfs.



**Table 6-1.** Peak streamflow estimates for the maintained reach of Sheehy Creek.

Annual Exceedance Probability	Recurrence Interval (yrs)	Discharge Estimate (cfs)
0.5	2	92.2
0.2	5	206
0.1	10	294
0.04	25	413
0.02	50	508
0.01	100	608

## 6.2 Channel Assessment

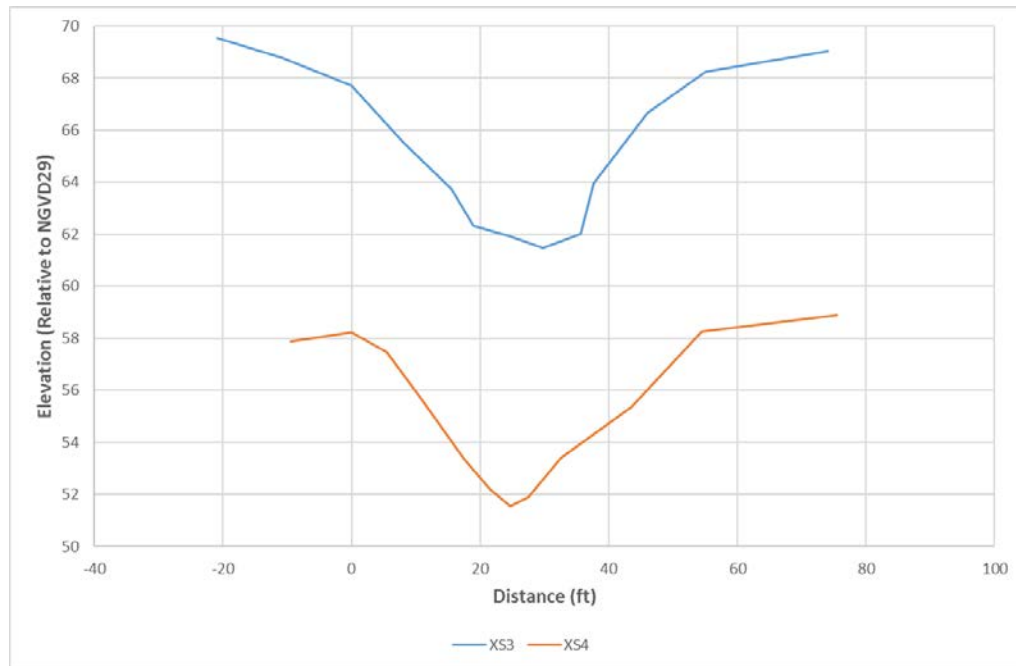
Prior to a field visit, RCD completed a GIS analysis to measure drainage area, reach lengths, culvert and structure lengths, and channel slope. RCD also examined historical aerial photos to identify potential significant changes to the channel.

RCD visited the maintained reach of Sheehy Creek in May 2016 and surveyed two channel cross sections (XS3 and XS4) at locations carefully selected to represent each respective subreach. The cross sections are shown in Figure 9. Surveying was performed with a theodolite and stadia rod relative to NGVD29 (Napa County benchmark 923-C). Lateral distance was measured with a tape. RCD surveyed the configurations of stream crossings and other structures in the reach, including the Kelly Road and Hwy 29 culverts. RCD also performed a visual assessment of the bed and banks and collected data for an assessment of roughness conditions in the channel.

Neither erosion or deposition of sediment was apparent in the channel. The stream banks appeared to be stable and in good condition.

The Kelly Road culvert is an old arch bridge that has been extended in both directions with box culverts. The Hwy 29 culvert is an 8-foot by 8-foot box culvert that is currently backwatered by presumed downstream beaver activity. This can be expected to affect culvert capacity to an unknown degree if these conditions persist during the storm flow season.

As part of the roughness assessment, RCD noted firm soil substrate, low irregularity, gradual variation in cross section, negligible obstructions, low degree of meandering, and large amounts of vegetation. Figures 6-1 and 6-2 depict roughness conditions in the reach.



**Figure 6-2:** Sheehy Creek channel cross sections XS3 and XS4, shown looking downstream.



**Photo 6-1:** The maintained reach of Sheehy Creek looking downstream from the Kelly Road culvert, showing channel roughness.



**Photo 6-2:** The maintained reach of Sheehy Creek looking upstream from the Hwy 29 culvert, showing channel roughness.

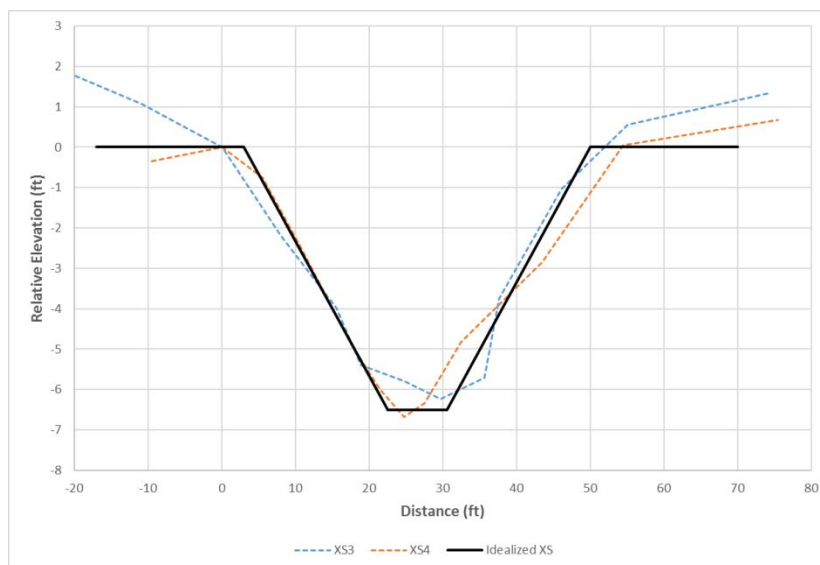
Data collected in the field were used to compute channel dimensions and channel and structure capacities. The Kelly Road culvert was modeled both as an arch and a box culvert to determine which section limits the capacity. Analysis of the Hwy 29 culvert assumes inlet control and no backwatering from beaver activity, which may or may not be the condition during the storm season. The results of channel and structure analyses are summarized in Table 6-2.

**Table 6-2.** Results of Sheehy Creek stream channel assessment. Culvert capacities are shown for headwater elevation at the top of the inlet. The overtopping capacities are included in parentheses.

Parameter	Result
Channel Slope (ft/ft)	0.01
Left Bank Slope (H:1V)	3
Right Bank Slope (H:1V)	3
Channel Depth (ft)	6.5
Cross Sectional Area (ft <sup>2</sup> )	180
Manning's Roughness Estimate	0.07
Channel Capacities (cfs)	
XS3	835
XS4	840
Kelly Rd Culvert	273 (Overtopping 533)
Hwy 29 Culvert	471 (Overtopping 831)

### 6.3 Channel Dimension Objectives

The channel assessment did not identify significant areas of erosion or deposition of the bed or banks of the maintained reach of Sheehy Creek, and the channel appeared to be well-vegetated and stable. This indicates that the channel was well-designed and is in a quasi-equilibrium condition. Therefore, the current dimensions of the channel should be maintained. To determine objectives for channel dimensions, RCD used the approximate bank slopes from cross sections XS3 and XS4 and computed the required width and depth of an idealized trapezoidal channel that would convey the Q100 under current roughness conditions and channel slope (Figure 6-3). The dimensions of this idealized channel cross section were used to set the quasi-equilibrium channel dimension objectives (Table 6-3).



**Figure 6-3:** Idealized trapezoidal channel cross section for the maintained reach of Sheehy Creek, overlaid on cross sections XS3 and XS4, shown looking downstream.

**Table 6-3.** Channel Dimension Objectives for the maintained reach of Sheehy Creek.

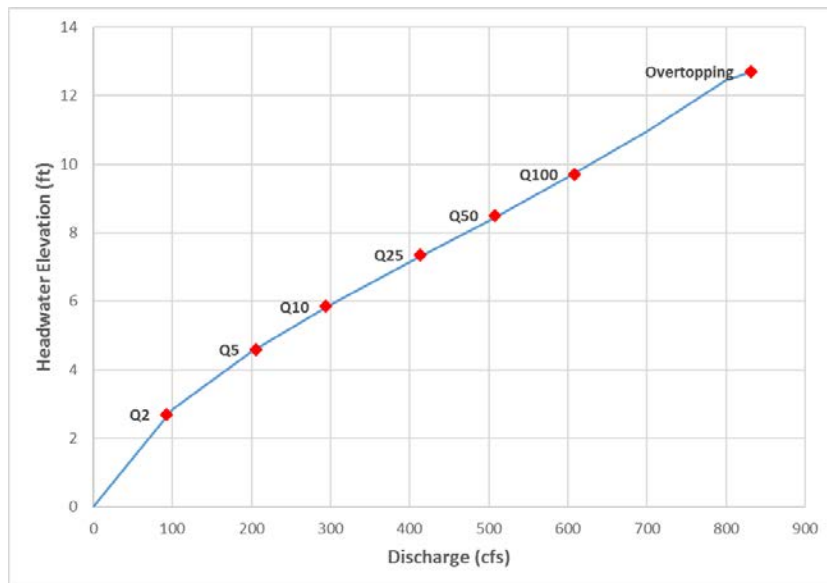
Dimension	Objective
Left Bank Slope (H:1V)	3
Right Bank Slope (H:1V)	3
Approximate Depth (ft)	6.5
Minimum Cross Sectional Area (ft <sup>2</sup> )	178

## 6.4 Channel Capacity Objective and Stage-Discharge Relationships

Based on the results of this channel assessment, all elements of the maintained reach of Sheehy Creek, with the exception of the Kelly Road culvert, will convey the Q100 under RCD's best estimate of normal roughness conditions. Therefore, the channel capacity objective for the reach should be set at the Q100 of 608 cfs.

Analysis reveals that the Kelly Road culvert will convey 273 cfs at the top of the culvert inlet, and will be overtopped at 533 cfs, and flooding can be expected to occur during storms that cause larger flows. Headwater elevation at the Hwy 29 culvert can be expected to exceed the top of the inlet during the Q100, but remain below the roadway. Backwater from such a flow may cause upstream flooding in the vicinity of the culvert. RCD's analysis of the Hwy 29 culvert assumes inlet control and does not include effects of the backwatering from downstream beaver activity. More rigorous analysis of this culvert should be completed to calculate precise capacities.

The analysis also generated a stage-discharge rating for the inlet of the Hwy 29 culvert (Figure 6-4). This rating assumes inlet control at all stages and no backwatering.



**Figure 6-4:** Stage-discharge rating for inlet of Sheehy Creek Hwy 29 culvert, obtained from HY-8 analysis. The red points show the water depth at the estimated recurrence interval peak flows.

## 6.5 Sheehy Creek Channel Assessment Summary

The maintained reach of Sheehy Creek has sufficient capacity to convey the Q100 (100-year peak flood event), with the exception of the Kelly Road culvert, and should therefore be maintained to convey this flow. In order to do this, the current channel slope of 0.01 and the current bank slopes of 3H:1V should be preserved. An approximate depth of 6.5 feet and minimum cross sectional area of 178 ft<sup>2</sup> should be maintained. The current Manning's roughness of 0.07 should be maintained as well. Analyses indicate that flooding of the channel may occur during the Q100 if roughness exceeds 0.09.

This preliminary assessment indicates that the Kelly Road culvert may overtop and flood during the largest storm events. In addition, the Hwy 29 culvert is currently backwatered due to presumed downstream beaver activity. This condition may decrease capacity should it persist into the storm season.





# Appendix G

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## Aquatic Pesticide Application Plan





April 4, 2014

NPDES Wastewater Unit  
State Water Resources Control Board  
1001 I Street, 15th Floor  
Sacramento, CA 95814

**Subject: Notice of Intent for coverage under Order 2013-0002-DWQ for the Napa County Flood Control and Water Conservation District**

To whom it may concern,

The Napa County Flood Control and Water Conservation District (District) is applying for coverage under the Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications, Water Quality Order 2013-0002-DWQ. The District is a new discharger under this Order.

Enclosed are the following items, as required for coverage:

- A Notice of Intent (NOI) completed according Attachment E of Order 2013-0002-DWQ;
- An application fee of \$2062.00; and
- An Aquatic Pesticide Application Plan (APAP).

As described in the APAP, the District's weed control activities are conducted throughout Napa County, including the Napa River and Suisun Creek watersheds within jurisdiction of the San Francisco Bay Regional Water Quality Control Board (RWQCB) (Region 2) and the Putah Creek/Lake Berryessa watershed within the jurisdiction of the Central Valley RWQCB (Region 5).

Please contact me if the state requires additional information to approve coverage under the NPDES General Permit.

Sincerely,

A handwritten signature in black ink, appearing to read "Richard Thomasser", is written over a large, stylized circular flourish that extends below the signature line.

Richard Thomasser, P.G.  
Operations Manager

**Attachment E – Notice of Intent**

**WATER QUALITY ORDER NO. 2013-0002-DWQ  
GENERAL PERMIT NO. CAG990005**

**STATEWIDE GENERAL NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM  
(NPDES) PERMIT FOR RESIDUAL AQUATIC PESTICIDE DISCHARGES TO WATERS OF  
THE UNITED STATES FROM ALGAE AND AQUATIC WEED CONTROL APPLICATIONS**

**I. NOTICE OF INTENT STATUS (see Instructions)**

Mark only one item   A. ☒ New Applicator   B. ☐ Change of Information: WDID# \_\_\_\_\_  
C. ☐ Change of ownership or responsibility: WDID# \_\_\_\_\_

**II. DISCHARGER INFORMATION**

A. Name <b>Napa County Flood Control and Water Conservation District</b>			
B. Mailing Address <b>804 First Street</b>			
C. City <b>Napa</b>	D. County <b>Napa</b>	E. State <b>CA</b>	F. Zip <b>94559</b>
G. Contact Person <b>Rick Thomasser</b>	H. E-mail address <b>richard.thomasser@countyofnapa.org</b>	I. Title <b>Watershed and Flood Control Operations Manager</b>	J. Phone <b>707-259-8657</b>

**III. BILLING ADDRESS (Enter Information only if different from Section II above)**

A. Name			
B. Mailing Address			
C. City	D. County	E. State	F. Zip
G. E-mail address	H. Title	I. Phone	



#### IV. RECEIVING WATER INFORMATION

A. Algaecide and aquatic herbicides are used to treat (check all that apply):

1. ☒ Canals, ditches, or other constructed conveyance facilities owned and controlled by Discharger.  
Name of the conveyance system: various in the Napa River watershed, Putah Creek and Lake Berryessa watershed and Suisun Creek watershed
2. ☐ Canals, ditches, or other constructed conveyance facilities owned and controlled by an entity other than the Discharger.  
Owner's name: \_\_\_\_\_  
Name of the conveyance system: \_\_\_\_\_
3. Directly to river, lake, creek, stream, bay, ocean, etc.  
Name of water body: Napa River watershed, Putah Creek and Lake Berryessa watershed, Suisun Creek watershed

B. Regional Water Quality Control Board(s) where treatment areas are located

(REGION 1, 2, 3, 4, 5, 6, 7, 8, or 9): Region 2 and 5

(List all regions where algaecide and aquatic herbicide application is proposed.)

#### V. ALGAECIDE AND AQUATIC HERBICIDE APPLICATION INFORMATION

A. Target Organisms: \_\_\_\_\_

*Arundo donax*, tamarisk (*tamarix* spp.), Scarlet Sesbania (*Sesbania punicea*), Perennial Pepperweed (*Lepidium latifolium*), Himalayan blackberry (*Rubus armeniacus* [syn. *Rubus discolor*]) and water primrose (*Ludwigia*)

B. Algaecide and Aquatic Herbicide Used: List Name and Active ingredients

glyphosate (trade name: Rodeo Aquamaster®) and imazapyr (trade names: Habitat®, Polaris®)

C. Period of Application: Start Date June 15, for the life of the permit

End Date Nov 15, with exceptions noted in GEN-1, for the life of the permit

D. Types of Adjuvants Used:

Glyphosate requires use of a non-ionic surfactant, such as R-11™, LI-700™, Cygnat Plus™ and Liberate™. Imazapyr requires use of an oil-based surfactant, such as Hasten™, Agri-Dex™, and Competitor™.

#### VI. AQUATIC PESTICIDE APPLICATION PLAN

Has an Aquatic Pesticide Application Plan been prepared and is the applicator familiar with its contents?

☒ Yes ☐ No

If not, when will it be prepared? \_\_\_\_\_

#### VII. NOTIFICATION

Have potentially affected public and governmental agencies been notified?

☐ Yes ☒ No

#### VIII. FEE

Have you included payment of the filing fee (for first-time enrollees only) with this submittal?

☒ YES ☐ NO ☐ NA

GENERAL NPDES PERMIT FOR RESIDUAL  
AQUATIC PESTICIDE DISCHARGES FROM  
ALGAE AND AQUATIC WEED CONTROL APPLICATIONS

ORDER NO. 2013-0002-DWQ  
NPDES NO. CAG990005

**IX. CERTIFICATION**

"I certify under penalty of law that this document and all attachments were prepared under my direction and supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment. Additionally, I certify that the provisions of the General Permit, including developing and implementing a monitoring program, will be complied with."

A. Printed Name: Richard Thomasser

B. Signature: [Signature]

Date: 4/2/14

C. Title: Operations Manager

**XI. FOR STATE WATER BOARD STAFF USE ONLY**

WDID:	Date NOI Received:	Date NOI Processed:
Case Handler's Initial:	Fee Amount Received: \$	Check #:
<input type="checkbox"/> Lyris List Notification of Posting of APAP	Date _____	Confirmation Sent _____



**Napa County  
Flood Control and Water Conservation District**

**Aquatic Pesticide Application Plan (APAP)  
for the  
Statewide General National Pollutant Discharge Elimination  
System (NPDES) Permit for Residual Aquatic Pesticide Discharges  
to Waters of the United States from Algae and Aquatic Weed  
Control Applications  
Water Quality Order No. 2013-0002-DWQ  
General Permit No. CAG990005**

*Prepared for:*

Napa County Flood Control and Water Conservation District  
804 First Street  
Napa, CA 94559

*Prepared by:*

Horizon Water and Environment  
180 Grand Avenue, Suite 1405  
Oakland, CA 94612

Horizon Water and Environment. Napa County Flood Control and Water Conservation District Aquatic Pesticide Application Plan. March 2014.  
(HWE 10.004) Oakland, CA.



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## List of Acronyms

asl	above sea level
BDR	Napa County Baseline Data Report
BMP	Best Management Practice
CDPR	California Department of Pesticide Regulation
COC	chain-of-custody
District	Napa Valley Flood Control and Water Conservation District
DNQ	detected, but not quantified
FDCF	field data collection form
FIFR	Federal Insecticide, Fungicide and Rodenticide Act
Flood Control Project	Napa River Flood Control Project
GIS	geographic information systems
GPS	global positioning system
MDL	minimum detection limit
ML	minimum level
ND	not detected
OHWM	ordinary high water mark
QAC	qualified application certificate
QAL	qualified application license
QAP	quality assurance plan
SWOA	South Wetland Opportunities Area
USEPA	United States Environmental Protection Agency
WIMS	weed information mapping system

# 1. Introduction

The Napa County Flood Control and Water Conservation District (District) is a special district of the County of Napa. Within its authority, the District provides maintenance for the flood control channels that it owns, as well as other channels for which the District has a maintenance agreement or easement. The District also provides discretionary maintenance in channels throughout the county, and responds to public requests for maintenance activities at other stream and channel locations (on an as-needed basis).

Vegetation management activities are conducted to maintain flow conveyance capacity, establish a canopy of riparian trees, and control invasive vegetation. Use of herbicides to control terrestrial and aquatic vegetation is relatively consistent from year to year, though locations change depending on recent growth and blockages. Herbicides may be applied on the banks of channels (above the Ordinary High Water Mark [OHWM]) and may include targeted spraying (such as to treat *Arundo donax*) and direct application (using a brush on stumps of trees that have been recently cut). Herbicides are also directly applied to submerged aquatic vegetation (below the OHWM) to maintain channel flow conveyance capacity. The District uses glyphosate and imazapyr for both terrestrial and aquatic herbicide applications.

This Aquatic Pesticide Application Plan (APAP) was developed in compliance with the *General NPDES Permit for Discharge of Aquatic Pesticides for Aquatic Weed Control* (Order No. 2013-0002-DWQ; NPDES No. CAG990005) (General Permit) that went into effect on December 1, 2013. This APAP covers application of aquatic herbicides throughout the entire Napa County. This includes the Napa River and Suisun Creek watersheds within Napa County which are under the jurisdiction of the San Francisco Bay Regional Water Quality Control Board. Additionally, this APAP covers aquatic pesticide application in the Putah Creek/Lake Berryessa watershed within Napa County that is under the jurisdiction of the Central Valley Regional Water Quality Control Board.

The following sections of this plan describe aquatic pesticide application activities conducted by the District:

- Section 2      Goals and Objectives
- Section 3      Application Area
- Section 4      Site Treatment Area
- Section 5      Vegetation Management
- Section 6      Aquatic Herbicides Applied
- Section 7      Herbicide Use Alternatives
- Section 8      Best Management Practices
- Section 9      Monitoring Program
- Section 10     Annual Reporting

## 2. Goals and Objectives

### Habitat Management Goals

The District's long-term habitat restoration goals include enhancement of the Napa River and its major tributaries, and the creation and restoration of brackish emergent marsh (tidal), seasonal and emergent freshwater wetlands, tidal mudflats, riparian and native woodlands. The broader goal is to establish an ecologically self-sustaining mosaic of habitats. The District's stream management goals include ensuring that adequate flood conveyance capacity is provided, maintaining stable stream bank conditions, and enhancing instream ecological conditions.

The District's vegetation management and invasive species plant management efforts support countywide restoration goals by:

1. Preserving and restoring upland, wetland, tidal, and woodland habitats throughout the County by identifying, mapping, and eradicating invasive plant species;
2. Avoid disturbing native habitat and plants areas and enhancing those areas through planting of appropriate native species.

### Management Philosophy and Prioritization: An Adaptive Management Strategy

Certain non-native invasive plant species may be tenacious and harmful, while others may restrict themselves to recently disturbed locations and be less invasive or harmful. Attempting to control all non-native invasive species present can be overwhelming and ultimately unsuccessful. Therefore, the District developed a strategy to ensure the efficient use of resources. The strategy is built upon the following principles:

1. Manage for the eradication and control of target non-native invasive species and maintain native habitat communities.
2. Assess species occurrences and assign treatment priorities based on the severity of the non-native species impacts to native habitat and rate of infestation. To accomplish this, non-native species are mapped using a global positioning system (GPS) and the Weed Information Mapping System (WIMS). The WIMS is a series of forms that allow the District to capture pertinent information about weed occurrences. District staff utilizes the WIMS system to identify and map non-native species in the field. WIMS data is then entered into a geographic information system (GIS) and queried to examine patterns and distributions on non-native species and develop treatment prioritization criteria.
3. Develop and consider appropriate methods for controlling non-native invasive species. Then, document these considerations in species specific control plans.
4. After the species specific control plan is implemented, results will be monitored to evaluate control method effectiveness. This information can be used to modify and improve priorities, control methods and plans, and prepare annual monitoring and treatment reports.
5. Repeat the planning, monitoring, and treatment cycle by re-establishing those methods that proved effective and modify control and management goals as necessary.

In summary, the District has adopted an adaptive management strategy. An adaptive strategy is one that uses the lessons from previous seasons of work to mold future efforts.



### 3. Application Area

The Application Area is located in Napa County, California as shown in Figure 1 and described below by drainage area. The descriptions below are from the Napa County Baseline Data Report prepared in 2005 (Napa County 2005<sup>1</sup>).

#### Napa River Watershed

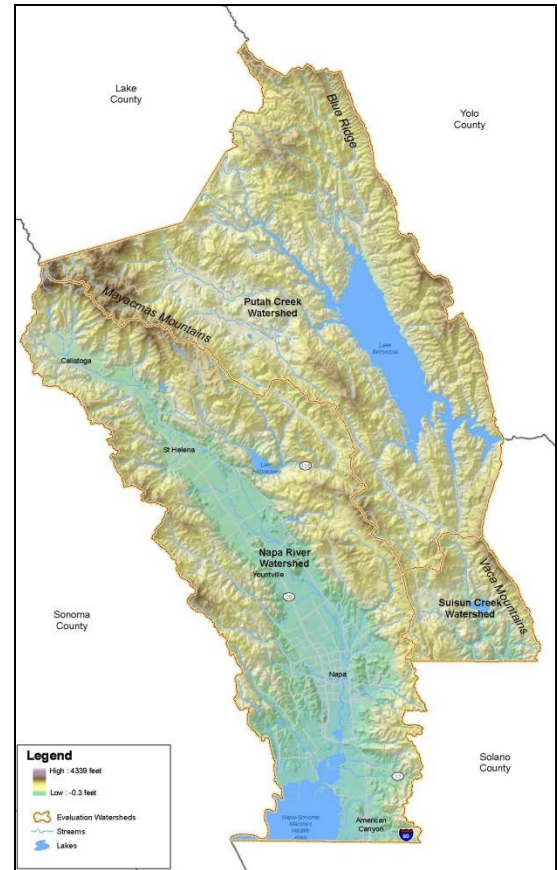
The Napa River drains an area of approximately 426 square miles and drains into San Pablo Bay, descending from an elevation of 4,344 feet (1,323 meters) in the Mayacmas Mountains to sea level (Figure 1). Historically, the lower reaches of the Napa River supported a diverse number of habitats including tidal marshes, freshwater marsh wetlands, oak woodland, riparian forests, and grasslands that provided habitat for a myriad of plant and animal species. Today most of these habitats still exist but have decreased in area and quality and continue to be threatened and degraded by habitat loss, urban development, agricultural practices, and invasive species colonization.

#### Putah Creek/Lake Berryessa Watershed

East of the Napa River watershed is the Putah Creek watershed, which contains Lake Berryessa. This region consists of several small valleys, including the Pope and Capell Valleys, surrounded by topography that is generally mountainous and steep. Elevations in the Lake Berryessa watershed are generally higher than in the Napa Valley. To the east of the Napa Valley, hills rise to an elevation of approximately 1,500 to 2,000 feet asl, forming a divide between the Napa Valley and the adjacent Putah Creek watersheds.

Putah Creek is the largest river in the Lake Berryessa basin. It originates in Lake County to the north, flows into Napa County and into Lake Berryessa, and flows out of the County at Lake Berryessa's outlet (Monticello Dam) along the eastern border where it eventually flows into the Sacramento River. Other notable tributaries in the drainage include Pope Creek, Chiles Creek, Capell Creek, and Eticuera Creek.

Lake Berryessa is the largest body of surface water in Napa County, with a storage capacity of 1.6 million acre-feet. The primary uses of the lake are as a water supply for the irrigation of agricultural lands and municipal and industrial users, power generation, and recreation. The District does not conduct vegetation management activities in Lake Berryessa.



**Figure 1: Napa River Watershed and Napa County**  
(Source: Napa County 2007)

<sup>1</sup> Napa County. 2005. Napa County Baseline Data Report, Version 1. Prepared by Jones & Stokes/EDAW. November. Oakland, CA.

Napa County. 2007. Draft Environmental Impact Report for the Napa County General Plan. SCH # 200510288. Prepared by PMC. February. Sacramento, CA.

## Suisun Creek Watershed

The Suisun Creek watershed lies to the south of Lake Berryessa and the Putah Creek watershed. Only the upper portions of the Suisun Creek watershed are located within Napa County; the flows to the south and into Solano County before discharging to Suisun Bay.

Lake Curry is a human-made reservoir created by the damming of Suisun Creek. It supplies water for municipal and industrial use in the City of Vallejo. The District does not conduct vegetation management activities in Lake Curry.

## 4. Site Treatment Areas

### 4.1 Napa River Restoration Projects

The District surveys and maps target non-native invasive species within the Napa River and its tributaries from Calistoga downstream to American Canyon. The purpose of the surveying and mapping is to support the eradication and management of target species and other ongoing river restoration projects. The District is responsible for the long-term maintenance of 15 miles of River Restoration on the Napa River from Rutherford Cross Rd. to Oak Knoll Avenue. The District recognizes that in order to effectively control target invasive species throughout the restoration reach it is necessary to manage and monitor invasive species in their source areas in the upper watershed.

The riparian corridor along the Napa River is generally narrow and fragmented with some interspersed late seral stage riparian forest. Through the restoration reaches there are some newly restored flood plain benches, alcoves and expanded riparian areas. Target species are treated in this reach from the top of the stream bank down to and below the OHWM, depending on the species and level of infestation. A typical treatment scenario includes a target species growing along the toe of the stream and overhanging the water. Herbicide is applied directly to the target species with a spray wand during the summer when flows are at the lowest level. When feasible the District cuts and removes the invasive vegetation prior to applying herbicide.

Herbicide treatments may occur along natural streams from the edge of the stream channel to the top of bank within the riparian zone. In the lower reaches of the Napa River herbicide treatments may occur in the intertidal zone. In an engineered flood control channel herbicide potentially could be applied to the surface of the water to treat *Ludwigia*. Herbicide treatment potentially could occur in a pond adjacent to a stream in an effort to minimize the spread of a particular species.

### 4.2 Napa River Flood Project

The Napa River Flood Control Project (Flood Control Project), implemented by the U.S. Army Corps of Engineers and the District, was designed to provide protection from a 100-year flood event and enhance, restore, and create wildlife and wetland habitat within the flood plain of the Napa River. The Flood Control Project Area covers a 6.9-mile reach of the Napa River from Trancas Street in the City of Napa to State Route 29

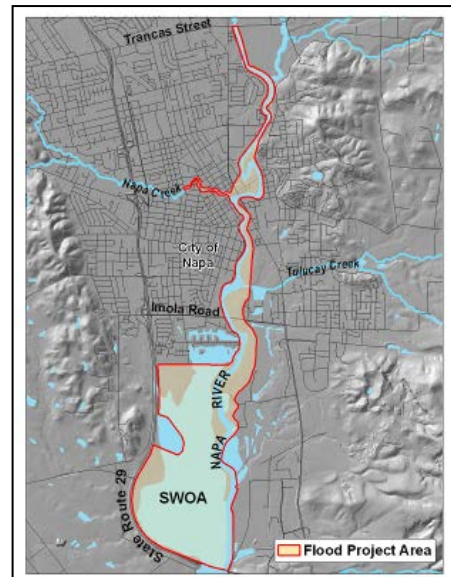


Figure 2: Napa River South Wetland Opportunity Area

(upstream to downstream, respectively), including an area solely for the purposes of habitat restoration known as the South Wetland Opportunity Area (SWOA), and encompasses over 1400 acres of land (Figure 2). The SWOA consists of intertidal marshes and sloughs, open mudflats, seasonal wetlands, and alluvial flood plains. A typical treatment area would be within the higher zones of the intertidal marsh. Target species are mapped within this zone and maintenance actions are prioritized based on the severity of the infestation.

### **4.3 Engineered/Modified Flood Control Channels**

The District is responsible for providing routine maintenance along 13 miles of engineered and modified flood control channels. Examples of this channel type include the Yountville and Salvador Collector channels, which collect drainage from upstream smaller tributaries. Most of the channels the District maintains are constructed with a trapezoidal cross section with earthen banks and streambeds. However, some channels have sections with hardened banks and beds formed in rock or concrete. Invasive species management within these channels is implemented to maintain the hydraulic capacity of the flood control channel and to minimize flow obstructions. Target species and problematic reaches are mapped and prioritized based on the level of infestation. A typical treatment area in the flood control channels may be on or near the edge of the water depending on the target species and level of infestation. The purpose of invasive species management in these reaches is to maintain adequate flow conveyance while creating a diverse and complex native riparian canopy.

### **4.4 Natural Channels**

The District targets non-native invasive species along water ways throughout Napa County. The District maps invasive plant species during annual stream surveys and develops management priorities based on the level of infestation. Channel conditions vary depending on the stream and reach but most are tributaries to the Napa River, which flow through agricultural and urban areas. Some of the natural channels are deeply incised with undercut and eroding stream banks. While other streams have mature riparian forests and well established bed forms. A typical treatment area in a natural channel would be from the toe of the stream to the top of bank.

### **4.5 Ponds**

The District does not commonly conduct invasive management in ponds. However, there are many irrigation ponds near the mainstem of the Napa River and along tributaries where invasive plants species do grow. At times it is necessary for the District to work with private property owners to manage non-native invasive plants within irrigation ponds to minimize potential dispersal into natural waterways.

## 5. Vegetation Management

The primary invasive exotic weeds managed in the program area are *Arundo donax*, tamarisk (*tamarix spp.*), Scarlet Sesbania (*Sesbania punicea*), Perennial Pepperweed (*Lepidium latifolium*), and Himalayan blackberry (*Rubus armeniacus* [syn. *Rubus discolor*]). These species rapidly invade stream channels, often growing aggressively to the exclusion of other riparian species. The rapid and voluminous growth of these invasive plants can significantly reduce channel capacity. The management of other invasive aquatic plants including water primrose (*Ludwigia*) is also conducted by the District in a limited number of creeks such as Salvador Creek and the Yountville Collectors. Managing invasive vegetation is a continuous, routine, and on-going activity of the District's stream maintenance program.

### 5.1 Herbicide Application for Invasive Species Control

Herbicides can be toxic to people and wildlife if not handled properly. However, the safe use of herbicides is a critical method for vegetation management, especially to control invasive and exotic plants. All herbicide applications conducted by the District occur in accordance with federal, state, and local regulations. The District applies herbicides to control invasive and exotic plants in upland areas (vegetation growing along and on top of stream banks) and within water bodies.

Targeted spot spraying and hand painting of cut stumps are the primary methods of herbicide application. Foliar spraying may be conducted to control growth on larger plants such as exotic trees or large stands of pampas grass. Herbicide application is conducted when the climate is dry (between June 15 and November 15), wind is not above 5-10 mph, and no rain is forecast for the next 24 hours. The maximum average herbicide use is 5 to 8 gallons monthly. The average total area where herbicide is applied is approximately 3 to 5 acres annually. Typical herbicides used for control of invasive and exotic plants are glyphosate (trade name: Rodeo Aquamaster®) and imazapyr (trade names: Habitat®, Polaris®). Herbicides are used on a site by site basis and only when necessary, such as when hand and mechanical methods are unsuccessful. Further detail on the District's application methods are provided below.

### 5.2 Invasive Species Profiles

In the paragraphs below summary species profiles for the primarily invasive and exotic plants managed by the District are presented along with stream management considerations and approaches. Other invasive species, such as yellow star thistle, are also managed by the District. Management approaches for control of other species are the same as those described below.

#### **Giant reed (*Arundo donax*)**

**Priority:** High (from top of bank to toe of stream channel).

*Arundo* is a bamboo-like plant targeted by the District as a priority weed. This species reproduces vegetatively and does not produce viable seed. When established within stream channels, *Arundo* can quickly reduce channel capacity, increase hydraulic roughness, and increase the flood risk. The plant's shallow roots encourage mobility in high flow events. Dislodged *Arundo* pieces move downstream, often plugging culverts or creating debris blockages at bridge crossings. Upon settling, *Arundo* will



*Arundo donax* removal by California Conservation Corps team



rapidly colonize at its new downstream location. In this manner, entire streams systems have been invaded in a relatively short time period. The dense lower stalks and root masses of *Arundo* are also effective at trapping fine sediment, whereby a positive feedback process occurs. *Arundo* settles, traps fine sediment, the channel bed elevates, more *Arundo* colonizes, more sediment is trapped, etc. *Arundo* favors stream beds and banks in full sun conditions. Developing a native riparian canopy that can shade the channel is an effective long-term strategy to reduce *Arundo* presence.

The District's approach to managing *Arundo* is to target removal activities by sub-watershed, beginning in upstream areas and eradicating *Arundo* colonies progressively downstream through each sub-watershed. *Arundo* is eradicated by either spraying the entire standing plant with herbicide or mechanically cutting the stalks and painting each stalk-stump by hand with herbicide. The District's standard *Arundo* herbicide mix includes glyphosate, a non-ionic surfactant, and ammonium sulfate. The herbicide mix is applied in the fall from September through early November. Dead canes are removed for fire safety in the fall (September or later) following herbicide application. Any bare soil remaining after cane removal is revegetated with native plants or seeds, such as the native species listed in Appendix A.

**Perennial Pepperweed** (*Lepidium latifolium*)

*Priority:* High (in wetland and brackish marsh areas). Perennial Pepperweed is scattered throughout seasonal wetland and wrack lines of brackish marsh areas within the Project Area and may interfere with primary habitat management and restoration goals. Plants are multiple stemmed and grow stiffly erect masses up to 5ft in height. The leaves are lanceolate, bright green to gray green, and entire or toothed. Basal leaves are stalked, up to 1 ft. long and 3 in. wide and have serrate margins. Flowering occurs from early summer to fall.

In general, it is assumed that populations are established and spreading, and complete eradicate is impossible. However, it is possible to control its spread with annual herbicide treatment, re-vegetation, and monitoring.

**Water primrose** (*Ludwigia peploides montevidensis*)

*Priority:* Moderate (on surface of water). *Ludwigia* is an invasive, exotic, aquatic weed found in apparently increasing occurrence on the west coast as well as nationally. The species occurs in tributaries to the Napa River, including Salvador Creek. Generally, winter streamflow rises above the *Ludwigia* patches or flushes the plants downstream. In most cases, *Ludwigia* patches are not problematic in conveying flood flows. However, accumulated *Ludwigia* is known to collect at downstream bridge piers where it can quickly grow, completely fill channels (as shown in the photo), and create flow blockages. *Ludwigia* also provides some beneficial



*Ludwigia* in Yountville Outfall

functions similar to the native species (*Ludwigia peploides peploides*) including, bank toe stabilization, nutrient exchange and uptake, and cover for young fish and amphibians. While these functions may not be enough to support presence of *Ludwigia* in District flood control channels, it does provide sound reasoning for leaving it in a channel if there is no other emergent cover, or where the degree of *Ludwigia* present does not create a flow blockage.

Mechanical removal is the primary method to control *Ludwigia* and is generally conducted using a long-



reach excavator from maintenance roads adjacent to the project site channel. Where the channel is too wide, the excavator may occasionally travel partially down the bank in areas that will not impact existing native and riparian vegetation. The excavator will work from the mid-bank position, thus reducing the need for multiple trips along the bank slope by smaller equipment. The District anticipates the need to periodically manage *Ludwigia* between June 15<sup>th</sup> and October 31<sup>st</sup>.

Debris generated from invasive plant management activities are either left on site to decay and redistribute nutrients into the soil or, if plant and root clippings remain viable for regrowth, the debris is taken to the local landfill for disposal.

## 6. Aquatic Herbicides Applied

### 6.1 Types of Herbicides Used

Types of herbicides expected to be used and degradation byproducts.

#### ***Glyphosate*** (Aquamaster®, AquaNeat®, Refuge®, and others)

Glyphosate is a foliar-applied, systemic herbicide used to control vegetation near water bodies and several immersed weeds. Glyphosate carries from the treated foliage to underground storage organs (e.g., rhizomes). Its mode of action inhibits the synthesis of certain amino acids and other secondary metabolites. To be most effective it should be applied during a perennial weed's flowering or fruiting stage. On annual species it will be most effective when applied during active plant growth. An aquatically approved non-ionic surfactant should be used with glyphosates that do not contain a surfactant. If a rain event occurs within 4 to 6 hours of application, the effectiveness of glyphosate is reduced. Therefore, as required by BMP GEN-1, herbicides will only be applied when a 40% chance or higher chance of rain is forecast 48 hours prior to or after planned applications.

Glyphosate degradation is by microbial activity in soil, and by sunlight and water to a lesser extent. Tests have shown the half-life of glyphosate in water is 35 days or more, while the half-life of glyphosate in anaerobic soil conditions is 22 days<sup>2</sup>.

#### ***Imazapyr*** (Habitat®, Polaris®, and others)

Imazapyr is a foliar-applied, translocated systemic herbicide used to control many floating and emergent weed species. It may be particularly effective on plants such as cattails and giant reed. Imazapyr works in meristematic tissue (i.e., rapidly growing and dividing) by inhibiting the synthesis of certain amino acids in protein production. A spray adjuvant must be used with imazapyr. Recommended spray adjuvants include non-ionic or silicone-based surfactants or methylated seed or vegetable oils. Imazapyr is quickly absorbed by plants. The growing plant tips usually yellow and die within 1-4 weeks after treatment.

The primary form of degradation in water is photodegradation with a half-life of approximately 2-5 days. Due to its rapid photodegradation by sunlight, water contamination by imazapyr is generally not of concern to people or the environment. Imazapyr is the primary herbicide used to control invasive

<sup>2</sup> California Department of Pesticide Regulation. 1998. Environmental Fate of Glyphosate. Prepared by Jeff Schuette. Environmental Monitoring & Pest Management. Sacramento, CA. Available: <http://www.cdpr.ca.gov/docs/emon/pubs/fatememo/glyphos.pdf>. Accessed, June 12, 2013.

*Spartina* cordgrass throughout the San Francisco Bay Estuary.

## 6.2 Surfactants

Surfactants are used to reduce the surface tension of the water and increase the conveyance of the chemicals to the target plants. Glyphosate requires use of a non-ionic surfactant, such as R-11™, LI-700™, Cygnet Plus™ and Liberate™. Imazapyr requires use of an oil-based surfactant, such as Hasten™, Agri-Dex™, and Competitor™. These surfactants are considered practically non-toxic (LI-700, Hasten and Agri-Dex) to moderately toxic (R-11). Acidifying agents like LI-700 and oil-based agents like Hasten and Agri-Dex exhibit lower toxicity compared to R-11, especially to aquatic species (ENTRIX 2003<sup>3</sup>). However, all these surfactants are approved for aquatic herbicide applications. The County strives to implement the least impactful means for aquatic plant control. Where feasible, the least toxic surfactant will be used with glyphosate and imazapyr.

## 6.3 Methods of Application

**Cut-Stump Treatment** - This technique is used when managing an infestation below the OHWM. The method involves applying a high concentration of herbicide directly to the cut face of the stump. Applications occur through the use of a small paint brush or hand sprayer with a cloth tied around the nozzle. Because there is direct access to the cambium the amount of herbicide used on each stump is low. This method ensures that there are very few adverse effects associated with herbicide contacting other plants surrounding the treatment area or coming in contact with the water surface.

**Foliar Spray** - This technique involves applying herbicide directly to the foliage of the plant. The application will be carried out with a backpack sprayer or a spray rig carrying several gallons of diluted herbicide. The sprayer tank is kept pressurized through the use of generator in the case of the spray rig or through hand pumping a lever on the backpack sprayer. When using this method wind conditions are always monitored and applications will cease if wind gusts exceed 5-10 mph. To ensure that sufficient uptake into the target plants occurs it is necessary to completely and thoroughly cover the leaf area. In many cases the biomass of the targeted plant will first be cut and removed and the re-growth will be treated sometime later. This method minimizes the amount of herbicide used. The foliar spray method tends to be ineffective on plants that have leaves with thick waxy cuticles.

**Wicking** - This technique requires a hand or backpack sprayer with a wicking wand that has a sponge attached to the end, which is used to wipe herbicide onto the leaves of a plant or on to a cut stump. The method ensures that herbicide is only applied to the target plant and minimizes overspray and dripping.

**Application Made According to Label** - All aquatic herbicide application are made according to the manufactures label and in accordance with regulations of the USEPA, California Environmental Protection Agency, California Department of Pesticide Regulation, California Division of Occupational Safety and Health and the local Agricultural Commissioner. Precautions on the product label to prevent fish kill or other impacts to wildlife will be followed.

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<sup>3</sup> Entrix, Inc. 2003. Ecological Risk Assessment of the Proposed Use of the Herbicide Imazapyr to Control Invasive Cordgrass (*Spartina spp.*) in Estuarine Habitat of Washington State. Washington State Department of Agriculture. Olympia, Washington. Available: <http://www.spartina.org/referencemtrl/Washington%20ERA-Imazapyr.pdf>. Accessed: June 12, 2013.

## 6.4 Application Training

District staff are trained annually on proper herbicide handling and use. Staff are trained by a District or County staff with a current State Department of Pesticide Regulation-Qualified Applicator Certificate (QAC). Staff with the QAC are required to complete 20 hours of continuing education every 2 years to stay licensed, and therefore are up-to-date on the latest techniques for pest control.

Annual trainings will be held with District staff and District contractors to review best management practices, target species, biological resources of concern, monitoring procedures and spill prevention and response procedures. Training will include a review of relevant invasive plant management literature and field training to ensure that District staff and Contractors are operating in accordance with the APAP.

The District commonly contracts herbicide application work to other companies. Prior to application, a Pest Control Advisor (PCA) licensed by DPR, makes a positive identification of pest(s) present checks applicable product label(s) for control efficacy, and in collaboration with District staff, the PCA prepares a written recommendation, including rates of application, notes any conditions that may limit the application to ensure that non-target flora and fauna are not adversely impacted. The District ensures that contractors conducting the application are properly trained in handling and use of herbicides, have a current Qualified Applicator Certificate (QAC), or Qualified Applicator Licenses (QAL). A QAC/QAL must complete 20 hours of continuing education every 2 years to stay licensed, and therefore are up-to-date on the latest techniques for pest control.

## 7. Herbicide Use Alternatives

The prioritization of treatment for non-native invasive species occurrences by the District is presented here as a guide which can be applied adaptively and modified as needed. The District established these priorities in the hope of minimizing the total, long-term workload based on available resources and management goals, and maximizing the potential environmental benefit for habitat protection and enhancement. A range of factors were developed to assign management priorities. District overall priorities are to:

1. Assign highest priority to fastest growing and most disruptive infestations that affect the most highly valued native habitat type(s) within the Project Area.
2. Consider the difficulties of control, giving higher priority to infestations most likely to be able to be controlled with available technology and resources.
3. Consider species, which are not yet problematic, but could become problematic if they spread throughout the District's general maintenance area, for priority treatment. The invasive species management program includes regularly monitoring the District's maintenance area for these species in order to quickly detect and eliminate them if they ever do appear.

Once a management area is identified, actions taken include the following alternatives. Some methods are applied simultaneously. For example, at a creek reach (say from one road crossing to the next), vegetation may be left alone in one area, trees may be planted to provide future shading in another area, grass may be mowed, and herbicides may be used to control cattail growth until the trees get tall enough to provide shading.

**No Action.** If the vegetation is not currently a threat, it is left alone and reevaluated the next season.

**Prevention** - The District implements preventative methods to discourage vegetation from growing in the channels. For example, the District plants trees to shade creek channels and prevent invasive aquatic plants like cattails from growing. This preventative method requires many years (5 to 10, or more) for the trees to grow tall enough to provide the shade needed to discourage cattail growth.

**Mechanical or Physical Methods** - The District controls vegetation growth by mowing aquatic vegetation or breaking up floating piles to encourage them to pass downstream. These methods only temporarily alleviate the flood threat and must be conducted on a regular basis.

**Cultural Methods** - The District has a long-standing program to plant native vegetation along channels in an effort to prevent growth of exotic, invasive vegetation. This is a long term process and requires a substantial maintenance effort to ensure successful growth of native vegetation.

**Biological Control Agents** - Biological control have not been used and no such controls have been identified as a viable alternative for controlling the species of concern.

**Grazing** - This option is most suitable for emergent and terrestrial weeds. There are potential impacts such as water quality from animal feces, nutrients, increase turbidity, and bank erosion, and impacts to desirable native plant species. The lack of adequate fencing, site access, and presence of vehicle traffic make this option unfeasible in some cases. Grazing will be considered as an alternative control where feasible.

**Aquatic Herbicides** - Aquatic herbicides are a key component of the District's vegetation management program. In order to successfully enhance native aquatic and wildlife habitat, while protecting the public and property in Napa County, the District needs to use a small amount of aquatic herbicides. If herbicides are not utilized for vegetation management, people and property could be at risk due to flooding. Only the least impactful herbicides are used and application of the minimum amount necessary for effective control, consistent with product label requirements, is conducted.

**Native Species Establishment** - After the successful removal of non-native invasive species, the introduction and re-colonization of native species has been successful along streambanks or margins of streams and rivers. This methodology provides competition for non-native species, creates, habitat, increases native plant diversity, and may reduce the need for future aquatic weed abatement. Limitation to this approach include lack of infrastructure for irrigation, ongoing access to private property, availability of labor to plant native species, and the high cost of ongoing site maintenance to ensure successful reestablishment. This approach is expensive, takes many years and requires long term access to private property. The District attempts to integrate this technique into all invasive plant management sites.

**Tilling or Disking** - This option is not a suitable alternative for controlling aquatic or riparian vegetation because tilling or disking exposes erodible soils which impact water quality. The District generally avoids tilling and disking in and around its flood control system, natural water ways, and wetlands so as not to encourage erosion of banks and sedimentation.

## **8. Best Management Practices**

The following BMPs will be implemented prior to and during herbicide application events. The purpose of these BMPs is to avoid and minimize impacts on people, the environment, and Beneficial Uses of waters of the U.S. and state.



BMP Number	BMP Title	BMP Description
GEN-1	Work Windows and Weather Considerations	<ul style="list-style-type: none"> <li>▪ Herbicide applications will occur between June 15 and November 15, with an extension through December 31 or until the first occurrence of any of the following conditions; whichever happens first:               <ul style="list-style-type: none"> <li>○ Local rainfall greater than 0.5 inches is forecasted within a 24-hour period from planned application events; or</li> <li>○ When salmonids begin upmigrating and spawning, as determined by a qualified biologist (typically in November/December)</li> </ul> </li> <li>▪ Check weather service prior to application and DO NOT make application if rain (40% chance or higher) is forecast 48 hours prior to or after planned applications.</li> <li>▪ DO NOT make spray applications if wind speeds are less than 3 mile per hour or over 10 miles per hour.</li> <li>▪ Avoid spraying during stable (inversion) conditions (early morning and early evening) when there is little or no vertical mixing of the air. These conditions generate concentrated drift clouds and increase the chance of drift fallout.</li> <li>▪ Monitor wind direction and do not spray when there are sensitive areas/crops immediately downwind.</li> <li>▪ Keep records of air temperature, wind speed, and wind direction for aerial applications.</li> </ul>
GEN-10	Spill Prevention and Response	<p>The District will prevent the accidental release of chemicals, fuels, lubricants, and non-storm drainage water into channels following these measures:</p> <ol style="list-style-type: none"> <li>1. To the extent practicable, algaecides and aquatic herbicides will be mixed and loaded in the District or District Contractors yard before leaving for the application site(s).</li> <li>2. New District field personnel will be appropriately trained in spill prevention, hazardous material control, and cleanup of accidental spills.</li> <li>3. 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 manufacturer's label.</li> <li>4. Field personnel will ensure that hazardous materials are properly handled and natural resources are protected by all reasonable means.</li> <li>5. 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.</li> <li>6. Application equipment will be regularly checked and maintained to identify and minimize</li> </ol>

BMP Number	BMP Title	BMP Description
		<p>the likelihood of leaks developing or equipment malfunction that would lead to a spill.</p> <ol style="list-style-type: none"> <li>7. District staff will routinely inspect the work site to verify that spill prevention and response measures are properly implemented and maintained.</li> <li>8. Applicators will report spills as required by County policy and in a manner consistent with local, state, and federal requirements.</li> </ol> <p><i>Spill Response Measures:</i> 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>
VEG-4	Standard Herbicide Use Requirements	<ul style="list-style-type: none"> <li>▪ Only herbicides and surfactants that have been approved for aquatic use by the U.S. Environmental Protection Agency (USEPA) and are registered for use by the California Department of Pesticide Regulation (CDPR) will be used for aquatic vegetation control work.</li> <li>▪ Herbicide application will be consistent with Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) label instructions and use conditions issued by the USEPA, CDPR, and the Napa County Agricultural Commissioner.</li> <li>▪ Conduct an annual search for Material Safety Data Sheets (MSDS) and Label updates or revisions for herbicides to be used.</li> <li>▪ The least persistent and lowest toxicity pesticide and the lowest recommended application rate to achieve the desired control.</li> <li>▪ Herbicides will not be mixed adjacent to storm drain inlets, culverts, or water courses. Mix herbicides in areas where spillage, if it occurs, can be easily contained.</li> <li>▪ Mix only as much herbicide as necessary for the application.</li> <li>▪ Use low pressure application equipment.</li> <li>▪ Conduct spot treatment when applicable.</li> <li>▪ Use spotters to avoid accidents and aide in preventing spraying in non-target areas.</li> </ul>
VEG-5	Properly Maintain Application Equipment	<ul style="list-style-type: none"> <li>▪ Calibrate spray equipment per manufactures specifications.</li> <li>▪ Conduct equipment screening tests and tank sampling.</li> <li>▪ Dedicate specific equipment for specific products.</li> <li>▪ Clean equipment regularly following the manufactures specifications and the pesticide label directions.</li> <li>▪ Select the appropriate nozzle to ensure proper coverage.</li> </ul>

BMP Number	BMP Title	BMP Description
		<ul style="list-style-type: none"> <li>▪ Maintain and equipment log to track calibration, cleaning and repairs.</li> <li>▪ Conduct visual inspection of equipment prior to use. Check all equipment for leaking hoses, connections and nozzles.</li> <li>▪ Monitor the operation of the nozzles during the application.</li> <li>▪ DO NOT use any equipment that appears to be damaged.</li> <li>▪ Discontinue use immediately in the event of an equipment malfunction.</li> <li>▪ Ensure all staff are trained to clean up spills</li> </ul>
VEG-6	Proper Handling, Storage, and Disposal of Herbicides	<ul style="list-style-type: none"> <li>▪ Clean equipment and dispose of rinse water per label directions:               <ul style="list-style-type: none"> <li>a. Rinse equipment according to manufacturer’s label instructions.</li> <li>b. Discharge rinse water only in areas that are part of the application site or at a certified waste treatment facility.</li> <li>c. Dispose of container rinse water and spray tank rinse water as a product over a target treatment site.</li> <li>c. Dispose of surplus chemical and containers according to label instructions, and County Agricultural Commissioner guidelines.</li> </ul> </li> <li>▪ Herbicide Storage               <ul style="list-style-type: none"> <li>a. All pesticides are stored at District/County facilities in original containers.</li> <li>b. All pesticides removed from original container for use are sealed within a service container.</li> <li>c. All service containers are sealed within a tool box inside the bed of a modified truck.</li> <li>d. Tool boxes are supervised when not locked.</li> </ul> </li> <li>▪ Pesticides that have reached their expiration date shall be disposed of.</li> </ul>
BIO-3	Protection of Sensitive Fauna Species from Herbicide Use	<p>Approved herbicides and adjuvants may be applied in habitat areas for sensitive wildlife species (including salmonids, California red-legged frog, western pond turtle); 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 sensitive habitat and proceed away from the sensitive habitat. When air currents are moving toward sensitive habitat, applications will not be made within 200 yards (600 feet) by air or 40 yards (120 feet) by ground upwind from sensitive habitat. However, these distances may be modified for the control of invasive species on salmonid streams if the following measures are implemented:</p>

BMP Number	BMP Title	BMP Description
		<ul style="list-style-type: none"> <li>▪ 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).</li> <li>▪ A qualified fisheries biologist will review proposed herbicide application methods and locations. The fisheries biologist will conduct a pre-application survey (and any other appropriate data research) to determine whether the proposed herbicide application would adequately prevent against fish kills, and prescribe measures to ensure adequate protection of biological resources.</li> </ul>
BIO-4	Avoid and Minimize Impacts to Special-Status Plant Species and Sensitive Natural Vegetation Communities	<p>If there are known occurrences of special status plant species near the project site a qualified botanist, arborist, or resource specialist 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 following protocols:</p> <ol style="list-style-type: none"> <li>1. A desktop audit of the CNDDDB, vegetation maps, soils maps, and aerial photos to identify if suitable habitats for special status plants and sensitive natural vegetation communities are potentially located within or near work areas.</li> <li>2. In the event that an area is identified as potentially having sensitive natural communities will be conducted by a qualified person prior to commencement of work.</li> <li>3. Surveys will be conducted during the appropriate time of the year to adequately identify plants.</li> <li>4. District staff will ensure avoidance and minimize impacts by implementing one or more of the following, as appropriate, per the botanist's recommendation:               <ol style="list-style-type: none"> <li>a) Flag or otherwise delineate in the field the special status plant populations and/or sensitive natural community to be protected;</li> <li>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).</li> <li>c) Time construction or other activities during dormant and/or non-critical life cycle period;</li> <li>d) Store removed sediment off site; and</li> <li>e) Limit the operation of maintenance equipment to established roads whenever possible.</li> </ol> </li> </ol>

BMP Number	BMP Title	BMP Description
		<p>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.</p> <p>6. If special status plant species are present and maintenance cannot avoid impacts to the species, then a qualified botanist will determine the ecologically appropriate minimization measures for the species. Minimization measures may include transplanting, seed collection, or both, depending on the physiology of the species.</p> <p>7. The District will not conduct maintenance activities that would result in the reduction of a plant species range or compromise the viability of a local population.</p>
APAP-1	Applicator Training	<p>District staff that handle and apply herbicides will be trained annually on proper herbicide handling and use. Staff will be trained by a District or County staff with a pesticide applicator certificate obtained from the State Department of Pesticide Regulation.</p> <p>Training will include review of the BMPs included in this document, with particular focus on target and non-target plants, environmental impact avoidance measures, and herbicide label requirements. The District will ensure that applicators are properly trained in handling and use of herbicides, have a current QAC, or QAL. A QAC/QAL must complete 20 hours of continuing education every 2 years to stay licensed, and therefore are up-to-date on the latest techniques for pest control.</p>
APAP-2	Planning and Coordination	<p>When a site is selected for application of herbicides, adjacent and downstream water users (farmers and agencies with water rights diversions) will be notified to ensure their water supply is not impacted during the aquatic herbicide treatment period.</p> <p>The District will post an annual work plan on the District website. Property owners adjacent to a project site will be notified of the work that is being planned and given information regarding project objectives and management strategy.</p>



## 9. Monitoring Program

This monitoring program was developed to answer the following two questions, as required in Attachment C, *Monitoring and Reporting Program*, of the General Permit.

1. Does the residual aquatic herbicide discharge cause an exceedance of receiving water limitations?
2. Does the discharge of residual aquatic herbicide, including active ingredients, inert ingredients, and degradation byproducts, in any combination cause or contribute to an exceedance of the “no toxics in toxic amount” narrative toxicity objective?

The District will comply with the monitoring provisions and reporting requirements stated in Attachment C of the General Permit. The questions above will be addressed and documented as described below.

### 9.1 Monitoring Locations

Samples collected and analyzed will be representative of the area affected by applied herbicides. The sampling sites will vary annually depending on the sites maintained that year. At a minimum, samples will be collected in similar hydrologic conditions (flowing and non-flowing conditions) within 5 to 15 feet from the treatment area. This is an appropriate distance away from the application site because in general, areas treated in Napa County are along the stream bank, within the riparian corridor of the channel. When herbicides are applied directly in a creek or river channel, samples will be collected 10 to 15 feet downstream of the treatment area. In a pond or body of standing water, samples will be collected 5 to 10 feet away from the treatment area.

Applications typically occur from the OHWM to the top of bank with a small portion of the application occurring over the edge of the channel and below the OHWM. In lower reaches that are tidally influenced the treatment may occur at the edge of the receding tide line and continue to the top of bank or outer edge of the infestation on the landward side.

Treatment types are summarized in Table 1.

**Table 1: Treatment Types**

<b>Treatment Site Type</b>	<b>Water Conditions</b>	<b>General Application Area Description</b>
Napa River	<ul style="list-style-type: none"> <li>- Flowing</li> <li>- Standing pools within the channel bank</li> </ul>	Non-tidal reaches of the Napa River mainstem may be treated. Herbicides may be applied to standing pools within the channel or onto vegetation on the banks. Vegetation will typically be treated from the toe of the stream up to the top of bank, however, applications may also occur below the OHWM and over the surface of the water.
Napa River Flood Project	<ul style="list-style-type: none"> <li>- Flowing – tidal</li> </ul>	Treatment will occur in the tidal zone along the edge of the channel.
Engineered/Modified Channels	<ul style="list-style-type: none"> <li>- Flowing (seasonally)</li> <li>- Stagnant pools</li> <li>- Dry channel</li> </ul>	Treatment within flood control channels may be applied to the surface of the water, along the edge of the channel below OHWM, and along the banks up to the top of bank.
Natural Channels	<ul style="list-style-type: none"> <li>- Flowing (seasonally)</li> <li>- Stagnant pools</li> <li>- Dry channel</li> </ul>	Treatment will occur from the toe of the stream to the top of bank. Applications may occur near or below the OHWM.
Ponds	<ul style="list-style-type: none"> <li>- Non-flowing</li> </ul>	Occasionally, water storage or stormwater detention ponds may be treated. Treatment may occur along the edge of the pond or over the surface depending on the species of concern.

## 9.2 Monitoring Types

Sample Type:

- Background or pre-treatment monitoring – Samples will be collected upstream at the time of the application event or in the application area just prior to (up to 24 hours in advance of) the application event.
- Treatment event monitoring – Event monitoring samples shall be collected immediately downstream of the treatment area in flowing waters or immediately outside of the treatment area in non-flowing waters, immediately after the application event, but after sufficient time has elapsed such that treated water would have exited the treatment area.
- Post-event monitoring – Post-event monitoring samples shall be collected within the treatment area within one week after application.

Table 2 describes the monitoring activities will occur annually at Background, Event, and Post-Event Monitoring locations identified in Table 1.

**Table 2: Monitoring Requirements**

Sample Type	Parameter	Method	Frequency
Visual	<ul style="list-style-type: none"> <li>▪ Water Body Description</li> <li>▪ Appearance of water</li> <li>▪ Weather Conditions</li> <li>▪ Flow Conditions</li> </ul>	Visual	All Applications, All Sites
Physical	<ul style="list-style-type: none"> <li>▪ Temperature (degF)</li> <li>▪ pH</li> <li>▪ Turbidity (NTU)</li> <li>▪ Electrical Conductivity @ 25degC (µmhos/cm)</li> </ul>	Grab	6 events for Imazapyr in each environmental setting <sup>1</sup> per year  1 event for Glyphosate from each environmental setting <sup>1</sup> per year
Chemical	<ul style="list-style-type: none"> <li>▪ Active Ingredient (µg/L)</li> <li>▪ Dissolved Oxygen (mg/L)</li> </ul>	Grab	6 events for Imazapyr in each environmental setting <sup>1</sup> per year  1 event for Glyphosate from each environmental setting <sup>1</sup> per year

<sup>1</sup>. Flowing and non-flowing water

### 9.3 Visual Monitoring

Visual observations of the water body will be noted on a sampling field data sheet log for each water sampling site chosen. Observations will include:

- Water Body Description (pond, lake, channel, creek, stream, etc.)
- Appearance of water (sheen, color, clarity, etc.)
- Weather Conditions (rain, wind, fog, etc.)
- Flow Conditions (stagnant, flowing, tidal inflowing or outflowing)

Attention will be given and noted to the presence of:

- Floating or suspended matter
- Discoloration
- Bottom deposits
- Aquatic life
- Visible films, sheens, or coatings
- Fungi, algal slimes or objectionable growths
- Potential nuisance conditions

See the example Field Data Collection Form (FDCF) in Appendix B.

### 9.4 Physical Monitoring

Physical measurements will be made during surface water sampling events to provide additional data for characterizing water quality. Measurements will be recorded on a sampling field data sheet. A YSI-650 MDS meter or equivalent will be used to measure pH, conductivity, temperature, turbidity, and dissolved oxygen. The meter will be calibrated according to the manufacturer's instructions prior to use.

Physical readings will be made "in-stream" by inserting the probe directly into the water, just downstream from the point where a water sample will be extracted. Readings from the probe should be collected at three feet below the surface of the water body, or at mid-water column depth if the depth is less than three feet.

A field data sheet will be used to record visual observations, water quality measurements, and water sample collection information. See the example FDCF in Appendix B.

### 9.5 Chemical Monitoring and Analysis

#### Sampling Design

The sampling events are designed to characterize the potential risk involved with herbicide applications relative to adjacent surface waters. Consistent with permit requirements, the monitoring program includes background/pre-treatment sampling up to 24 hours prior to the application, application event monitoring immediately post-treatment, and one-week post-application event monitoring (a total of three samples per event). During background sample collection, the sampling point will be recorded using a GPS unit to aid staff in locating the point for future sampling events.

The application event samples will be collected after sufficient time has elapsed such that treated water will have entered the adjacent area. In tidal areas, herbicides will be applied on a low or receding tide. Thus, application event samples will be taken 0.5-5 hours post-treatment when the tide has again flooded the site. Finally, the one-week post-treatment monitoring will be conducted when sufficient water is present at the site on the seventh day after the application. See Section 9.1 above for further discussion of sampling locations.

### **Field Sampling Procedures**

Water samples will be collected using a sampling rod and pre-cleaned amber glass 1-liter bottles provided by the laboratory. To collect the sample, the bottle is attached to the sampling rod with a clamp, extended out over the water at the application site, and lowered to approximately three feet below the surface of the water body, or at mid-water column depth if the depth is less than three feet. When the bottle is full it is pulled back out of the water and the cap is affixed to the mouth of the bottle. The sample is labeled in permanent ink with the sample ID number, date, time, and initials of the sampler.

The sample ID number is determined by the following protocol: a four-letter code unique to the site, followed by the site visit number (e.g., -01 for pre-treatment, -02 for treatment, or -03 for one-week post-treatment), followed by the time since the application (e.g., “pre” for the baseline sample, the number of hours since the application for the treatment sample, or “1w” for the one-week post-treatment). For example, “SAL3-01-pre-1h” would mean: Salvador Creek, site 3, pre-treatment sample, 1 hour prior to application.

To help assess contamination from field equipment, ambient conditions, sample containers, transit, and the laboratory, one field blank will be collected and submitted to the lab for analysis on a regular basis. It is standard for the lab to include blanks as part of their quality control, but additional trip blanks consisting of distilled water will be submitted as a quality assurance measure. These will be added to either the treatment event or post-treatment event sample batches since the herbicide levels in the pre-treatment samples are usually ND (not detected). Field blank samples will be prepared by pouring distilled water into a pre-cleaned sampling container at the sampling point.

### **Sample Shipment**

Following collection, water samples will be stored in a cooler with ice packs and shipped for priority overnight delivery to the laboratory. If samples are not shipped until the following day, they will be stored in a cooler on ice until they can be transferred to a refrigerator, and subsequently transferred back into a cooler for shipping.

### **Field Data Sheets**

At each sampling location, the sample ID number, the time of the sampling, the sample depth, and the water temperature, pH, dissolved oxygen, conductivity, and salinity measurements, will be entered on a FDCF. Also recorded on the FDCF will be site information, including the site ID number, the station location (application point, upstream, downstream), station type (reference, treated), wind conditions, tidal cycle, water color, and the type of herbicide and surfactant that might be present. Any other unusual conditions or concerns will be noted, and any fish, birds, or other wildlife present will be recorded. The FDCFs will be dated and numbered consecutively for each site on that date. Data from these field forms will be entered into an electronic spreadsheet for processing, and the FDCFs will be compiled into a data log and kept for at least 5 years in the District’s office. An example FDCF is included in Appendix B.



A Chain-of-Custody (COC) form will be completed and sent with the samples to the laboratory. COC procedures ensure the custody and integrity of the samples through transport, delivery to lab, data gathering, and reporting. The following will be documented on the COC form:

1. Quantity and identification by name of samples transported
2. Name and signature of person transporting samples, date, time and purpose
3. Name and signature any subsequent person transporting samples, date, time and purpose
4. Name and address of laboratory performing analysis
5. Name of persons at laboratory receiving samples and the receipt date
6. Condition of samples when received at lab

### Laboratory Analysis

Samples will be analyzed for the active ingredients used and the most appropriate EPA-approved analytical method. Analyses will be conducted in accordance with the latest edition of “Guidelines Establishing Test Procedures for Analysis of Pollutants,” promulgated by the USEPA in title 40 CFR Part 136. Note that the approved methods listed in 40 CFR Part 136 do not include test procedures for imazapyr. However, other methods approved by the USEPA will be used for imazapyr. The proposed analytical methods for glyphosate and imazapyr are shown in Table 3 below.

**Table 3: Required Sample Analysis**

Herbicide Active Ingredient	CAS Registration Number	EPA Test Method and Reporting Limit	Sample Collection Comments
Glyphosate	1071-83-6	547 0.5 µg/L	Two 40mL VOA No chemical preservative 14 days hold time
Imazapyr	81334-34-1	8321B (LC/MS/MS detection) 100 µg/L	1 liter amber glass No chemical preservative 7 days hold time

Analysis of residual active ingredients in samples will be conducted by a laboratory certified by the California Department of Public Health in accordance with California Water Code section 13176. The name and contact information for the laboratory will be included in all monitoring reports. Each season, the contracted analytical laboratory is required to provide a Quality Assurance Plan (QAP) that meets USEPA standards prior to initiating analysis. The lab plan must specify the method of analysis to be used, and describe any variations from a standard protocol.

Laboratory results will be reported as follows:

1. Each sample result will be reported with the applicable Minimum Level (ML) and the current Minimum Detection Limit (MDL), as determined by the procedure in 40 CFR Part 136.
2. Sample results greater than or equal to the reported ML shall be reported as measured by the laboratory (i.e., the measured chemical concentration in the sample.)
3. Sample results less than the Report Limit, but greater than or equal to the laboratory’s MDL, shall be reported as “Detected, but Not Quantified,” or DNQ. The estimated chemical concentration of the sample shall also be reported.
4. For the purposes of data collection, the laboratory shall write the estimated chemical concentration next to DNQ as well as the words “Estimated Concentration” (may be shortened

to “Est. Conc.”). The laboratory may, if such information is available, include numerical estimates of the data quality for the reported result. Numerical estimates of data quality may be percent accuracy (plus a percentage of the reported value), numerical ranges (low to high), or any other means considered appropriate by the laboratory.

5. Sample results less than the laboratory’s MDL shall be reported as “<” followed by the MDL.
6. The laboratories will establish calibration standards so that the ML value (or its equivalent if there is differential treatment of samples relative to calibration standards) is the lowest calibration standard. At no time is the laboratory to use analytical data derived from extrapolation beyond the lowest point of the calibration curve.
7. Multiple Sample Data: If two or more sample results are available, the District will compute the arithmetic mean unless the data set contains one or more reported determinations of DNQ or ND. In those cases, the District will compute the median in place of the arithmetic mean in accordance with the following procedure:
  - a. The data set shall be ranked from low to high, ranking the reported ND determinations lowest, DNQ determinations next, followed by quantified values (if any). The order of the individual ND or DNQ determinations is unimportant.
  - b. The median value of the data set shall be determined. If the data set has an odd number of data points, then the median is the middle value. If the data set has an even number of data points, then the median is the average of the two values around the middle unless one or both of the points are ND or DNQ, in which case the median value shall be the lower of the two data points where DNQ is lower than a value and ND is lower than DNQ.

## 10. Annual Reporting

The District will prepare and submit an annual report to the Regional Water Quality Control Board Executive Officer by March 1<sup>st</sup>. The report will clearly state whether discharge of aquatic herbicides, their residues, or their degradation by products occurred.

The annual report will contain the following information:

1. An executive summary discussing compliance or violation of the General Permit and the effectiveness of the APAP to reduce or prevent the discharge of pollutants associated with aquatic pesticide applications.
2. A summary of aquatic herbicide application events conducted in the past year, including map of application and treatment areas, types and amounts of aquatic herbicides used, and all information used to calculate dosage and quantity of each herbicide used.
3. A summary of monitoring data, including chemical analysis results. All reported data will be arranged in a summary table. The data shall be summarized to clearly illustrate whether the aquatic herbicide applications were conducted in compliance with effluent and receiving water limitations.
4. Identification of BMPs and their effectiveness in meeting permit requirements. Additionally, the report will include a discussion of proposed BMP modifications or improvements.
5. Proposed changes to the APAP, BMPs, and monitoring program, as necessary to further ensure compliance with the General Permit.

## Appendix A. Sample District Planting Palettes

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# COMPREHENSIVE PLANT PALETTE BY SPECIES AND CONTAINER SIZE

Container / Pole / Plug Plantings

Acreage Total

x.xx ac

	Biological Name / Common Name	Container	Quantity Required
Trees	<i>Acer macrophyllum</i> / Big Leaf Maple	Treepot 4	XX
	<i>Aesculus californica</i> / California Buckeye	Seed	XX
	<i>Alnus rhombifolia</i> / White Alder	Treepot 4	XX
	<i>Fraxinus latifolia</i> / Oregon Ash	Treepot 4	XX
	<i>Juglans californica</i> var. <i>hindsii</i> / California Black Walnut	Treepot 4	XX
	<i>Populus fremontii</i> / Fremont's Cottonwood	Pole	XX
	<i>Populus fremontii</i> / Fremont's Cottonwood	Treepot 4	XX
	<i>Quercus kelloggii</i> / Black Oak	Treepot 4	XX
	<i>Quercus agrifolia</i> / Coast Live Oak	Treepot 4	XX
	<i>Quercus lobata</i> / Valley Oak	Treepot 4	XX
	<i>Salix laevigata</i> / Red Willow	Pole	XX
	<i>Salix lasiolepis</i> / Arroyo Willow	Pole	XX
	<i>Salix lutea</i> / Yellow Willow	Pole	XX
	<i>Umbellularia californica</i> / Bay Laurel	Treepot 4	XX
	<b>Total Trees</b>		0

Shrubs	<i>Achillea millefolium</i> / Yarrow	Deepot 40	XX
	<i>Baccharis pilularis</i> / Coyote Bush	Deepot 40	XX
	<i>Baccharis salicifolia</i> / mule fat	Deepot 40	XX
	<i>Calycanthus occidentalis</i> / Western Spice Bush	1-Gallon	XX
	<i>Heteromeles arbutifolia</i> / Toyon	Treepot 4	XX
	<i>Physocarpus capitatus</i> / Ninebark	1-Gallon	XX
	<i>Ribes californicum</i> / California gooseberry	1-Gallon	XX
	<i>Rosa californica</i> / California Wild Rose	1-Gallon	XX
	<i>Sambucus mexicana</i> / Elderberry	1-Gallon	XX
	<i>Symphoricarpos albus</i> / Snowberry	1-Gallon	XX
	<b>Total Shrubs</b>		0

Vines	<i>Lonicera hispidula</i> / Honeysuckle	1-Gallon	XX
	<i>Aristolochia californica</i> / Pipe vine	1-Gallon	XX
	<b>Total Vines</b>		0

Herbaceous	<i>Bromus carinatus</i> / California Brome	Plug	XX
	<i>Carex barbarae</i> / Santa Barbara Sedge	Super Stubby (L6)	XX
	<i>Carex praegracilis</i> / California Field Sedge	Super Stubby (L6)	XX
	<i>Elymus glaucus</i> / Blue Wildrye	Plug	XX
	<i>Elymus triticoides</i> / Creeping Wildrye	Plug	XX
	<i>Euthamia occidentalis</i> / Western Goldenrod	Liner	XX
	<i>Festuca idahoensis</i> / Idaho Fescue	Plug	XX
	<i>Juncus balticus</i> / Baltic Rush	Plug	XX
	<i>Juncus effusus</i> var. <i>brunneus</i> / Common Rush	Super Stubby (L6)	XX
	<i>Muhlenbergia rigens</i> / Deergrass	1-Gallon	XX
	<i>Symphyotrichum chilense</i> / Common Aster	Plug	XX
	<b>Total Grasses and Forbs</b>		0

## Sample District Seeding Palette

### VEGETATION MANAGEMENT & DISTURBED AREA SEEDING

Seeding Acreage Total

x.xx ac

#### Habitat Type: Disturbed Area

0.5 ac

#### Herbaceous

##### Biological Name / Common Name

##### Seeding Method

##### Qty

*Bromus carinatus* / California Brome

Broadcast Seed

X

*Elymus glaucus* / Blue Wildrye

Broadcast Seed

X

*Elymus triticoides* / Creeping Wildrye

Broadcast Seed

X

*Festuca idahoensis* / Idaho Fescue

Broadcast Seed

X

*Festuca microstachys* / Small Fescue

Broadcast Seed

X

*Hordeum brachyantherum* / Meadow Barley

Broadcast Seed

X



## Appendix B. Field Data Collection Form

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## Field Data Collection Form

Site ID (XXXX) (eg. SAL3 ): \_\_\_\_\_ Date: \_\_\_\_\_ Collected By: \_\_\_\_\_

Station Location (circle): at application point upstream downstream Station Type (circle): Reference TreatedWind (circle): low high Tidal Cycle (circle): high low slack Water Color (circle): green green-brown brown blue (dye)

Herbicide: \_\_\_\_\_ Surfactant (if applicable): \_\_\_\_\_ Gallons tank mix applied \_\_\_\_\_ Application Time (Start/Finish): \_\_\_\_\_/\_\_\_\_\_

## Field Measurements

Water Depth	pH	Dissolved Oxygen	Water Temp	Conductivity	Salinity	Meter Used
Meters		mg/L	°C	mS	ppt	

## Samples Collected

Sample ID (XXXX-YY-Ab)*	Time	Sample Depth (m)	Notes

\* XXXX-YY-Ab (eg. SAL3 -01- pre - 0.5h) = XXXX Site No., YY site visit number (01- first , 02-second, 03 -third), A: time to application (either pre, increments thereafter in half hours – 0.5), b: time increment (h=hour, w=week (for 1 week post-treatment))

Additional Notes or Comments: \_\_\_\_\_

Wildlife presence: \_\_\_\_\_



# Appendix H

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## Arundo Management Program





# Napa River Watershed Invasive Plant Management: *Arundo* Management and Riparian Enhancement Plan



**June 2015**

Prepared by:  
Napa County Flood Control &  
Water Conservation District  
804 First Street  
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## Background

### Invasive Plant Management Overview

The Napa County Flood Control and Water Conservation District (District) takes an integrated approach to stream management that involves protecting existing resources, managing non-native invasive plant species, and enhancing native riparian plant communities while maintaining flood conveyance and bank stability conditions. The District's invasive plant management program targets a number of priority non-native invasive plants, which are outlined in Chapter 4 of the District's Stream Maintenance Manual (SMM).

### *Arundo donax*

One major focus of the District's invasive plant management program has been on controlling *Arundo donax*. The District has been responding to concerns regarding the infestation of *Arundo* in the Napa River and its tributaries for over 15 years. *Arundo* is a significant issue because it can rapidly invade stream channels, often growing aggressively to the exclusion of other riparian species. The rapid and voluminous growth of this invasive plant can significantly reduce channel capacity. Successful eradication is possible in the Napa River Watershed because it has not reached the level of infestation that is seen in other streams, for example throughout Southern California. The District's *Arundo* management program is based on an adaptive management strategy which allows for operational procedures, maintenance activities, and treatment approaches to be updated as new best management practices (BMPs) are developed to minimize potential impacts.

In 2001, the District began collaborating with the *Arundo* Del Norte working group, a cooperative partnership of several northern California agencies, to identify the most effective treatment options and began systematically mapping and monitoring the distribution of *Arundo* throughout the watershed and collaborating with landowners and other organizations on the management and treatment of *Arundo*. The District's approach to managing *Arundo* is to target removal activities by sub-watershed, beginning in upstream areas and eradicating *Arundo* colonies progressively downstream through each sub-watershed as much as possible. Because infestations are mostly located on private property, the District's program includes significant outreach to local landowner's to gain permission to conduct treatments and follow-on revegetation activities.

Managing invasive vegetation is a continuous, routine, and on-going activity of the District's stream maintenance program. The District's invasive plant management activities may have temporary impacts and there is the possibility of impacting non-target species during treatment. The District has a robust habitat enhancement and restoration program designed to offset the temporary impacts associated with invasive plant management activities. Typically *Arundo* removal requires two to four years of treatment with herbicide, followed up by a riparian enhancement strategy that may include native plant revegetation and/or erosion control BMPs. A critical component to *Arundo* and invasive management in general is the ongoing monitoring and maintenance of treatment areas.

### *Arundo* Management Issues

*Arundo* is an extremely resilient and difficult plant to manage within the riparian corridor. The District takes every opportunity to review and update operational procedures to minimize potential impacts. In 2011, the District, following treatment recommendations from the *Arundo* Del Norte

group, treated standing patches of Arundo with a mixture of Glyphosate and Imazapyr in the fall. The theory was that the herbicide combination was more effective, applications in the fall would translocate to roots more efficiently as the plant goes dormant, and that spraying a standing patch maximized herbicide contact with the leaf surface area. At that time (2011) the District was collaborating with the California Land Stewardship Institute (CLSI) on a project reach along the Napa River from Larkmead Lane to Lodi Lane and was also conducting a second round of herbicide treatment along a District project reach upstream of Larkmead Lane to the city of Calistoga's wastewater treatment plant on the Napa River. The licensed applicator for the 2011 applications was the Napa County Mosquito Abatement District (NCMAD) operating under the direction of a District contractor who was overseeing the Arundo management program. Subsequent monitoring of treatment areas found that there were impacts to non-target vegetation associated with this method. In 2013, the District was notified of some observed impacts to nearby grapevines and an investigation of NCMAD for this incident by the Napa County Agricultural Commissioner, focused on the impacted grapevines. This incident, and our own observations of non-target impacts, resulted in the District re-examining its invasive treatment program as discussed more specifically later in this report.

The District continued monitoring and treating the project reaches to ensure that the Arundo was completely controlled. Follow up treatments were carried out with only Glyphosate in 2012, 2013 and 2014. The follow up treatments were limited to small isolated patches of regrowth. Monitoring of treatment sites found that within the project reach upstream of Larkmead Lane 43 trees ranging from 3-20 inch DBH were impacted from the 2011 treatment round. The District recognizes that the non-target tree impacts should be mitigated in accordance with regulatory permits. Tree impacts and the associated mitigation ratios (for tree removals) included within the District's current Department of Fish and Wildlife Routine Maintenance Agreement indicate that the District should install 202 native trees to mitigate for the observed impacts to non-target trees. To date, the District has carried out revegetation at six locations within this project reach and has already installed 303 trees. **Appendix A** summarizes the non-target tree impacts in this reach and the mitigation plantings installed to date. There were additional impacts to non-target vegetation downstream of Larkmead Lane, and the impacted non-target vegetation was removed in 2013 ahead of the revegetation effort that was carried out by CLSI. Although the planting that the District has already implemented already exceeds the indicated mitigation requirements at the subset of revegetated sites completed, the District intends to continue enhancement efforts throughout all affected project reaches. As part of the ongoing riparian enhancement effort the District will focus on installing similar tree species to the trees that were impacted at treatment sites to re-establish similar canopy cover as discussed below.

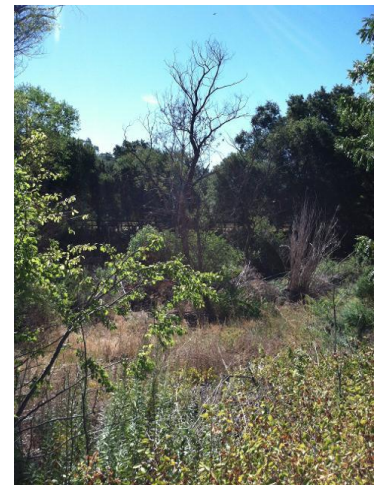


Photo 1: Example of non-target tree impacts.

## Native Riparian Enhancement and Mitigation Plan

The District maps all treatment locations and is conducting ongoing monitoring to ensure successful control of Arundo. In treatment sites that have had impacts to non-target vegetation the District will install similar native tree, shrub, and grass species consistent with upstream and downstream reference sites. The objective is to enhance the complexity of the riparian corridor by increasing



canopy cover and diversity of the riparian plant communities. This means evaluating sites to determine if understory, mid-canopy, or upper canopy species are missing and planting according to site conditions. This adaptive and flexible planting strategy allows the District to enhance the complexity and diversity of treatment sites rather than applying a one size-fits all planting approach or focusing just on woody vegetation.

The District has recently started applying a multi-phased riparian enhancement strategy. The concept is based on successional native plant development. The initial rounds of herbicide treatment employed to control the Arundo can be viewed as the beginning of a disturbance-driven successional sequence. This approach allows the District to focus on planting a site with the goal of enhancing plant diversity and complexity of the riparian structure over multiple years on a planting continuum that mimics natural succession. The first phase includes applying native grass seed, rice hay or mulch to a site to help suppress other non-natives that may colonize the site and to help stabilize exposed soils. The second phase is to identify suitable revegetation sites and select and install an array of native plants that mimic upstream or downstream reference conditions with a focus on early seral stage species. The third phase includes installation of irrigation, dry-water or applying an alternative water plan. The fourth phase is the ongoing monitoring and maintenance to control non-natives and ensure plant survivorship. The overall objective of this strategy is to allow treatment areas to be adaptively managed in a manner that will enhance the riparian structure at all canopy levels through the installation of a variety of vegetation types, including herbaceous plants, shrubs and trees.

This adaptive and flexible planting strategy is important because, based on field observation the District recognizes that sites will evolve from year to year depending on the location of the treatment site on the streambank and stream flow conditions. Often once the Arundo has been successfully controlled, small secondary high flow channels will scour out around the Arundo root masses. These micro topographic changes associated with fluvial processes will influence the riparian planting strategy, and the District recognizes that these changes are beneficial to overall channel complexity but is focused on minimizing the input of fine sediments and significant bank erosion. Over the years the District has observed that some sites will naturally recruit native riparian plants, such as elderberry, willows, and sedges. In cases where natural recruitment is significant the District's focus will be mainly on the maintenance of non-natives.



Photo 2: Example of revegetation site.

In treatment areas that have had impacts to non-target species the District is actively working on implementing riparian enhancement efforts. These efforts include a variety of strategies as described above and are dependent on site conditions. At revegetation sites the District will typically over plant with the understanding that about 10 percent of the installed plants may not survive due to site constraints, such as soil conditions, water, or other disturbances. As noted above, there were 43 impacted trees indicating 202 native riparian trees as mitigation; and the District has thus far implemented six revegetation projects within the reach that include 303 native trees (**Appendix A**). This high density planting will be continued at other revegetation sites to ensure that temporary impacts are fully mitigated and the riparian corridor is enhanced as planned.

## Typical Planting Plan

The average size of the District's completed Arundo treatment sites is approximately 950 sq ft or .02 acres. Typical plant species and densities are outlined in Table 2 below. At most sites the District will increase quantities to improve success and has outlined a typical planting plan in Table 1, which provides a general approach to the revegetation. A combination of mid-canopy and upper-canopy trees are included with a combination of mid-canopy and low-canopy shrubs, as well as herbaceous ground cover. Exact species and quantities will be selected based on site conditions and nearby reference sites.

**Table 1: Planting Plan Example**

Coverage Type	Scientific Name	Common Name	Quantity (950 ft <sup>2</sup> /.02 acres)
<b>Trees</b>	<i>Salix laevigata</i>	red willow	20
	<i>Alnus rhombifolia</i>	white alder	5
	<i>Quercus agrifolia</i>	live oak	5
	<i>Quercus lobate</i>	valley oak	5
	<i>Juglans californica</i>	Walnut	3
	<i>Aesculus californica</i>	California buckeye	2
<b>Shrubs</b>	<i>Baccharis pilularis</i>	Coyote Bush	5
	<i>Rosa californica</i>	California wild rose	5
	<i>Symphoricarpos rivularis</i> Elderberry	snowberry	10
	<i>Sambucus nigra</i>	blue elderberry	2
<b>Herbaceous</b>	<i>Carex barbarae</i>	Santa Barbara sedge	75
	<i>Juncus spp.</i>	Juncus	25
	Native grass seed mix variation as described in Table 3		
Total			157

## Current Arundo Treatment Approach

As discussed above, the District's approach to Arundo treatment has been refined over the years and operational procedures are annually reviewed. Often, the District is notified by a concerned landowner, at which point the District will survey the reach in question to identify and map the extent of the Arundo infestation. The District then outreaches to the appropriate landowners to discuss the feasibility of carrying out an Arundo management project. Once a group of landowners has approved the work the District will request a limited permit of entry from each participating landowner before initiating the Arundo management work. The first step in the Arundo removal process is to cut the plant at the base in early summer using a chainsaw or flail mower and then the biomass is chipped along the top of the bank. The District then contracts with a licensed pesticide applicator to carry out the initial round of herbicide treatment in late September through early October using Glyphosate (2-5%), a non-ionic surfactant, and blue marker dye. Applicators are only applying herbicide to the new growth and using a targeted application procedure. Annual monitoring of each site is carried out for the following two-three maintenance season, to determine if the infestation requires follow up herbicide treatments.

Once the District determines that the infestation has been completely controlled a riparian

enhancement strategy is developed. The riparian enhancement strategy includes identifying areas that require erosion control BMP's and/or are suitable revegetation sites. The first stage includes spreading native grass and wild flower seed and/or the placement of woodchips or rice hay along the bank. The second step is to identify suitable revegetation areas and determine if there is a point of connection for irrigation or if an alternative watering system is required. In suitable revegetation areas the District will choose appropriate native plants from the riparian plant palette (**Table 2**). Plant selection is based on site conditions. The objective is to create a multi-layered riparian canopy that enhances the complexity and diversity of the riparian structure to improve channel shading and create a functional understory that can compete with other non-natives. In treatment sites that have abundant natural recruitment the District may limit the installation of new species and focus on monitoring and managing other non-natives to ensure successful native plant establishment.

Once the Arundo has been successfully eradicated from a site and riparian enhancement efforts have been carried out the District will continue to monitor plant survivorship, irrigation systems, and re-growth for five years. Ongoing maintenance of treatment sites is critical and may include management of other non-natives, mulching to improve soil structure and water holding capacity, and installation of additional plants to mimic the natural successional development of the riparian structure. The District is committed to following through with the management and enhancement of treatment reaches and is dedicated to eradicating Arundo from the watershed.



Photo 3: Example of large patch of Arundo along Streambank.



Photo 4: CCC crew removing Arundo Biomass.



Photo 5: CCC crew completing Arundo biomass removal.



Photo 4: Example of typical regrowth prior to herbicide application.

## Summary

The District recognizes that riparian vegetation influences numerous important ecological functions in relation to aquatic and terrestrial habitat and provides important physical benefits. River ecosystems are highly susceptible to infestation of non-native invasive plants because of their dynamic hydrology and because channels can act as conduits for the efficient dispersal of propagules. Arundo has been, and will continue to be, an ongoing management concern of residents within Napa County due to its ability to rapidly colonize streambanks, impact native vegetation, reduce habitat quality, consume high quantities of water, and constrict channels leading to flood-related hazards. The District has been adapting management methods over the years and is in the process of mitigating for impacts associated with early treatment approaches in an effort to enhance the riparian corridor. Arundo infested sites were a significant environmental issue prior to the District beginning treatment and the above-described temporary impacts associated with non-target species being impacted, are unfortunate but are being mitigated through riparian enhancement efforts which will create a higher quality riparian corridor over time. Furthermore, the practices that lead to these impacts have been abandoned and operational procedures have been updated.

In 2012 the District developed a Stream Maintenance Manual that outlines an integrated stream maintenance strategy, which includes resource protection and environmental sustainability in addition to flood control and channel maintenance principles. This manual and program provide clear guidance on how projects can be implemented to avoid and minimize environmental impacts while conducting maintenance projects. The District has modified Arundo and invasive management operational procedures since the 2011 treatment incident. These include removing the standing patch of Arundo and only treating the regrowth, which minimizes the amount of herbicide being applied. Upon successful treatment of an infestation area a phased approach to riparian enhancement is being employed to enhance the complexity, diversity, and structure of the riparian corridor within a treatment reach.

The District intends to continue to work with landowners on the treatment, restoration, monitoring and maintenance of Arundo sites throughout the watershed and is committed to controlling and eradicating Arundo in the most environmentally sensitive manner. The District feels that current Arundo project sites clearly demonstrate the effectiveness of our current treatment approach and that non-target species are being avoided.

**Table 2: Riparian Planting Palette**

Botanical Name	Common Name	Quantity/Acre
TREES		
<i>Acer macrophyllum</i>	Big leaf maple	20
<i>Aesculus californica</i>	California buckeye	20
<i>Alnus rhombifolia</i>	White alder	60
<i>Fraxinus latifolia</i>	Oregon ash	20
<i>Juglans hindsii</i>	Black walnut	25
<i>Populus fremontii</i>	Fremont's cottonwood	30
<i>Quercus agrifolia</i>	Coast live oak	15
<i>Quercus lobata</i>	Valley oak	20
<i>Salix laevigata</i>	Red willow	90
<i>Salix lasiandra</i>	Arroyo willow	40



<i>Salix lucida</i>	Shining willow	30
<i>Umbellularia californica</i>	Bay laurel	20
SHRUBS		
<i>Baccharis pilularis</i>	Coyote bush	35
<i>Calycanthus occidentalis</i>	Western spice bush	15
<i>Heteromoles arbutifolia</i>	Toyon	15
<i>Rhamnus californica</i>	Coffeeberry	15
<i>Rosa californica</i>	California wild rose	40
<i>Symphoricarpos albus</i>	Snowberry	20
LOW HERBACEOUS PLANTS		
<i>Carex barbarae</i>	Santa Barbara sedge	500
<i>Carex praegracilis</i>	California field sedge	200
<i>Elymus glaucus</i>	Blue wildrye	750
<i>Festuca idahoensis</i>	Idaho fescue	500
<i>Juncus balticus</i>	Baltic rush	500
<i>Juncus effusus var. brunneus</i>	Pacific rush	500
<i>Leymus triticoides</i>	Creeping wildrye	750
<i>Lonicera hispidula</i>	Honeysuckle	250
<i>Muhlenbergia rigens</i>	Deergrass	500

**Table 3: Basic Seed Mix for SMP Erosion Control**

Scientific Name	Common Name	Application Rate (lbs/acre)	Growth Form
<i>Achillea millefolium</i>	yarrow	2	forb
<i>Agrostis exarata</i>	spike bentgrass	4	grass
<i>Artemisia douglasiana</i>	mugwort	4	forb
<i>Baccharis salicifolia</i>	mule fat	4	shrub
<i>Bromus carinatus</i>	California brome	4	grass
<i>Collinsia heterophylla</i>	Chinese houses	2	forb
<i>Deschampsia cespitosa</i>	tufted hairgrass	4	grass
<i>Elymus glaucus</i>	blue wildrye	4	grass
<i>Eschscholzia californica</i>	California poppy	2	forb
<i>Festuca idahoensis</i>	Idaho fescue	8	grass
<i>Hordeum brachyantherum</i>	California barley	8	grass
<i>Leymus triticoides</i>	creeping wild rye	4	grass
<i>Nassella pulchra</i>	Purple needle-grass	4	grass
<i>Poa secunda</i>	one sided blue grass	4	grass
<i>Vulpia microstachys</i>	vulpia	8	grass



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## Appendix A. Arundo Treatment and Revegetation Sites

Table A: Non-target tree impacts

Tree	Size/DBH	CDFW Mitigation Count*
Red willow	14	6
Walnut	16	6
Cottonwood	4	3
Walnut	8	6
Red willow	8	6
Red willow	10	6
Pine	15	6
Red willow	8	6
Red willow	8	6
Cottonwood	5	3
Cottonwood	6	3
Cottonwood	8	6
Valley Oak	3	3
Valley Oak	3	3
Red willow	6	3
Red willow	5	3
Red willow	7	6
Red willow	5	3
Ash	6	3
Walnut	5	3
Red willow	16	6
Red willow	8	6
Walnut	10	6
Walnut	2	1
Red willow	15	6
Red willow	6	3
Red willow	6	3
Red willow	8	6
Red willow	18	6
Walnut	8	6
Ash	12	6
Red willow	7	6
Red willow	10	6
Red willow	8	6
Red willow	6	3
Red willow	16	6
Red willow	16	6
Red willow	14	6
Valley Oak	8	6
Alder	20	6
Red willow	4	3
Red willow	6	3
Total Trees Impacted		43
Total Tree Mitigation		202

\* Mitigation Count is based upon required ratios for trees removed as part of the District's Stream Maintenance Program

# Appendix I

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## Typical Preliminary Design Plans for Biotechnical Treatments



## Erosion Control Fabric with Coir Log

**Description:** The use of erosion control fabric with coir logs includes: (1) a coir log, (2) erosion control fabric, (3) live woody cuttings, and (4) revegetation. Coir logs are tightly bound coir fibers held together by fiber netting made from coir twine. They typically range in size from 6 to 20 inches in diameter and 10 to 20 feet in length. Coir logs provide toe protection and can trap sediment in areas of low velocity flow. Coir logs provide erosion and stream scour protection and moisture retention while anchoring live woody cuttings, stakes, or both. The erosion control fabric is biodegradable and retains sediment while riparian vegetation develops and matures. Figure I-1 shows a conceptual plan for a coir log project.

**Applicability:** This treatment is suitable as a temporary measure to stabilize the bank toe while riparian vegetation develops for streambanks experiencing low to moderate flow velocities. This type of treatment is suitable for streambanks where finished slopes are 2h:1v or shallower. Coir log and erosion control fabric is generally not recommended in areas of medium to high erosive potential or in areas where infrastructure must be protected (e.g., underground utility lines, bridges, or culverts).

**Installation:** Before installation, grading or vegetation removal may be required. Depending on the work site and the scale of the project, the installation process may require use of heavy equipment such as an excavator. In other cases, work may be completed by hand. To the extent possible, equipment should be operated from the top of the bank and installation should be undertaken when water levels are relatively low or absent (summer season). However, coir logs can be installed without dewatering.

Ideally, this treatment would coincide with the riparian-plant dormant season to maximize the success of planted vegetation. Coir logs are typically staked in a single row at the banks toe. The bank behind the log is scarified, reshaped, and planted with woody or herbaceous vegetation. The coir logs themselves may also provide a growth medium for riparian vegetation. The slope is then mulched with weed-free straw, then covered with erosion control fabric.

**Variations:** Modifications of the coir log template design include replacing the coir log with a willow wattle (i.e., a bundle of live willow branches) and/or replacing the erosion control fabric with a live brush mattress (i.e., willow poles laid in a crisscross pattern on the bank slope) as described below. These variants can be considered in locations where channel capacity can accommodate very high bank roughness conditions. These variants also require high water availability for woody riparian vegetation and a high confidence in the successful establishment of vegetation. For locations with high velocity and shear stress, the coir roll may be replaced with rock slope protection (i.e., riprap) to provide more robust scour protection. The rock slope protection may need to extend further up the bank than the coir log. A civil engineer should be consulted to determine appropriate sizing<sup>1</sup> and extents of rock slope protection.

**Considerations:** Coir logs may be transported and installed without the use of heavy equipment,

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<sup>1</sup> There are several standard procedures for sizing rock slope protection including methods developed by Caltrans (2000) and U.S. Army Corps of Engineers (1994). These methods require computation or measurement of site specific channel hydraulics. As such, rock size will be determined on a case-by-case basis.

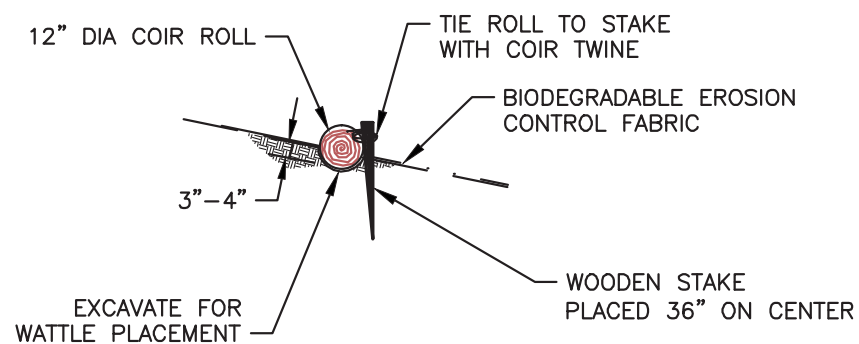


making them a valuable tool where access is limited. However, coir logs should only be used in areas that can support vegetation and where vegetation, in combination with any toe protection, will provide all necessary and long-term bank strength. Coir log and erosion control fabric are not appropriate under bridges, areas subject to heavy foot traffic, or where poor soil or water conditions will inhibit growth.

Costs vary, but generally run from \$26-\$43 per linear foot for installation. Unlike other treatments, coir logs and erosion control fabric are designed to deteriorate over the course of several years, minimizing permanent impacts. This treatment requires minimal maintenance, which may include watering, vegetation removal of unwanted species, and/or replanting of failed vegetation.



COIR LOG INSTALLATION (TYP) - SECTION VIEW



## Brush Mattress

**Description:** A brush mattress utilizes live willow pole cuttings to provide structure and stability to streambanks. Brush mattresses consists of a dense layer of interwoven willow pole cuttings anchored to the slope. Over time, the mattress will develop a strong network of interlocking roots and plant stems, protecting against erosion while providing habitat for riparian species. Brush mattresses provides immediate natural armor to the bank and helps to capture sediment during flooding. Figure I-2 shows a conceptual plan for a brush mattress project.

**Applicability:** Brush mattresses are not suited for dry ephemeral creeks. This treatment is suitable for slopes that are 2h:1v and shallower and requires basal flows that keep the basal ends of branches in the mattress moist or wet. Brush mattresses may be suitable for moderate to high energy settings for both short and long-term protection. Caution should be exercised if using a brush mattress without a rock bolster at the toe when erosive forces exceed critical threshold for underlying soils. In addition, brush mattress is generally not recommended where infrastructure must be protected (e.g. underground utility lines, bridges, or culverts).

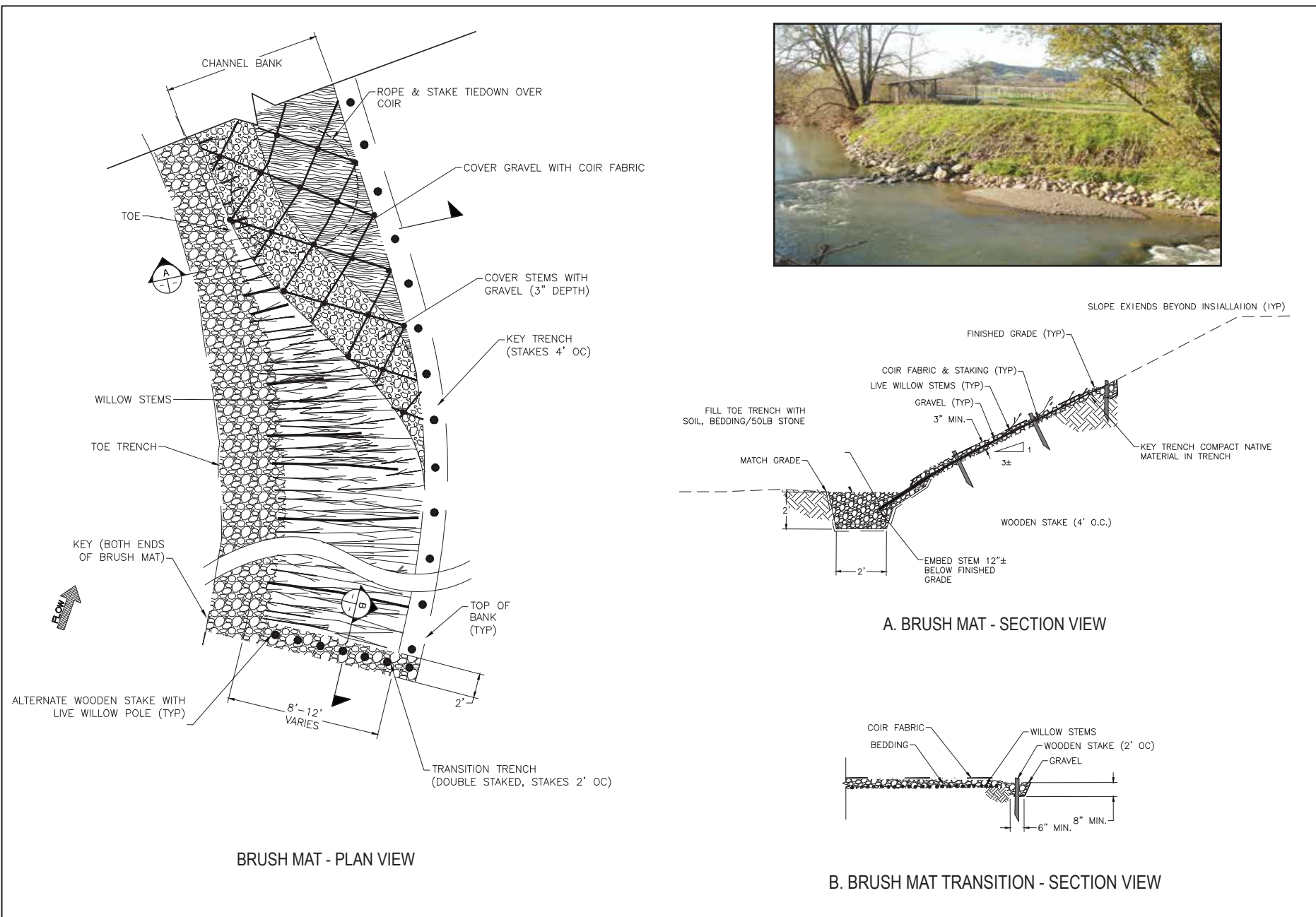
**Installation:** Each brush mattress site would have different requirements, but installation can occur by hand or with heavy machinery. Before installation, grading or vegetation removal may be required. To the extent possible, equipment should be operated from the top of the bank and installation should be undertaken when water levels are relatively low or absent (summer season).

Once the soil is prepared, installation involves placing a dense layer of willow pole cuttings parallel to the slope. These cuttings should be ½ to 2 inches in diameter and 3 feet in length at a minimum. Wood stakes are driven in between the cuttings with jute rope or twine interwoven to create a web structure with live fascine or rock at the base. Additional soil or grading may be needed to ensure good contact between the slope substrate and willow cuttings. The mattress may be partially backfilled with soil to ensure contact between slope substrate and willow cuttings.

**Variations:** Willow survival increases if work is performed near the dormant period (e.g., December through March). Varying plant and erosion control fabric treatments could also be applicable depending on the nature of the site and the goals of the project. Brush mattress installation may be combined with toe protection such as coir logs, root wads, or live fascines to increase effectiveness.

**Considerations:** A site suited to brush mattress treatment requires a hydrological regime that (1) keeps the basal ends of the live branches moist during most of the growing season and (2) sustains flows sufficient to keep the woody plants growing well without exceeding the plants' flood tolerance. This treatment is only suitable for locations with adequate soil moisture to support willow growth. For sites at the threshold of suitability, supplemental irrigation may be required to establish the brush mattress. For steep slopes, erosion control fabric may be required.

Costs vary, but average from \$12 to \$24 per linear foot, making this a cost-effective treatment. Brush mattresses may be constructed by hand, giving this access to remote or hard-to-reach locations. Cost variances are largely dependent on the amount of work needed to prepare the bank. If the brush mattress is not installed so that it lies uniformly flush with the bank, sprouting may fail and the branches may die, significantly reducing the effectiveness of the project. Monitoring requirements vary, but maintenance and hand watering may be required until vegetation becomes well-established.



## Willow Wall

**Description:** A willow wall consists of a row of willow stakes planted near the toe of a slope with willow cuttings woven through to construct a willow “wall” and backfilled with soil to create a terrace. Once established, willow pole cuttings will provide dense vegetated cover with high habitat value. The terraces themselves may be planted with herbaceous or woody vegetation, further anchoring the soil. Figure I-3 shows a conceptual plan for a willow wall project.

**Applicability:** This treatment is suitable for creeks with steep banks, areas with a confined right-of-way, moderate flow velocity, and high stress flow conditions. Willow walls are effective for remote bank stabilization since installation may be completed with hand tools and manual labor. A willow wall can provide immediate toe protection in low to medium energy settings, but high energy settings require additional protection (e.g. riprap or large wood) until the willows establish a root base.

**Installation:** Willow walls can be constructed completely by hand, but it may be more effective to use machinery such as bobcats, backhoes, rippers, augers, stingers, or excavators to complete construction. To the extent possible, equipment should be operated from the top of the bank.

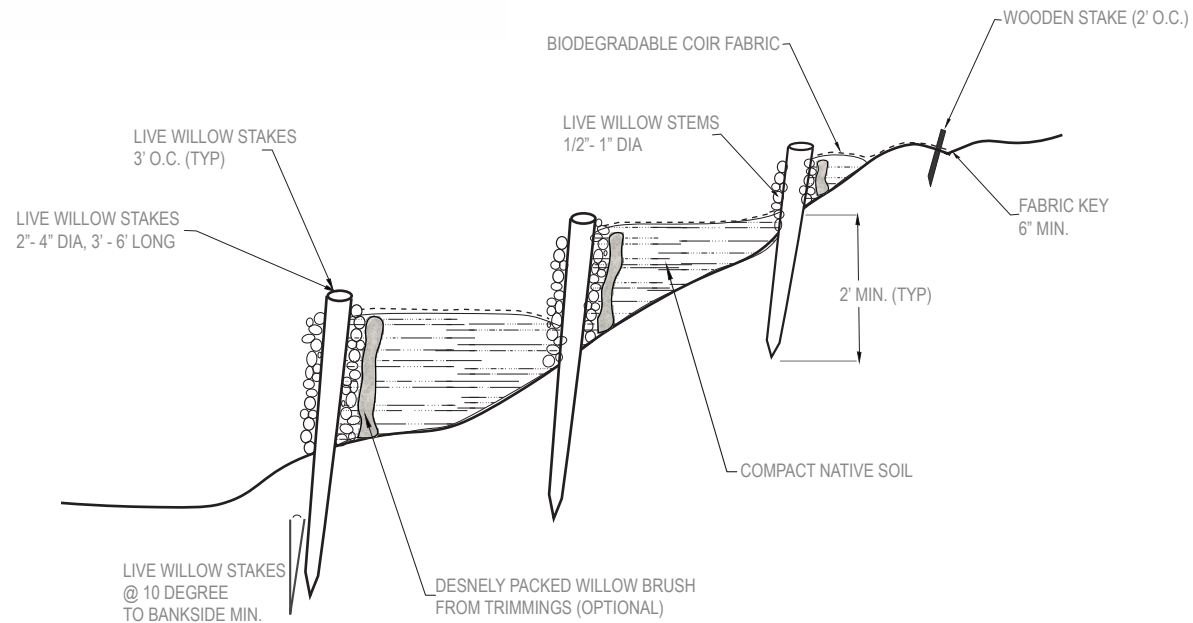
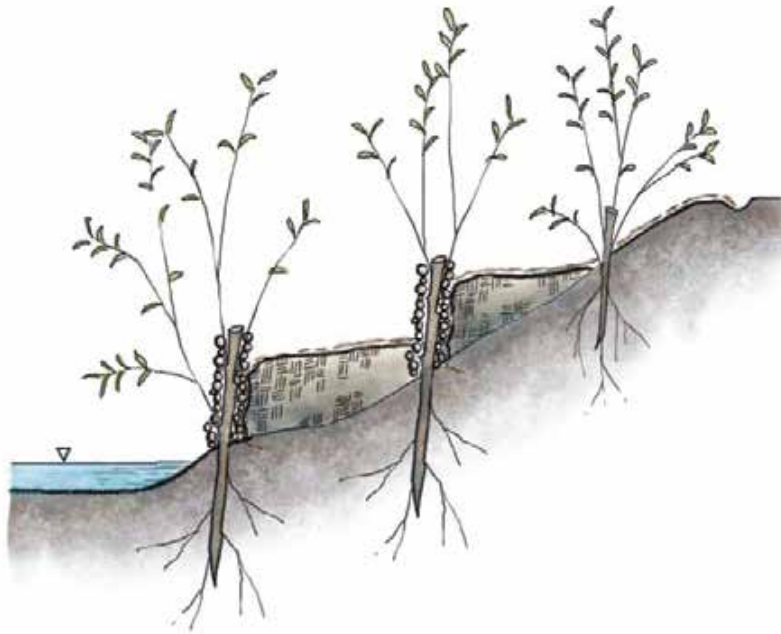
Prior to construction, bank grading or vegetation removal may be required. Cuttings should be 2 to 3 inches in diameter and at least 3 feet long. Longer cuttings may be used where soil is dry or when used in conjunction with additional treatment methods. Thinner willow samplings are then woven between the cuttings at an angle slightly above horizontal to increase survival rates. Soil is backfilled and compacted behind the willow wall creating a terrace. This willow wall terracing process continues until the willow wall reaches the top of the bank or transitions to another suitable erosion control treatment. The terraces may be seeded with native species and/or planted with nursery stock. Erosion control fabric may be placed on terraces until vegetation is established.

**Variations:** A row of rock, logs, or wooden planks held by additional willow cuttings can be added to the bottom of each wall to prevent undercutting as the willow becomes established. Willow wall treatments may be combined with brush mattress or soil lifts to enhance effectiveness. Different planting or erosion control fabric regimes may be needed depending on the terrain and desired riparian vegetation regime. In high flow situations, toe protection including riprap or root wads may be required.

**Considerations:** Willow survival increases if work is performed near the dormant period (e.g., December through March). Willow walls provide immediate erosion protection but are only suitable for locations with adequate soil moisture to support the growth of willows. For sites at the threshold of suitability, supplemental irrigation may be required to establish willows. This treatment is not recommended in areas where bank stability is required to protect infrastructure because willow walls are vulnerable to failure during the establishment period (1 to 2 years). This treatment will result in dense vegetation growth so channel capacity should be sufficient to accommodate these conditions.

This treatment provides a relatively cost-effective stabilization option since the wall may be constructed by hand. Costs vary, but generally average between \$12-\$24 per linear foot. Maintenance and monitoring are critical to success of this treatment and could substantially impact the cost effectiveness. Therefore, any watering or wildlife protection regimes would increase costs.





## Preventative Erosion Controls

**Description:** This technique combines many of the treatment options described above, namely erosion control fabric with coir logs, soil lifts, willow cuttings, and other biotechnical elements. Brush layering is another biotechnical treatment and is shown on Figure I-4. Preventative erosion control may include minor grading or reshaping of streambanks to lay back over-steepened or incised sections to create a stable slope. Additional planting of woody or herbaceous vegetation is important for long-term success as roots stabilize the soil and provide riparian habitat.

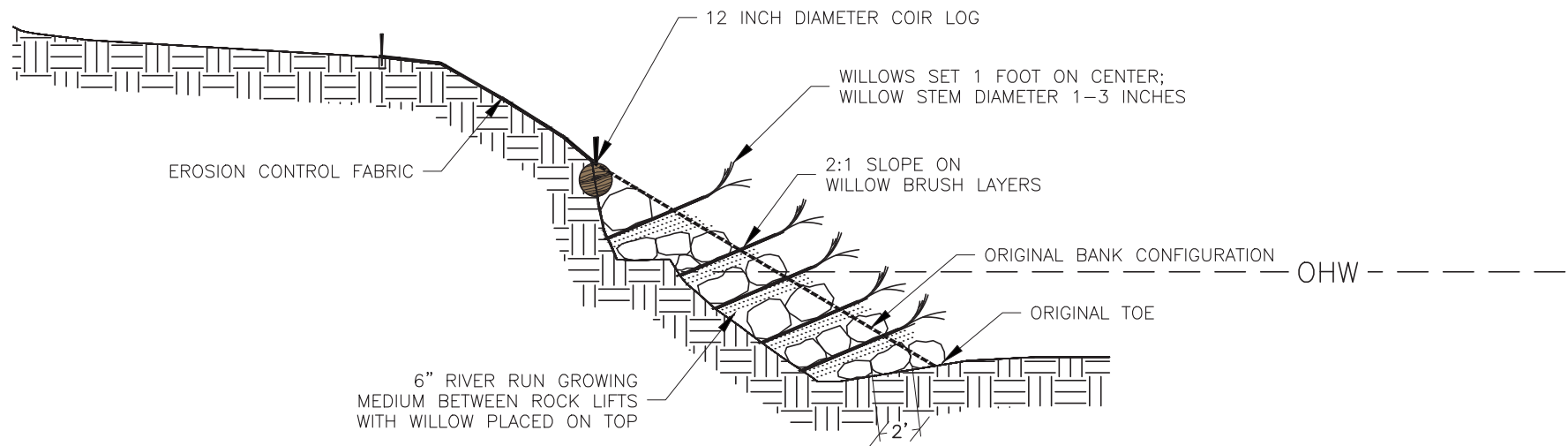
**Applicability:** This treatment is suitable for streambanks experiencing low to moderate flow velocities and finished slopes of 2h:1v or shallower. This treatment is also suitable for upland locations with sufficient soil moisture to support vegetation. Depending on the treatment type and scope, this may not require heavy machinery. This treatment should not be relied upon for emergency situations or infrastructure protection as preventative erosion controls take time (at least one growing season) to establish and are subject to varying biological processes.

**Installation:** Due to the wide variety of techniques applicable, this installation description is highly general. Preventative erosion control construction may initially involve grading or stabilizing the soil with vegetation, woody cuttings, or other biotechnical techniques, including the use of coir logs, willow walls, or soil lifts. In addition, coir logs, large woody debris, or riprap may need to protect the toe of slope. Herbaceous or woody vegetation is often planted in step with the seeding of native vegetation. Revegetation efforts should select plant species based upon the site specific hydrologic regime, soil type, and project goals. Erosion control fabric may be laid over the soil to act as a stabilizer until vegetation germinates.

**Variations:** Preventative erosion controls may be paired with any of the above treatments, but may be particularly useful for downed tree, large woody debris, or other erosion control projects. For example, a common erosion issue occurs when undermined trees fail and the entire root wad and tree end up in the stream leaving an un-vegetated and overstepped bank (See Chapter 7 for further discussion). In such cases, the District may modify the tree and reshape the bank to allow for planting and erosion control. In other cases, the preventative erosion control treatment may require a combination of any of the aforementioned techniques.

**Considerations:** Preventative erosion controls are not meant to be quick or short-term fixes. These could be constructed by hand, but the use of heavy machinery like bobcats or excavators may be required. Depending on the site's hydrology and planting season, additional hand watering may be required to establish herbaceous and woody vegetation. Due to the varying array of treatments for different situations, each treatment may have different consequences. While the bank may be protected by erosion control fabric during the vegetation establishment period, high flows may exceed the erosion protection capabilities of the temporary treatments. Willow survival increases if work is performed near the dormant period (e.g., December through March).

Costs would be highly dependent on site needs and treatment type. Using the above estimates, these treatments would be less expensive and would likely range from \$12-\$30 per linear foot. Monitoring and maintenance activities would require visual inspection to determine success and may require additional hand watering, especially during the first year.



## Encapsulated Soil Lifts

**Description:** Encapsulated soil lifts consist of stacked layers of compacted soil that are wrapped in erosion control fabric to form stepped terraces. Willow cuttings may be laid horizontally between the lifts and planted perpendicularly in the soil. Native seeds can be included in the soil lifts in order to provide additional herbaceous cover. When willows become established, they provide further stability and roughness to the embankment. Nearly all applications of this method require the use of toe protection below the lower limit of vegetation. Figure I-5 shows a conceptual plan for a soil lift project.

**Applicability:** This treatment is useful for protecting or stabilizing steep banks in confined streams or narrow right of ways where bioengineered or biotechnical treatment is needed. Soil lifts are suitable for nearly any streambank slope or energy setting. Soil lifts are particularly common in conjunction with the use of rock or root wads to prevent scour and increase complexity. Due to their flexible nature, soil lifts can be used in a variety of settings ranging from a few feet up to 30 feet of new bank. In addition, this treatment can provide immediate erosion control and infrastructure protection.

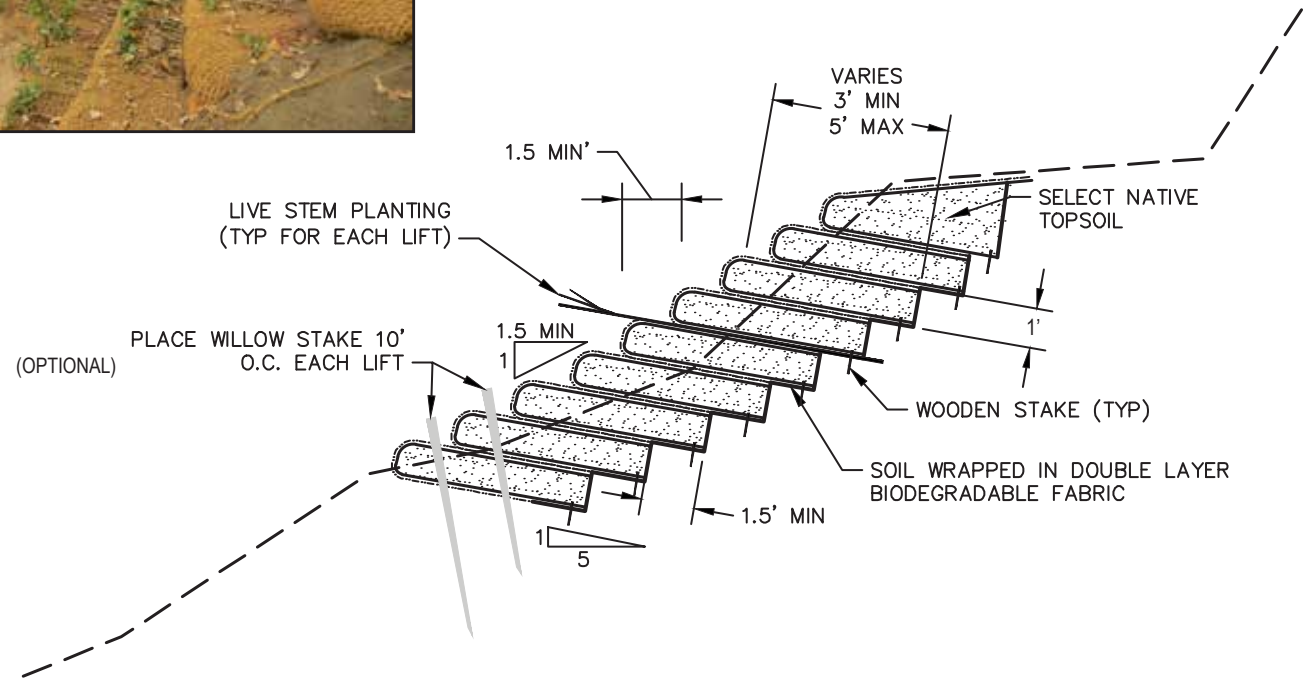
**Installation:** Encapsulated lift construction varies, but generally involves : (1) dewatering and excavation; (2) placing a fortified toe; (3) backfilling the appropriate fabric with soil and herbaceous seed; (4) laying horizontal willow cuttings perpendicular to the soil; (5) compacting and encapsulating the soil; and (6) repeating as necessary to desired height. Soil lifts are general  $\frac{1}{2}$  to  $1\frac{1}{2}$  feet tall, can be filled with a variety of soils, and may be placed in a variety of patterns. Lifts on slopes greater than 10 degrees may need to be anchored with willow poles driven through the lifts and into underlying soil to prevent slippage.

Prior to construction, vegetation removal, excavation, or grading may be necessary. Construction generally requires heavy machinery like bobcats, excavators, compactors, and loaders. Soil reinforced banks must be constructed during the dry season when flows are low or absent and dewatering is possible.

**Variations:** This technique may be applied in a variety of ways with different fabrics and structural components. Some projects may require stronger, longer lasting fabrics, soils, or configurations. In low velocity areas, an armored rock or woody debris toe may be unnecessary. In higher velocity locations, stronger mesh or a larger toe may be required.

**Considerations:** While soil lifts are highly adaptable to different projects, this treatment is best suited for locations with adequate soil moisture to support willow growth. In addition, the soil lifts generally require construction access for heavy equipment. When used in moderate and high energy settings, careful attention must be paid to construction of the transition to existing banks so that soil lifts do not destabilize them.

Encapsulated soil lifts require the use of heavy machinery, making this more expensive while requiring adequate space to access and construct the treatment. Costs vary, but generally average between \$12-\$30 per linear foot depending on the type of fabric, location, and design. Soil lifts generally require little or no maintenance so long as they are subject to flows at or below their design specifications. Monitoring involves routine visual surveys to look for damage or scour and to assess impacts above and below the treatment.





## Crib Wall

**Description:** A crib wall is an elongated box or set of boxes built out of logs or similar materials and backfilled with soil or rock. A crib wall is an engineered structure that can be used to protect very steep banks in moderate to high energy flow environments. The gaps between the successive layers of logs or rocks can serve as planting sites to create a live crib wall. Crib walls are highly effective in retaining banks and provide effective protection against bank erosion for decades. Figure I-6 shows a conceptual plan for a crib wall project.

**Applicability:** This treatment is useful for protecting or stabilizing very steep banks in confined streams or narrow right of ways and allows for establishment of vegetation on slopes that exceed 1h:1v. Crib walls are suitable for high energy settings provided that the crib wall is anchored properly. This treatment is a suitable alternative to conventional hardscape approaches that are typically used to protect infrastructure (e.g. roads or utility lines). Crib walls are not recommended for use as an emergency bank-protection technique because they require time to design and installation is impracticable during high flows.

**Installation:** Installation begins with clearing and grubbing the work area, followed by excavation of the foundation base to ensure that the crib wall can be keyed into the bank and below the immediate depth of local scour. In-water construction work should occur during the dry season when flows are typically low. If flows are present, construction would require installation of a coffer dam or other temporary dewatering structure. Vertical log piles or piers are installed into the streambed using an auger or excavator. The lengths vary but the logs generally have a diameter of 6 to 18 inches. Horizontal crib members are placed and anchored using steel cables or rebar to form a rectangle with the long side abutting the river.

Crib wall construction may require the use of machinery such as bobcats, backhoes, cranes, augers, or excavators to complete construction. To the extent possible, equipment should be operated at the top of the bank. Erosion control fabric may then be used to contain soil/substrate as it is backfilled into the crib wall. Live woody cuttings or other vegetation may then be laid horizontally in the structure, as well as planted perpendicularly into the soil at the top. When willows become established, they provide additional stability and hold the soil/substrate.

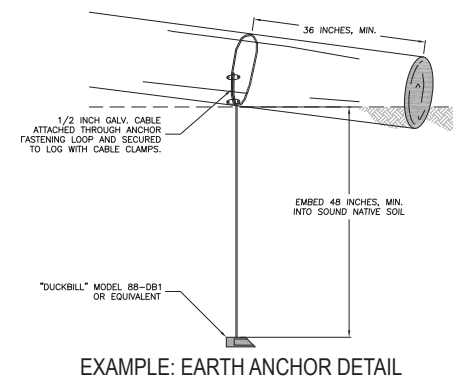
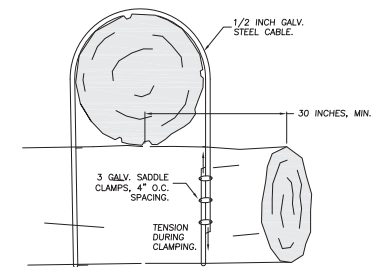
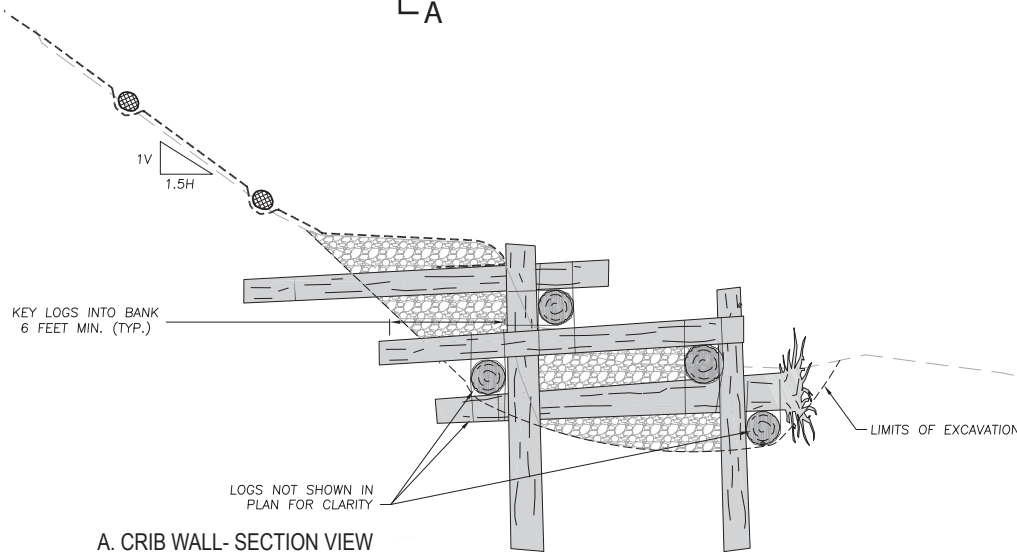
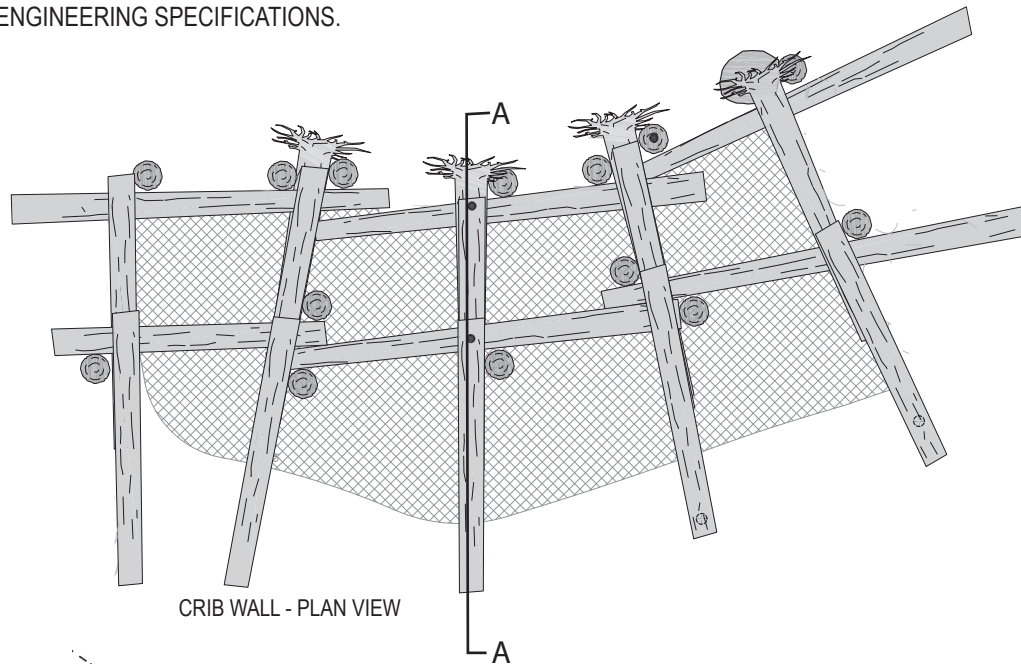
**Variations:** Crib walls may require a reinforced toe to prevent excessive scour. Crib walls can use wood, cement, or other similar materials in a variety of shapes, sizes, and alignments. Crib walls may end abruptly or can transition to encapsulated soil lifts above the ordinary high-water mark (OHWM) and may or may not be planted with vegetation. In addition, crib walls may be constructed behind the current bank, providing protection against, and a limit to, future erosion.

**Considerations:** This treatment requires construction access for heavy equipment and will likely require excavation below OHWM to prevent scour issues. When used in moderate and high energy settings, careful attention must be paid to the construction of the transition to existing banks and the potential for scour. Because crib walls do not provide roughness, careful attention must be paid to impacts on spawning and rearing habitat and dewatering. This includes timing and designing construction to avoid spawning habitat.

This treatment is costly to design and construct. Costs vary, but average between \$250 and \$350 per linear foot. Costs are greatly affected by dewatering needs, materials costs, and construction design.

Monitoring and maintenance of log structures should be conducted annually and normal maintenance includes repairing anchors, maintaining vegetation, and fixing damaged structures. Compared to other treatments, this is a relatively permanent treatment with impacts on channel structure, streambank stability, and altered streamflow.

\*THESE ARE FOR CONCEPTUAL PURPOSES ONLY. LOG DIAMETER/LENGTH, EMBEDMENT DEPTH, AND NUMBER/TYPE OF CONNECTORS ARE DEPENDENT UPON SITE CONDITIONS AND ENGINEERING SPECIFICATIONS.



## References

Caltrans. 2000. Project Planning and Design Guide, Caltrans Storm Water Quality Handbooks. Accessed June 27, 2017.

USACE. 1994. Channel Stability Assessment for Flood Control Projects. EM 1110-2-1418. U.S. Army Corps of Engineers, Engineering and Design. <http://www.usace.army.mil/inet/usace-docs/eng-manuals/em1110-2-1418/toc.htm>. Accessed June 27, 2017.

## Appendix J

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### Stream Bank Stabilization Cost-Share Program







# Stream Bank Stabilization Cost-Share Program

The District is committed to making a concerted effort to reduce streambank erosion and enhance riparian corridors throughout Napa County. Riparian and stream bank enhancement measures include extensive planting of riparian vegetation along exposed streambanks and removing non-native and invasive species along watercourses. In an effort to reduce streambank erosion the District offers a cost share program to assist private property owners with stream bank stabilization. The District offers three cost-share options:

1. 50/50 native riparian planting solution,
2. 50/50 bank stabilization for engineered hardscape solution,
3. 75/25 biotechnical bank stabilization solution,

## Cost-Share Program Check List

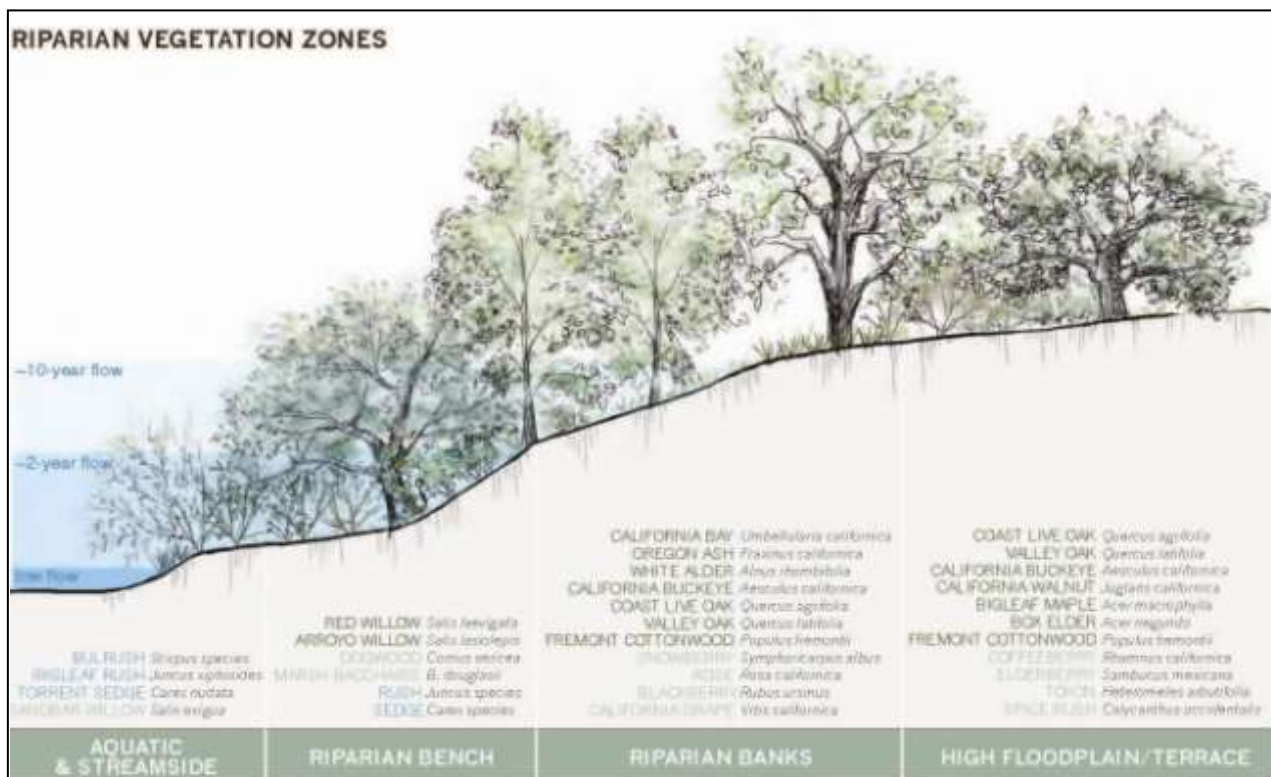
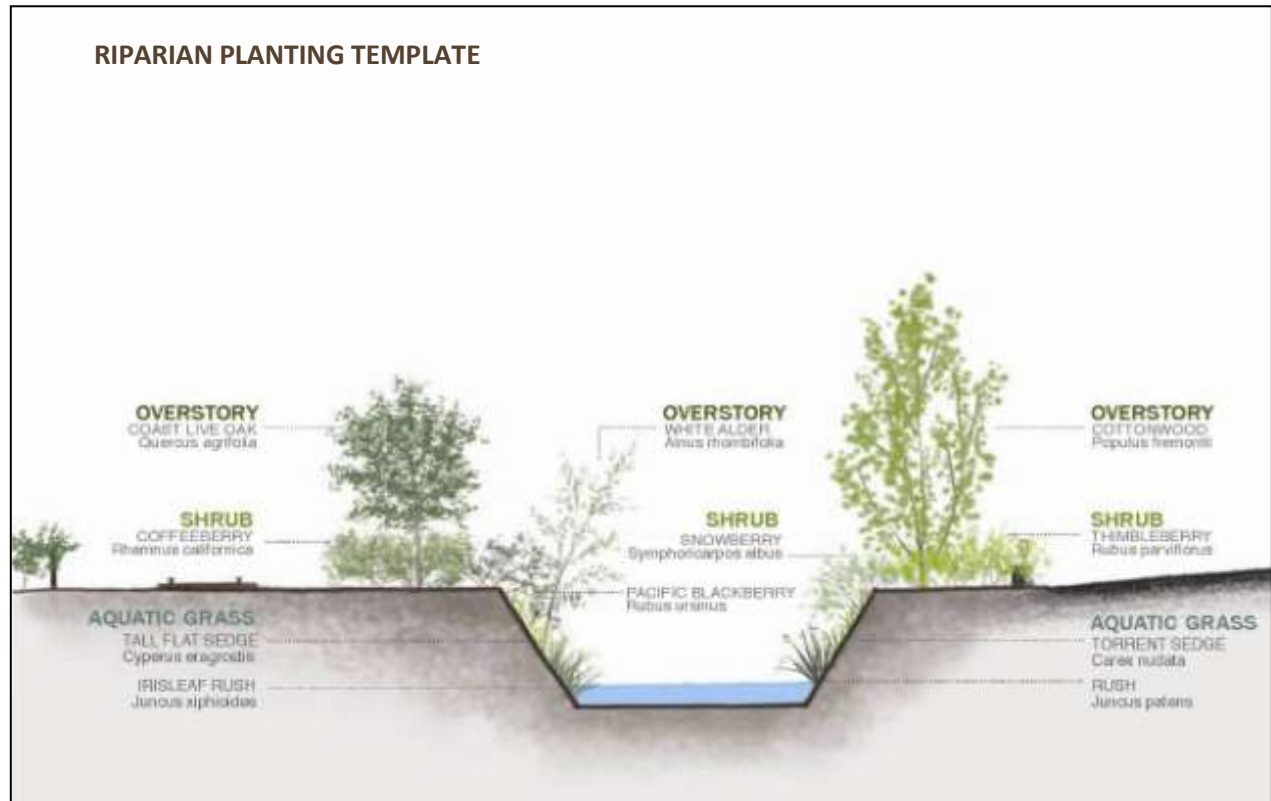
Interested parties shall follow the steps outlined below to ensure that the project is completed according to the Stream Bank Stabilization Cost Share Program procedures. To be eligible for project reimbursement each step must be completed. Further details are provided in Exhibit A of the sample agreement (page 5).

1. Meet With Flood Control District To Discuss Stream Bank Issues
2. Property Owner Contacts Design Engineer or Landscape Architect
3. Property Owner Takes Project Through Design Phase
4. Property Owner Completes & Submits Permit Application (DFG, San Francisco Bay Regional Water Quality Control Board, Army Corps of Engineers)
5. Property Owner Submits Design & Permits To Flood Control District For Review
6. Agreement Is Drafted By The District & Signed By The Property Owner
7. District Engineer Signs Off On The Project
8. Notice To Proceed Is Issued By The District
9. Property Owner Completes Project According To Design & Permits
10. Property Owner Is Reimbursed For Completed Project For The Agreed Amount Upon Proof Of Payment (Completed according to DFG Permits, Designs, and District Approval)



*To schedule a site visit or request additional information on the Stream Bank Stabilization Cost-Share Program call the Flood Control District at (707)259-8624 or visit our website at [www.countyofnapa.org/flooddistrict/](http://www.countyofnapa.org/flooddistrict/)*

# Napa County Flood Control & Water Conservation District



# Napa County Flood Control & Water Conservation District

## COIR LOG AND EROSION CONTROL FABRIC

### DESCRIPTION

This treatment provides simple biotechnical erosion protection and bank stabilization. A coir log placed at the toe of the slope protects from scour. Erosion control fabric protects the bank slope from erosion during the vegetation establishment period.

### APPLICABILITY

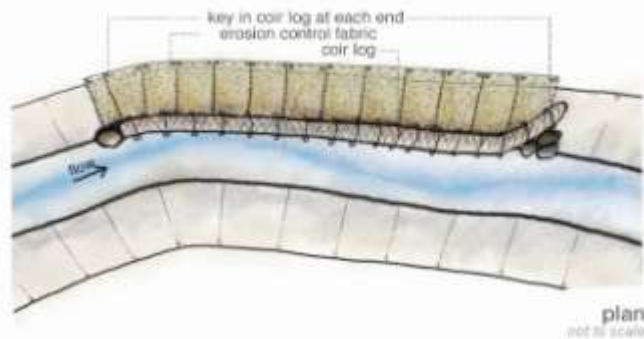
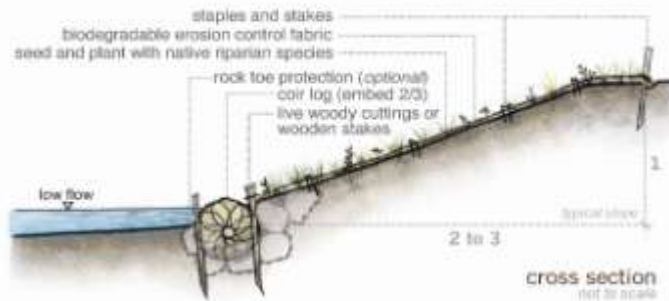
Suitable for low to moderate velocity and shear stress conditions. Recommended for newly graded banks and existing banks with 2h:1v slopes or shallower.

### CONSIDERATIONS

May require a wide right-of-way to accommodate broad bank slopes.

### VARIATIONS

Replace coir log with willow wattle and/or replace erosion control fabric with live brush mattress to increase vegetation cover. Where feasible, consider including a floodplain bench to increase flood flow capacity, channel complexity and diversity of riparian vegetation. Provide rock toe protection in high energy settings.



## WILLOW WALL

### DESCRIPTION

The willow pole cuttings are used as a biotechnical structural element to increase bank strength. Once established, willow pole cuttings will provide dense vegetated cover with high habitat value.

### APPLICABILITY

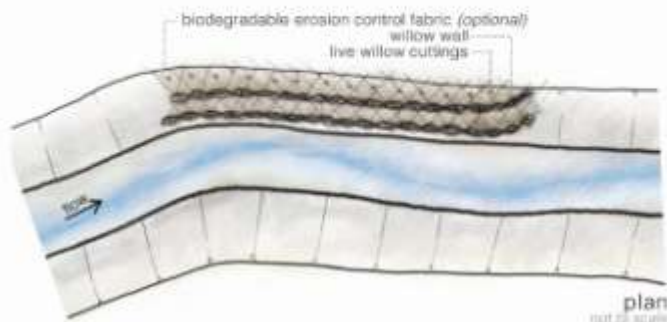
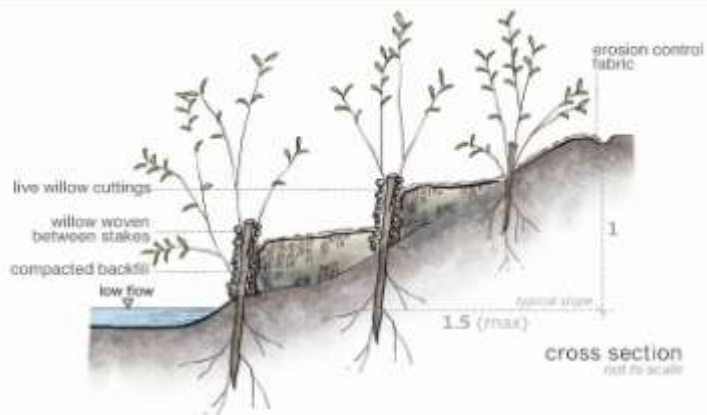
Suitable for moderate velocity and shear stress flow conditions. Suitable for steep slopes. Can be constructed with hand tools and labor, especially useful where access is limited.

### CONSIDERATIONS

Generally not suitable for protecting infrastructure. Mature willows will increase roughness and may require maintenance and thinning. Site should be appropriate for increased roughness.

### VARIATIONS

Can be combined with brush mattress or soil lifts.





# Napa County Flood Control & Water Conservation District

## ENCAPSULATED SOIL LIFTS

### DESCRIPTION

This treatment uses soil and sediment wrapped in erosion control fabric to reconstruct stream banks. Live willow cuttings are planted in interstitial spaces. Provides high habitat and aesthetic value once vegetation is established.

### APPLICABILITY

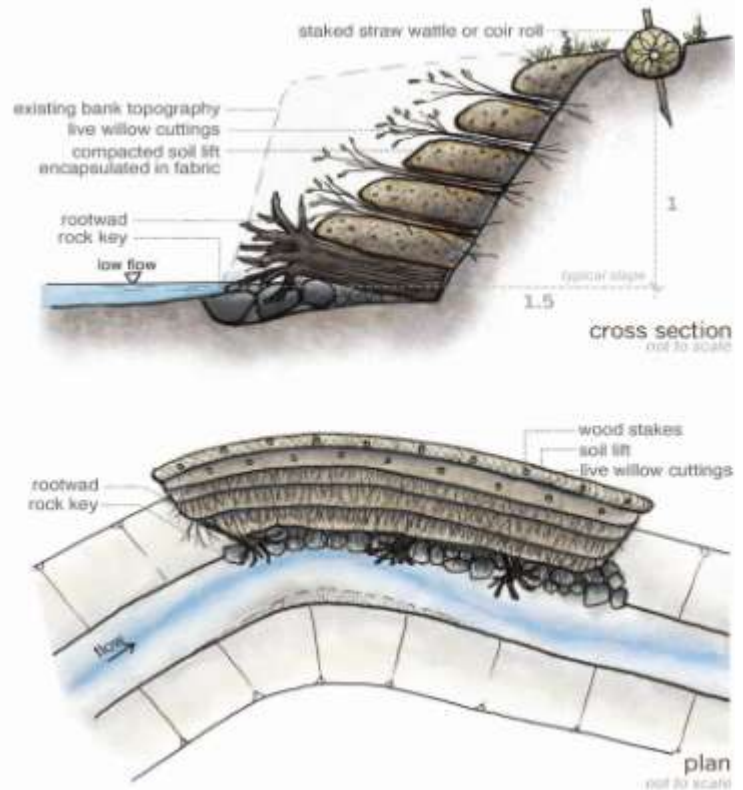
Suitable for steep slopes with moderate to high velocity and shear stress flow conditions. Appropriate for confined areas or constricted right-of-ways.

### CONSIDERATIONS

Costly to construct and requires good access. Reuse native bank soil when feasible. Incorporate root wads or large woody debris when feasible to increase habitat complexity.

### VARIATIONS

Provide rock toe protection in high energy settings.



## CRIB WALL

### DESCRIPTION

This treatment involves construction of an engineered log crib structure filled with native soil and/or stream substrate. Suitable for restoring or establishing native riparian vegetation on extremely steep slopes. Provides high habitat value on confined, steep banks.

### APPLICABILITY

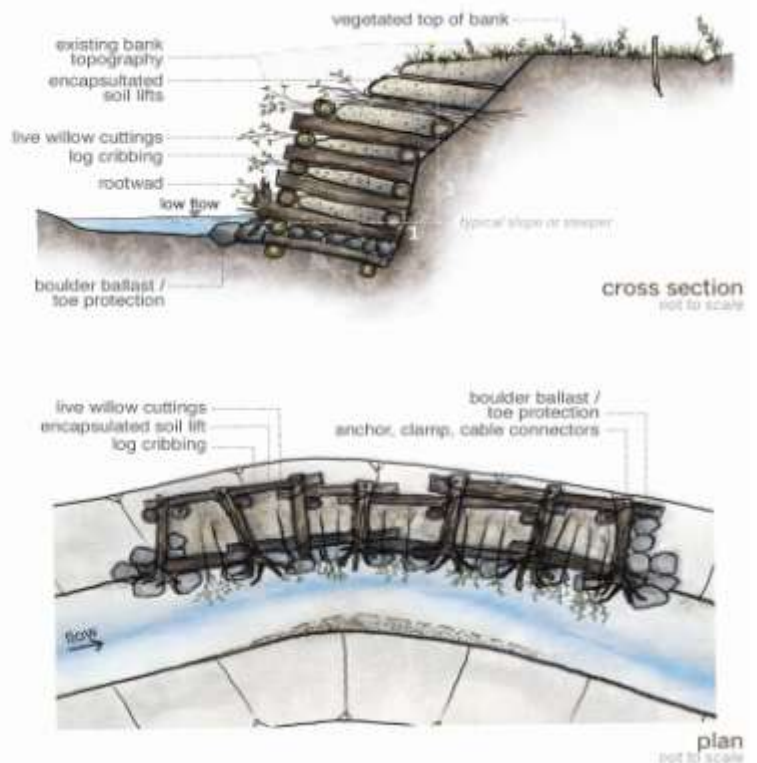
Suitable for high velocity and high shear stress flow conditions for stream reaches with steep, overhanging banks. May be appropriate where right-of-way is highly constrained or where valuable infrastructure is threatened by erosion.

### CONSIDERATIONS

Costly to construct and requires heavy equipment access. Requires boulder ballasts and anchoring. Risk of downstream impacts if crib wall is dislodged in high flows. Reuse native bank soil when feasible.

### VARIATIONS

Transition to encapsulated soil lifts above ordinary high water.





# Napa County Flood Control & Water Conservation District

## Native Riparian Planting List

Trees			
Scientific Name	Common Name	Planting Area/Zone	Habitat and Suitability
<i>Acer macrophyllum</i>	Big leaf maple	Mid to Upper Bank	Preferred species, relatively upright growth, wide spreading well adapt to toe and mid bank.
<i>Acer negundo</i>	Box Elder	Mid to Upper Bank	Spreading well adapt to heavy soils
<i>Alnus rhombifolia</i>	White alder	Toe to Mid Bank	Preferred species, relatively upright growth, wide spreading well adapt to toe and mid bank.
<i>Aesculus californica</i>	California buckeye	Upper Bank	Preferred species, relatively upright growth, wide spreading well adapt to toe and mid bank.
<i>Fraxinus latifolia</i>	Oregon Ash	Toe to Mid Bank	Preferred species, relatively upright growth, wide spreading well adapt to toe and mid bank.
<i>Juglans californica</i>	N.California Black Walnut	Mid to Upper Bank	Adds diversity
<i>Populus fremontii</i>	Fremont cottonwood	Toe to Mid Bank	Upright growth, wide spreading, well adapted to mid and upper bank plantings
<i>Quercus agrifolia</i>	Coast live oak	Upper Bank	Relatively upright growth, wide spreading, well adapted to mid and upper bank plantings
<i>Quercus lobata</i>	Valley oak	Upper Bank	Relatively upright growth, wide spreading, well adapted to mid and upper bank plantings
<i>Salix laevigata</i>	Red willow	Toe to Mid Bank	Preferred species, relatively upright growth, wide spreading, well adapted to mid and upper bank plantings
<i>Salix lasiolepis</i>	Arroyo willow	Toe to Mid Bank	Fast growth, spreading,
<i>Umbellularia californica</i>	California bay laurel	Upper Bank	Relatively upright growth, wide spreading, well adapted to mid and upper bank plantings
Shrubs			
<i>Baccharis douglasii</i>	Marsh bacharis	Toe to Mid Bank	Suitable, may need to control stem density over time
<i>Bacharis salicifolia</i>	Mulefat	Toe to Mid Bank	Suitable, may need to control stem density over time
<i>Calycanthus occidentalis</i>	Western spicebush	Toe to Mid Bank	Suitable, may need to control stem density over time
<i>Cornus sericea</i>	Stream dogwood	Toe to Mid Bank	Suitable, may need to control stem density over time

# Napa County Flood Control & Water Conservation District

<i>Corylus cornuta californica</i>	California Hazelnut	Mid to Upper Bank	Suitable, adds diversity and forage
<i>Holodiscus discolor</i>	Toyon	Upper Bank	Suitable, adds diversity and forage
<i>Rhamnus californica</i>	Coffeeberry	Upper Bank	Suitable, adds diversity and forage
<i>Rosa californica</i>	California wild rose	Toe to Upper Bank	Suitable, may need to control stem density over time
<i>Symphoricarpos albus laevigatus</i>	Snowberry	Mid to Upper Bank	Suitable, adds diversity and forage
<i>Sambucus mexicana</i>	Blue elderberry	Upper Bank	Suitable, adds diversity and forage, may need to control stem density over time
<i>Rubus Ursinus</i>	California blackberry	Toe to Mid Bank	Possible Himalayan blackberry competitor
<b>Grasses/Sedges</b>			
<i>Carex barbarae</i>	Santa Barbara sedge	Toe to Upper Bank	Rhizomatous, excellent soil binder
<i>Carex nudata</i>	Torrent Sedge	Toe to In-Channel	Use in higher gradient gravel and cobble substrate
<i>Eleocharis macrostachya</i>	Pale spikerush	Toe to In-Channel	Rhizomatous
<i>Elymus glaucus</i>	Blue wild rye	Mid to Upper Bank	Clumping heavy seeder
<i>Festuca californica</i>	California fescue	Mid to Upper Bank	Rhizomatous, excellent soil binder
<i>Juncus effusus</i>	<i>Pacific Rush</i>	Toe to In-channel	Clumping heavy seeder
<i>Juncus patens</i>	Common Rush	Toe to In-Channel	Clumping heavy seeder
<i>Hordeum brachyantherum</i>	Meadow barley	Toe to Mid Bank	Tufted, heavy seeder
<i>Leymus triticoides</i>	Creeping wild rye	Toe to Upper Bank	Rhizomatous, excellent soil binder
<i>Leersia oryzoides</i>	Rice cut grass	In-Channel	Possible cattail competitor

# Napa County Flood Control & Water Conservation District

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## NAPA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT AGREEMENT NO. NCFCWCD \_\_\_\_\_

### (STREAMBANK COST SHARING AGREEMENT)

Project Name: OWNER NAME – CREEK NAME Bank Repair

Owner: OWNER FULL NAME

APN: \_\_\_\_\_

Site Address: \_\_\_\_\_

**THIS AGREEMENT** (“Cost-Sharing Agreement”) is made and entered into as of this \_\_\_\_ day of \_\_\_\_\_, by and between the NAPA COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT ( “DISTRICT”) and the persons and/or entities (“OWNER”) listed above as the owner(s) of Napa County Assessor’s Parcel No. \_\_\_\_\_ ( “the Property”);

### **RECITALS**

This Cost-Sharing Agreement is made in recognition by DISTRICT and OWNER of the following facts:

1. OWNER owns the Property and has the authority to enter into this Agreement and to be bound by the terms hereof.
2. DISTRICT, by action of its Board of Directors at a regular meeting on June 8, 2010, approved modifications to the District Engineer’s policy guidelines (“Policies and Guidelines”) that were originally adopted on April 1, 1997 for a program providing property owners reimbursement of a portion of the costs of designing, permitting, repairing and restoring damaged river and stream banks under the circumstances, terms and conditions set forth in Exhibit “A”, attached hereto and incorporated by reference herein.
3. DISTRICT has budgeted funds for such eligible cost sharing assistance and the District Engineer is authorized to determine eligibility and enter into an agreement with OWNER, pursuant to the policies mentioned above.
4. River and stream bank damage suffered on the Property as a consequence of floods can be repaired or remedied through a project (“Project”) of reconstruction and stabilization meeting the eligibility requirements of the Policies and Guidelines, the project description, plans and specifications (“Plans and Specifications”) of which, prepared by a licensed engineer or qualified landscape profession retained by OWNER, are set forth in Exhibit “B”, attached hereto and incorporated by reference herein.

# Napa County Flood Control & Water Conservation District

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5. Having obtained at least two bids from a duly licensed contractor for completion of the Project in accordance with the Plans and Specifications and an estimate of Project costs based thereon, OWNER has requested, as shown on Exhibit "C", attached hereto and incorporated by reference herein, and DISTRICT is willing to enter into this Cost-Sharing Agreement for the funding by DISTRICT, depending on the type of project, up to 75% of the costs of the Project, in accordance with the Policies and Guidelines on a reimbursement basis, with all initial outlays being made by OWNER.

## **TERMS**

**NOW, THEREFORE,** DISTRICT and OWNER agree as follows

1. OWNER shall be solely responsible for all payments due or owing to any person or entity for services performed or materials provided in connection with completion of the Project. No reimbursement of OWNER by DISTRICT for any of the costs of the Project shall be made by DISTRICT until all work is complete and documentation of the actual costs and payment therefore has been provided to DISTRICT as set forth in (3), below.

2. OWNER hereby grants DISTRICT, its representatives, and the representatives of any agency issuing permits for or otherwise having jurisdiction over the Project a right of entry onto the Property as well as a right of entry onto and right of passage over any other land owned or within the legal possession of OWNER where deemed necessary by DISTRICT or such agency to obtain access to the sites of the Project on the Property. In addition to granting such right of entry, OWNER shall cooperate with all such agencies and representatives in the accomplishment of the Project.

3. Upon receipt by DISTRICT's Engineer of a notice of completion and a written claim completed on a form satisfactory to the DISTRICT Engineer and DISTRICT Auditor, and depending on the nature of the project, an amount equal to 50 or 75% of the actual, documented construction costs, but not to exceed \$30,000 in total, shall be reimbursed by DISTRICT to OWNER.

4. OWNER shall retain and make available to DISTRICT for copying and inspection upon request all records pertaining to the design, construction, completion, maintenance and costs of the Project for at least five years following completion of the Project as signified in the notice of completion.

5. Except for the designation of an individual to act as a liaison pursuant to this Cost-Sharing Agreement, to the extent that DISTRICT makes any commitments, assumes any responsibility, or is required to perform any act under the terms of this Cost-Sharing Agreement or the underlying public law, such commitments, responsibilities and performances shall become the responsibility of OWNER.

6. OWNER agrees that the Project shall be conducted and completed in accordance with the Plans and Specifications. To the extent that any changes in such work or the Plans and Specifications become necessary in the opinion of either OWNER or DISTRICT, OWNER agrees to be bound by, and to pay OWNER's share of the cost of any such changes and to be solely responsible for retaining any licensed engineers, contractors or other professionals necessary to design and/or implement.

7. OWNER specifically acknowledges that any delays or stoppages effecting the commencement or completion of the Project shall not result in any further responsibility of DISTRICT and,

# Napa County Flood Control & Water Conservation District

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to the extent DISTRICT has or claims to have, an obligation to third parties under this Cost-Sharing Agreement, such obligation shall become the obligation of OWNER.

8. OWNER hereby agrees to indemnify, save and hold DISTRICT harmless from any claims, losses, judgment or expense, including reasonable attorneys' fees, arising from the work undertaken to complete the Project, the design of the Project, or the subsequent use or maintenance of the Project.

9. OWNER and DISTRICT mutually acknowledge that, while the partial public reimbursement of OWNER for costs incurred in completion of the Project serves in part a public purpose through facilitating and expediting remediation of a possible threat to public as well as private resources in the event of future flooding events, nevertheless it is the intention of the parties that OWNER shall have sole responsibility for ownership, design, contracting, oversight, control, and completion of the Project; that nothing in this Cost-Sharing Agreement shall convey to DISTRICT any easement or property rights to the Property or Project; that nothing in this Cost-Sharing Agreement shall imply or be interpreted so as to result in the Project being deemed a "public project", "public contract", or DISTRICT project for any purposes, including but not limited to laws pertaining to competitive bidding or payment of prevailing wages on public projects, permit exemptions, tax exemptions, or public liability; and that nothing in this Cost-Sharing Agreement shall impose on DISTRICT any responsibility for future use or maintenance of the Project.

**IN WITNESS WHEREOF**, this Agreement was executed by DISTRICT and OWNER as  
of the date first above written.

FIRST NAME LAST NAME and FIRST NAME LAST NAME

By: \_\_\_\_\_

"OWNER"

NAPA COUNTY FLOOD CONTROL AND  
WATER CONSERVATION DISTRICT

<p><b>APPROVED AS TO FORM</b></p> <p>Office of District Counsel</p> <p>By: _____</p> <p>Date: _____</p>
---

By: \_\_\_\_\_

Phillip M. Miller , P.E., District Engineer

"DISTRICT"



## EXHIBIT A

### Napa County Flood Control and Water Conservation District Stream Bank Stabilization Program

Do you own property with or along a creek? Is the creek eroding or undermining your property? The Flood Control District has a program that can help you permanently stabilize stream banks affecting your property. Contact Shaun Horne at the Flood Control District at (707) 259-8624 for more information or to apply.

#### ELIGIBILITY POLICIES

1. Property must be *privately owned*.
2. The Owner must *not be eligible for financial assistance from any other known grant funds* for bank repairs or the removal of invasive non-native plants and the restoration of native plants. District staff will assist the owner in making this determination, and if necessary, put the owner in contact with the appropriate agency.
3. A professional engineer must design structural repairs. Qualified landscape professionals in consultation with the local office of the United States Department of Agriculture / Natural Resources Conservation Service (USDA/NRCS) may design non-structural or bio-engineered repairs. Such designs must utilize stream assessment protocols established by the NRCS/NCRCD, and meet "Stream Corridor Improvement" practice standards. In either case *the installation is to be performed by a licensed contractor*.
4. The *Owner must agree to maintain the resulting improvements and* keep them up to standards acceptable to the District and all agencies issuing permits for the repair and restoration project. The owner must also agree to allow the District access for inspection purposes on an annual basis for up to five (5) years.
5. The *stream bank must show evidence of serious erosion, or* in the opinion of District or NRCS staff, have the very *real potential of serious erosion* occurring during high flows if left unprotected, or have the presence of significant amounts of invasive non-native plants. Protective measures shall be those that are deemed to be permanent in nature.

#### IMPLEMENTATION POLICIES

1. *Owner must apply to the District for assistance prior to making permanent repairs or improvements. District will not reimburse Owner for work done prior to the District's granting of written authorization to proceed.*
2. Upon receipt of a written request to participate in the District's program, District staff will perform a field check with Owner to check the severity of the stream bank erosion, potential for erosion or the significant presence of invasive non-native plants.
3. District staff will then make a determination of Owner eligibility.
4. Owner will be required to enter into an agreement with the District identifying the obligations of both parties. The District Engineer is authorized to execute said agreements on behalf of the District.

5. **Owner shall be responsible for contracting with a professional engineer or qualified landscape professional for the preparation of plans, specifications, cost estimates and construction inspection.**
6. Plans will be reviewed and approved by District staff and shall conform to the Standards that the District uses for similar projects under District jurisdiction and ownership.
7. **Owner shall be responsible for hiring a licensed contractor** to construct the repairs and improvements in accordance with the approved plans and specifications.
8. **Owner shall obtain all legally required permits and /or licenses from federal, state and local regulatory agencies and agrees to complete all permit required monitoring and reporting. Non-compliance with permit conditions may result in District's refusal to reimburse Owner's costs, depending on the nature of the non-compliance and at the sole discretion of the District Engineer.**
9. District shall reimburse Owner upon:
  - a. Receipt of a statement from the Engineer or qualified landscape professional that the work was performed in substantial conformance to the regulatory agency permits, and approved plans and specifications, including all required mitigation planting etc.
  - b. Receipt of evidence that the contractor has been fully paid, indicating the amount that was paid for the eligible work. This should be in the form of a signed letter or final zero balance invoice sent to the District by the contractor or copies of canceled checks and
  - c. A final inspection of the completed project by Flood District staff.
10. **District funds shall be used to reimburse Owner for 50% of the cost of construction and other related expenses such as permit fees, design costs and construction inspection, up to a maximum amount of \$30,000. Designs that utilize bioengineering techniques, as defined below, will be reimbursed 75% of the aforementioned costs.**
11. **Bioengineering construction methods are those that incorporate structural repairs with native vegetation and are designed to protect and enhance the riparian environment. Bioengineered methods are designed to work with the natural geomorphic conditions in a stream versus to control erosion by simply armoring the stream bank. Generally, a setback of active land use at the top of the stream bank is also encouraged whenever possible. Approval of the Project for the higher reimbursement percentage (75% versus 50%) will be based on the sole discretion of the District Engineer.**  
**Projects involving only non-native invasive vegetation removal and replanting with native plants (no regarding of streambank or armoring) will be reimbursed at 50%.**
12. Completed projects shall be maintained by owner to standards acceptable to the District.
13. District shall be granted access rights to inspect the facility at any time during and after construction.
14. Project approvals shall be granted on a 'first come, first served' basis determined by the date that the Owner signs the Project Agreement. Project approval will be revoked if construction has not been completed within one (1) year of the date the Owner signs the Project Agreement. District Engineer has the authority to grant an extension of time if Owner can demonstrate that he/she has proceeded with due diligence and that factors beyond his/her control have delayed the project.

15. The District Engineer is authorized to execute agreements committing no more than the total amount of money budgeted in any given fiscal year. He can also establish a waiting list of Project Agreements that have been signed by Owners in order to continue the 'first come, first served' policy. Owners who wish to proceed in advance of the District's commitment of funds will be eligible for reimbursement only if funding eventually becomes available; said funding extends to their place on the waiting list; and if they have followed all program criteria. District staff is authorized to assist Owners on the waiting list as they would Owners with funded projects, to review and approve plans and do project inspection. The reason for this is to give incentive to Owners to make repairs before the next rainy season, rather than wait for the next year's budget appropriation. The waiting list will also assist the Board in measuring the demand for this program.

# Appendix K

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## Sediment Sampling and Analysis Guidelines





## Appendix K: Sediment Sampling and Analysis Guidelines

### Introduction

These sediment sampling and analysis guidelines accompany the description of sediment disposal in Chapter 7 of the Stream Maintenance Manual (Manual), and identify disposal options based on characteristics of the sediment. Guidance is provided for identifying sediment sampling frequency, sampling methodology, sediment analysis, and other sediment characterization activities. Sediment sampling, disposal, monitoring, and reporting conditions issued by the San Francisco Bay Regional Water Quality Control Board (RWQCB) under the forthcoming Waste Discharge Order (No. R2-2019-XXXX) are included by reference and as guided by the “Beneficial Reuse of Dredged Materials: Sediment Screening and Testing Guidelines” developed by the RWQCB in May 2000, U.S. EPA Guidelines and sampling methodologies, and sampling parameters provided by the RWQCB in March 2018. The sediment sampling and disposal process will be coordinated annually between the RWQCB and the Napa County Flood Control and Water Conservation District (District) as part of the review and approval process for annual stream maintenance and disposal activities.

### Sediment Disposal

Sediment disposal sites will be identified when the need for sediment removal activities arise; sediment removal and disposal activities may not be necessary every year. Sediment disposal sites will be reviewed and approved by the RWQCB based on analytical results from sediment sampling at the channels to be maintained and in consideration of the ultimate fate of the sediment. The conditions for approval will evolve as the RWQCB and District become familiarized with the characteristics of sediment removed as part of maintenance activities and with sediment disposal and reuse conditions.

In general, sediment disposal sites can be characterized into five categories based on potential reuse or disposal opportunities. These categories include (1) on-site reuse, (2) other wetland, channel, or floodplain restoration reuse, (3) upland agricultural or commercial reuse (dry), (4) landfill disposal, and (5) hazardous waste disposal options. These disposal options are listed below in preferential order according to how well they support program objectives for ecologic sustainability.

- n **Option 1: On-site reuse.** This includes reusing the sediment on-site (i.e., at the project site) within the channel or easement area for various fill or restoration purposes. For example, sediment excavated from the channel bottom could be placed adjacent to the active channel (remaining within the easement area), to enhance soil, vegetation, and riparian habitat conditions. Sediment could also be used on-site for bank stabilization purposes.
- n **Option 2: Wetland, channel, or floodplain restoration or enhancement.** Option 2 consists of beneficial reuse of the sediment outside or off-site of District channel or easement areas, but in a wetland, channel, or floodplain setting to support ecologic functioning and habitat. As examples, gravel removed from one creek that does not support steelhead or salmonids could be placed in another creek that does in order to enhance salmonid habitat. Additionally, excavated sediment could be reused as part of habitat enhancement activities along the Napa River mainstem.

Under this option, sediment would be used as fill in an already approved and permitted restoration project. This is a specific case where an approved and permitted project requires the use of

sediment to fill a wetland or enhance in-stream habitat. It is important to note that this sediment disposal plan in no way encourages or sanctions the filling of existing wetlands. However, for restoration projects that are already approved and permitted, it may be preferable to use sediment materials that share similar properties. In this way, using good quality excavated channel sediment for reuse in a wetland, channel, or floodplain setting may be preferable or advantageous to using other fill material or soils.

For the purposes of the sediment quality criteria discussed below, Option 2 sites are located in the vicinity of and potentially drain to wetlands or water bodies.

- n **Option 3: Upland agricultural or commercial reuse (dry upland sites).** Under this option, sediment would be reused for upland agricultural or commercial uses that are dry, whereby the sediment would not be secondarily eroded to stream channels or water bodies. Demand for dry sediment is high, particularly for use as soil amendment for agricultural crops, construction of foundation pads for buildings or structures, or permanent fill of pits or to level the landscape. It is likely that upland disposal sites within Napa County will be frequently available and can accept large quantities of sediment.
- n **Option 4: Landfill disposal.** In this option the sediment would be disposed at an approved and operating landfill for use as daily cover material for landfill operations. The nearest operating landfills are the Upper Valley Disposal and Recycling (UVDS) Clover Flat Landfill located in St. Helena and the Potrero Hills Sanitary Landfill in Suisun City. Another landfill disposal option is the Redwood Landfill located in Novato. Sediment would be taken to the nearest landfill in need of cover material.

The District, in conjunction with the City of Napa and the U.S. Army Corps of Engineers, maintains two sediment disposal sites in the southern portion of the county. These are the Edgerly Island Disposal Site and the Napa Sanitation District Imola Site (described in Chapter 10 of the Manual). Both sites are approved by the USACE to receive sediment spoils from dredging of the Napa River and other sites within the county. The Edgerly Island Disposal Site has the capacity to receive up to 330,000 cu. yds. of sediment and has only been used once; the site is nearly empty. The Napa Sanitation District Imola Site has the capacity to receive up to 50,000 cu. yds. of sediment and has not been utilized since 2016. Both sites operate under Waste Discharge Requirements (WDRs) issued by the RWQCB.

- n **Option 5: Hazardous waste disposal.** This option involves the disposal of sediments containing hazardous levels of contaminants. Hazardous waste will be disposed at appropriate hazardous waste facilities. The nearest hazardous waste landfill is located in Kettleman City, California.

These five disposal options will be evaluated in decreasing preference with potential site selection based on the quality of sediment. The preference is to select disposal options that most beneficially reuse the sediment with the least environmental effects.

It is anticipated that off-site disposal (Options 3 and 4) would be proposed for the majority of maintenance activities. Disposal Option 2 would be implemented on rare occasions due to the infrequency of sediment removal and the specific needs of other pre-approved restoration projects in the County. Option 5 would only be used if the sediment is deemed hazardous. The specific disposal sites for the options selected will be identified as part of the sediment planning process and approved by the RWQCB prior to maintenance.

## Sample Analysis Approach

All sediment samples will be analyzed according to the forthcoming conditions of the RWQCB Waste Discharge Requirements - Monitoring and Reporting Program (Order No. R2-2019-XXXX). Sampling parameters/analytes may be modified after a history of sampling is obtained. This may result in not

requiring monitoring for some of these contaminants under certain situations or at certain locations, or the addition of more parameters/analytes if deemed necessary by the RWQCB.

Analytes tested will vary depending on the proposed reuse of the sediment, as follows.

- § If sediment is reused on-site (Option 1), no testing is required because it is assumed the sediment quality would be comparable to existing conditions at the location of on-site reuse.
- § If sediment is reused for wetland, channel, or floodplain restoration, where the newly placed sediment would be in contact with water bodies (Option 2), analysis would be conducted according to the “wetland surface” testing requirements stated in the *Beneficial Reuse of Dredged Materials: Sediment Screening and Testing Guidelines* (RWQCB 2000). Required analysis includes sediment chemistry and acute toxicity testing.
- § If sediment is reused for upland agricultural or commercial use where dry sediment would be permanently removed from the system (i.e., there would be no contact with water bodies), then analytes listed in Table 1 would be tested. This analyte list was provided to District by RWQCB staff in March 2018.
- § If sediment is taken to a landfill for use as cover material or to the Edgerly Island Disposal Site or the Napa Sanitation District Imola Site, sediment quality testing would be conducted as required by RWQCB permits issued to those sites and in compliance with DTSC waste acceptance regulations.
- § Sediment exhibiting levels in the hazardous range, as defined by the California Department of Toxic Substances Control (DTSC), would be taken to a permitted hazardous waste facility.

### Sample Collection Frequency and Locations

- § For sediment removal projects that involve the removal and disposal of less than 200 cubic yards of sediment, one sample will be collected and analyzed. Details on the methodology used to collect and composite samples are described below.
- § For sediment removal projects that require the removal and disposal of more than 200 cubic yards of sediment, one sample will be collected for every increment of 500 cubic yards of sediment to be removed (beyond the original 200 cubic yards). Details on the methodology used to collect and composite samples are described below.
- § Sampling locations will be selected to represent overall sediment conditions at the maintenance site. Sampling sites will be selected to target conditions at the upstream and downstream ends of the project zone. As is feasible, sampling sites will also specifically target conditions downstream of culvert crossings, culvert outfalls, and key stream confluences.

### Sediment Sampling Methodology

This guidance applies to discrete (single) samples and composite samples. All samples shall be collected by means of a hand trowel, a hand auger, or another sampling method approved by the regulatory agencies. The individual collecting the sample will have the discretion of choosing the sampling method which is the most efficient to perform.

All sampling equipment will be decontaminated using Alconox® soap and rinsing with distilled or de-ionized water. Latex-free gloves will be worn when handling cleaned equipment. Sampling will be conducted in accordance with the methods described below:

#### Hand Trowel Procedure

1. Remove vegetation and woody debris from the ground surface.
2. If collecting a subsurface sample, use a shovel to dig down to the desired sampling interval.
3. Use a stainless steel hand trowel to collect soil.
4. Place soil in an appropriate sampling container.
5. Replace all excavated soils to their original location (i.e., backfill the sampling hole).

#### Hand Auger Procedure

1. Remove vegetation and woody debris from the ground surface.
2. Use the hand auger to advance down to the top of the sampling interval.
3. Use a hand auger to collect soil from the desired depth.
4. Use a clean (decontaminated) tool to scoop the soil out of the auger and place in an appropriate sampling container.
5. Replace all excavated soils to their original location (i.e., backfill the sampling hole).

#### Composite Sediment Sampling

Discrete sediment samples will be collected from multiple locations to represent the entire wedge of sediment designated for removal using a hand trowel or auger. Discrete samples will be composited into one sample by mixing the soil in a decontaminated container, then filling the sampling jars. Laboratory analyses will be performed on the composite sample.

#### Sampling Depth

The sampling depth will be determined in the field. At each sampling location, the staff collecting the samples shall make an estimate of the depth of the sediment using visual clues and/or existing data. Sediment samples shall be collected at the surface and at 1 ft. intervals down to a maximum 3 ft level. In the event that the depth of the sediment is less than 1 foot, then the sample shall be collected at the surface. Samples will be collected up to a maximum depth of 3 feet because collection of samples below that depth is prohibitively difficult due to the finite strength of the individual collecting the sample, and the wet properties of the sediment, which may cause a borehole to collapse. In some locations it may even be infeasible to collect a sample at 3 feet bgs due to the unstable nature of the sediments or grain size (gravels or cobbles too large or compacted to sample). In the event that it is infeasible to collect a sample at the depth interval specified, the sample shall be collected at the deepest interval possible (using 1/2 foot increments). Also note that the maximum depth at the majority of sediment removal sites is not greater than 3 feet because sediment is removed at this threshold due to the significant reduction in channel conveyance capacity which occurs when sediment is accumulated higher than 3 feet.

#### **Other Sediment Sampling Details**

In general, samples will be taken from the finest sediment at a sampling site and every attempt will be made to collect sediments that are representative of the materials to be removed. Most contaminants are associated with fine-grained sediment, and it is therefore important that some of the samples contain the finest sediment that is present at a given project site. Fine sediments include mud, silts, and finer sandy materials. A suitable field test for grain size is to rub sediments between the fingers: finer sediments will feel smooth, whereas coarser sediments will be gritty (SWRCB 2008). Note that in many of Napa County channels, the grain size of accumulated sediments is larger, in the large sand and small gravel ranges. Contaminants are less apt to sorb onto larger sized materials.

### **Observed Contamination and Results That Exceed Water Quality Criteria**

For all projects, any observed contamination as evidenced by chemical-like odors, oily sheens, or irregularly colored sediment would be immediately reported to the local fire department's hazardous materials team and the appropriate RWQCB staff person in the Cleanups and Investigations Unit. The RWQCB will direct the District on how to handle and remove potentially hazardous sediment.

In addition, if sediment test results are found to exceed water quality criteria, the District will coordinate with the RWQCB to develop an action plan to properly handle and dispose of the sediment. Under the guidance of the RWQCB, the sediment removal activity may proceed according to the action plan or the maintenance activity may not be conducted.

### **Sediment Disposal Best Management Practices**

Sediment Disposal Best Management Practices are discussed in Chapter 4 of the Manual and in Table 4-1, Stream Maintenance Best Management Practices.

### **Reporting of Sediment Sampling Results**

The District will maintain records of field sampling methods, locations, depths, analysis, and results.

The District will submit complete laboratory sediment sampling results to the RWQCB when sediment removal activities are proposed.



TABLE 1: Sediment Sampling Analyte List

EPA Test Method <sup>1</sup>	Analyte	Reporting Limit for Soil <sup>2</sup> (mg/kg)	Analyte (cont.)	Reporting Limit for Soil (mg/kg)
9045	pH	pH Units		
6010/ CAM 17	Metals			
	Antimony (total)	1.1	Lead (total)	1.1
	Antimony (soluble)	1.0 mg/l	Lead (soluble)	0.50 mg/l
	Arsenic (total)	0.086	Mercury (total)	0.10
	Arsenic (soluble)	0.10 mg/l	Mercury (soluble)	0.10 mg/l
	Barium (total)	0.13	Molybdenum (total)	0.36
	Barium (soluble)	1.0 mg/l	Molybdenum (soluble)	0.10 mg/l
	Beryllium (total)	0.11	Nickel (total)	1.1
	Beryllium (soluble)	0.050 mg/l	Nickel (soluble)	0.10 mg/l
	Cadmium (total)	0.12	Selenium (total)	0.074
	Cadmium (soluble)	0.10 mg/l	Selenium (soluble)	0.10 mg/l
	Chromium (total)	0.66	Silver (total)	0.33
	Chromium (soluble)	0.10 mg/l	Silver (soluble)	0.10 mg/l
	Cobalt (total)	0.30	Thallium (total)	1.1
	Cobalt (soluble)	1.0 mg/l	Thallium (soluble)	0.10 mg/l
	Copper (total)	0.26	Vanadium (total)	0.55
	Copper (soluble)	0.10 mg/l	Vanadium (soluble)	0.10 mg/l
	Fluoride (total)	1.0	Zinc (total)	2.4
			Zinc (soluble)	0.50 mg/l
8081	Organochlorine Pesticides			
	Aldrin	0.0050	Endosulfan I	0.0050
	$\alpha$ -HCH (hexachlorocyclohexane)	0.0050	Endosulfan II	0.0050
	$\beta$ -HCH	0.0050	Endosulfan sulfate	0.0050
	$\gamma$ -HCH (Lindane)	0.0050	Endrin	0.0050
	$\delta$ -HCH	0.0050	Endrin aldehyde	0.0050
	Chlordane (tech)	0.20	Heptachlor	0.0050
	4,4'-DDD	0.0050	Heptachlor epoxide	0.0050
	4,4'-DDE	0.0050	Kepone	1.0
	4,4'-DDT	0.0050	Methoxychlor	0.0050
	Dieldrin	0.0050	Mirex	0.10
			Toxaphene	0.20
8141	Organophosphorus Pesticides			
	Azinphos-ethyl	0.10	Famphur	0.10
	Azinphos-methyl	0.10	Fenthion	0.025
	Bolstar (Sulprofos)	0.050	Malathion	0.025
	Chlorpyrifos	0.025	Mevinphos	0.050
	Coumaphos	0.10	Parathion, ethyl	0.025

<sup>1</sup> The most recent version of EPA's Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", also known as SW-846, will be used.

<sup>2</sup> All laboratory analytical reports will include the detection and reporting limits, any flags, and a QA/QC report. Electronic (PDF) submittals are preferred.

EPA Test Method <sup>1</sup>	Analyte	Reporting Limit for Soil <sup>2</sup> (mg/kg)	Analyte (cont.)	Reporting Limit for Soil (mg/kg)
	Demeton-O	0.050	Parathion, methyl	0.025
	Demeton-S	0.050	Phorate	0.025
	Diazinon	0.025	Ronnel	0.050
	Dichlorvos (DDVP)	0.050	Simazine	0.050
	Dimethoate	0.10	Stirophos	0.025
	Disulfoton	0.025	Thionazin	0.050
	EPN	0.050	Tokuthion	0.050
	Ethion	0.025	Trichloronate	0.0050
	Ethoprop	0.050		
8082	Polychlorinated biphenyls (PCBs)			
	Aroclor 1016	0.20	Aroclor 1242	0.20
	Aroclor 1221	0.20	Aroclor 1248	0.20
	Aroclor 1232	0.20	Aroclor 1254	0.20
			Aroclor 1260	0.20
8260	Volatile Organic Compounds (VOCs)			
	Acetone	0.020	1,1-Dichloropropene	0.0050
	Benzene	0.0050	cis-1,3-Dichloropropene	0.0050
	Bromobenzene	0.0050	trans-1,3-Dichloropropene	0.0050
	Bromochloromethane	0.0050	Ethylbenzene	0.0050
	Bromodichloromethane	0.0050	Hexachlorobutadiene	0.0050
	Bromoform	0.0050	Isopropylbenzene	0.0050
	Bromomethane	0.0050	p-Isopropyltoluene	0.0050
	n-Butylbenzene	0.0050	Methyl ethyl ketone	0.015
	sec-Butylbenzene	0.0050	Methyl isobutyl ketone	0.010
	tert-Bertylbenzene	0.0050	Methyl tert-butyl ether (MTBE)	0.0050
	Carbon tetrachloride	0.0050	Methylene chloride	0.0050
	Chlorobenzene	0.0050	Naphthalene	0.0050
	Chloroethane	0.0050	n-Propylbenzene	0.0050
	Chloroform	0.0050	Styrene	0.0050
	Chloromethane	0.0050	1,1,1,2-Tetrachloroethane	0.0050
	2-Chlorotoluene	0.0050	1,1,2,2-Tetrachloroethane	0.0050
	4-Chlorotoluene	0.0050	Tetrachloroethene	0.0050
	Dibromochloromethane	0.0050	Toluene	0.0050
	1,2-Dibromo-3-chloropropane	0.0050	1,2,3-Trichlorobenzene	0.0050
	1,2-Dibromoethane	0.0050	1,2,4-Trichlorobenzene	0.0050
	Dibromomethane	0.0050	1,1,1-Trichloroethane	0.0050
	1,2-Dichlorobenzene	0.0050	1,1,2-Trichloroethane	0.0050
	1,3-Dichlorobenzene	0.0050	Trichloroethene	0.0050
	1,4-Dichlorobenzene	0.0050	Trichlorofluoromethane	0.0050
	Dichlorodifluoromethane	0.0050	Trichlorotrifluoroethane	0.0050
	1,1-Dichloroethane	0.0050	1,2,3-Trichloropropane	0.0050
	1,2-Dichloroethane	0.0050	1,2,4-Trimethylbenzene	0.0050
	1,1-Dichloroethene	0.0050	1,3,5-Trimethylbenzene	0.0050
	cis-1,2-Dichloroethene	0.0050	Vinyl chloride	0.0050
	trans-1,2-Dichloroethene	0.0050	m,p-Xylene	0.0050
	1,2-Dichloropropane	0.0050	o-Xylene	0.0050
	1,3-Dichloropropane	0.0050	Xylenes (total)	0.0050

EPA Test Method <sup>1</sup>	Analyte	Reporting Limit for Soil <sup>2</sup> (mg/kg)	Analyte (cont.)	Reporting Limit for Soil (mg/kg)
8270	Poly Aromatic Hydrocarbons (PAHs)			
	Acenaphthene	0.062	Dimethyl phthalate	0.33
	Acenaphthylene	0.062	4,6-Dinitro-2-methylphenol	1.6
	Anthracene	0.062	2,4-Dinitrophenol	1.6
	Benzidine	1.6	2,4-Dinitrotoluene	0.33
	Benzoic acid	1.6	2,6-Dinitrotoluene	0.33
	Benz(a)anthracene	0.33	1,2-Diphenylhydrazine	0.33
	Benzo(b)fluoranthene	0.062	Fluoranthene	0.062
	Benzo(k)fluoranthene	0.062	Fluorene	0.062
	Benzo(g,h,i)perylene	0.062	Hexachlorobenzene	0.33
	Benzo(a)pyrene	0.062	Hexachlorobutadiene	0.33
	Benzyl alcohol	0.66	Hexachlorocyclopentadiene	1.6
	Bis(2-chloroethoxy) methane	0.33	Hexachloroethane	0.33
	Bis(2-chloroethyl) ether	0.33	Indeno(1,2,3-cd)pyrene	0.062
	Bis(2-chloroisopropyl) ether	0.33	Isophorone	0.33
	Bis(2-ethylhexyl) phthalate	0.33	2-Methylnaphthalene	0.062
	4-Bromophenyl phenyl ether	0.33	2-Methylphenol (o-cresol)	0.33
	Butyl benzyl phthalate	0.33	3 & 4 -Methylphenol (m,p-cresol)	0.33
	4-Chloroaniline	0.66	N-Nitrosodi-n-propylamine	0.33
	4-Chloro-3-methylphenol	0.33	N-Nitrosodimethylamine	0.66
	2-Chloronaphthalene	0.33	N-Nitrosodiphenylamine	0.33
	2-Chlorophenol	0.33	Naphthalene	0.062
	4-Chlorophenyl phenyl ether	0.33	2-Nitroaniline	1.6
	Chrysene	0.010	3-Nitroaniline	1.6
	Dibenz(a,h)anthracene	0.062	4-Nitroaniline	1.6
	Dibenzofuran	0.33	2-Nitrophenol	1.6
	Di-n-butyl phthalate	2.0	4-Nitrophenol	1.6
	Di-n-octyl phthalate	0.33	Nitrobenzene	0.33
	1,2-Dichlorobenzene	0.33	Pentachlorophenol	1.6
	1,3-Dichlorobenzene	0.33	Phenanthrene	0.062
	1,4-Dichlorobenzene	0.33	Phenol	0.33
	3,3'-Dichlorobenzidine	0.66	Pyrene	0.062
	2,4-Dichlorophenol	0.33	1,2,4-Trichlorobenzene	0.33
	Diethyl phthalate	0.33	2,4,5-Trichlorophenol	0.33
	2,4-Dimethylphenol	0.33	2,4,6-Trichlorophenol	0.33
8015 <sup>3</sup>	Total Extractable Petroleum Hydrocarbons (TPHs)			
	TPH as Diesel	1.0		
	Motor Oil	2.0		
	Gasoline (1,4-Bromofluorobenzene)	1.0		
8290 <sup>4</sup>	Dioxin	1.0 pg/g		
	Asbestos	1% (PLM EPA Qualitative Method) 0.005 to 0.001 (TEM by EPA Quantitative Method)		
GCMSSIM	Nonylphenol	0.2		

<sup>3</sup> The full list of TPHs will be reported with all peaks (rather than specific compounds).

<sup>4</sup> For dioxin/furans all congeners and their TEQs will be reported.

NOTE: this table is replicated from Table 4, “Discrete Sediment Sampling and Analysis” from the draft Monitoring and Reporting Program for City of American Canyon Stream Maintenance Program (RWQCB 2016)

## Sediment Sampling Plan Development Guidelines

Sediment sampling plans will be developed to correspond with the forthcoming conditions of the RWQCB Waste Discharge Requirements - Monitoring and Reporting Program (Order No. R2-2019-XXXX). The plan will include a list of sediment removal projects planned for a given year, number of samples to be collected, locations of sampling (e.g., Google map), list of analytes proposed for testing at each site, and preliminary disposal/reuse locations. The plan may also incorporate previous testing results from prior years and adjustments to sampling and analysis methods to improve results. For each sediment removal project that involves disposing sediment in upland agricultural or commercial reuse areas, the District will sample all analytes listed in Table 1. The District proposes an exemption from further sediment testing for sites that have been tested two or more times with no exceedances of the U.S. EPA’s reporting limits. Sediment removal projects that involve beneficial reuse of sediment must sample sediment in accordance with the RWQCB’s *Beneficial Reuse of Dredged Materials: Sediment Screening and Testing Guidelines* (2000).

An example template for a sediment sampling plan is presented in Attachment 1.

Once completed, the sediment sampling plan will be submitted to the Regional Board for review. This may include an in-person meeting or conference call with the Regional Board. After receiving the Regional Board’s approval of the sediment sampling plan, the District will then coordinate with their field crews or subconsultant to prepare for and conduct sampling and laboratory testing. A memorandum summarizing sampling results will be prepared after the lab results are complete.

## References Cited

- California Department of Toxic Substances Control (DTSC). 2005. California Regulations, Title 22, Chapter 11, Article 3. Characteristics of Hazardous Waste. Available: [http://www.dtsc.ca.gov/LawsRegsPolicies/Title22/upload/OEARA\\_REG\\_Title22\\_Ch11\\_Art3.pdf](http://www.dtsc.ca.gov/LawsRegsPolicies/Title22/upload/OEARA_REG_Title22_Ch11_Art3.pdf).
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euse.pdf](http://www.waterboards.ca.gov/sanfranciscobay/water_issues/available_documents/benr<br/>euse.pdf)

U.S. Environmental Protection Agency (USEPA) 2008. *Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites. RSL Table Update. Region 9.* September 12, 2008.

Available:

[http://www.epa.gov/region09/waste/sfund/prg/pdf/master\\_sl\\_table\\_bwrun\\_12SEP2008.  
pdf](http://www.epa.gov/region09/waste/sfund/prg/pdf/master_sl_table_bwrun_12SEP2008.pdf)



**Attachment 1.** Example Template for the SMP's Annual Sediment Sampling and Disposal Notifications

# Memorandum

**Subject:** Sediment Sampling and Disposal Notification for Napa County's Stream Maintenance Program

[Date]

**To:** Agnes Farres, San Francisco Bay Regional Water Quality Control Board (SFBRWQCB)

**From:** Mike Gordon, Napa County Flood Control and Water Conservation District (District)  
Rick Thomasser, District

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This is the proposed sediment sampling and disposal plan for the District's 2018 Stream Maintenance Program (SMP) maintenance sites for review and approval by the SFBRWQCB (or Regional Board), as required under the Monitoring and Reporting Program, as part of Waste Discharge Requirements and Water Quality Certification Order No. R2-2019-XXXX.

## 1. Summary of SMP sampling efforts to date

Regulatory approval of the SMP by the SFBRWQCB was provided in August 2012 and most recently in 2019. SCWA has conducted sediment sampling at XX sites since [year]. The results of the sediment analysis have been submitted to the RWQCB each year. The attached Excel file (electronic) includes test results from all samples collected under the SMP since 2012 [District to attach].

## 2. Evaluation of Proposed [Year] Sediment Removal Sites

The sites listed below are proposed for sediment removal in 2019. Project designs for these projects will be submitted by the Water Agency as part of their 2019 Annual Notification.

1. [Site 1]
2. [Site 2]
3. [Site 3]
4. [Site 4]

The District requests an exemption from further testing for the following project sites that have been tested two or more times with negative exceedances or elevated anthropogenic background levels (see Table 1).

- Site 3
- Site 4

**Table 1** summarizes past sampling efforts within 1,000 feet of proposed sediment removal locations, analyte exceedances, and the proposed testing plan.

**Table 1.** Evaluation of [Prior Year] Project Sites using Existing Sediment Results Compared to U.S. EPA Reporting Limit for Soil.

Project Site	Previous Reach(s)	Previous Year Sampled	Analytes with Exceedance(s)	Previous Results (mg/kg)	EPA Reporting Limit for Soil (mg/kg)	High Background (mg/kg)	Exempt from Testing	Comment
Site 1								Tested 1x, no exceedances
Site 2								Tested 1X, no exceedances
Site 3								Tested 2x, no exceedances
Site 4								Tested 2X, no exceedances

### 3. Proposed Sediment Sampling and Testing Plan for [YEAR]

Sampling plans for [year] project sites, including creek reach, removal volume, number of composite samples, and core sampling locations are presented in Table 2.

**Table 2:** Proposed Sediment Sampling Plan for [YEAR]

Maintenance Reach Number, Maintenance Scale (see SMP Manual for reach locations)	Linear Feet of Sediment Removal	Estimated Amount of Sediment to be Removed (cubic yards)	Number of Samples to be Collected	Comments
Site 1				[Description of where the core samples will be collected]
Site 2				[Description of where the core samples will be collected]

### 4. Sediment Disposal and Reuse Plan for 2019

[Description of sites proposed for sediment disposal and reuse (e.g., Edgerly Island, Imola Avenue, landfill, upland agricultural or commercial use, on-site, or beneficial reuse).]

# Appendix L

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## Typical Plans for Napa County RCD's Road Maintenance Activities

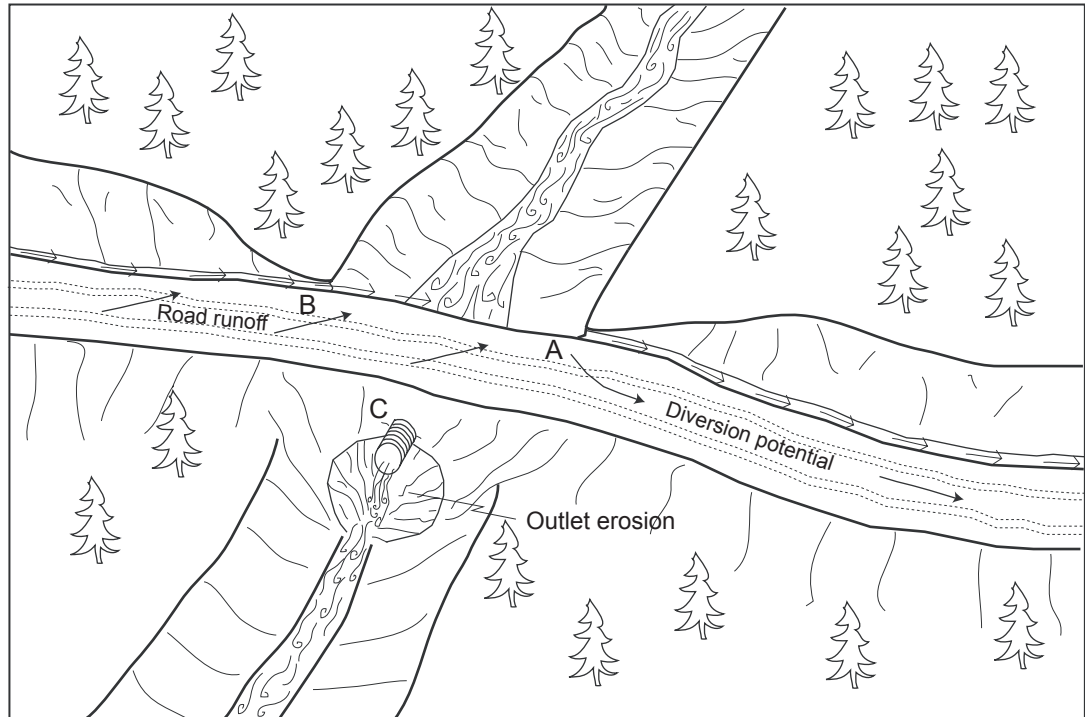




# Typical Problems and Applied Treatments for a Non-fish Bearing Upgraded Stream Crossing

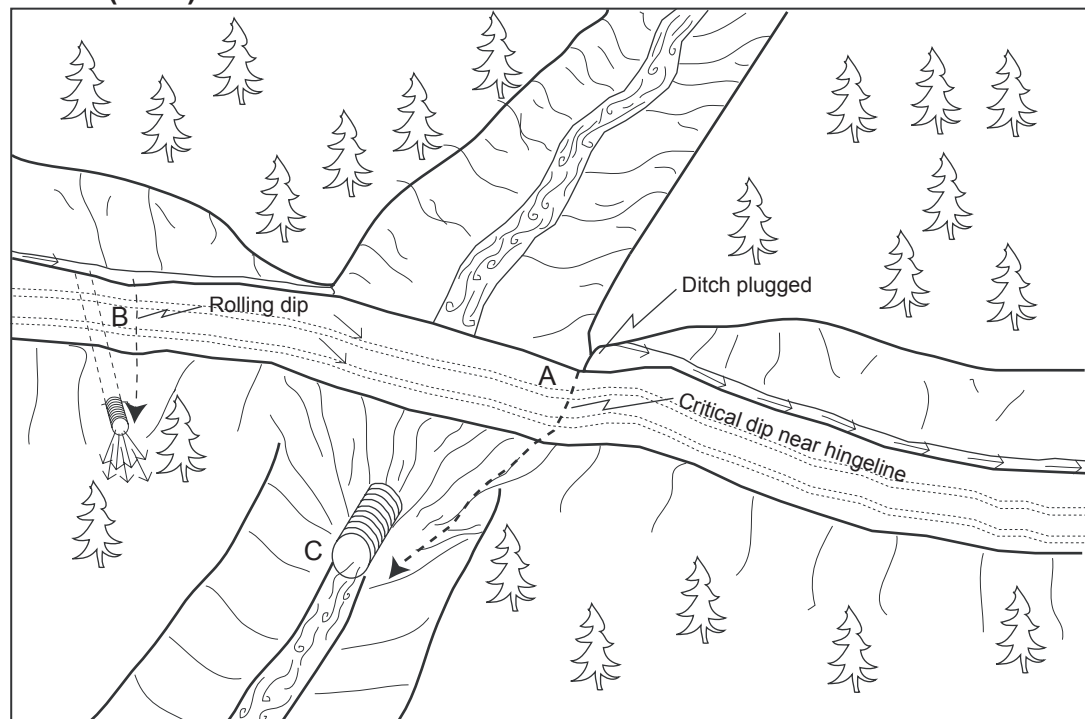
## Problem condition (before)

- A - Diversion potential
- B - Road surface and ditch drain to stream
- C - Undersized culvert high in fill with outlet erosion



## Treatment standards (after)

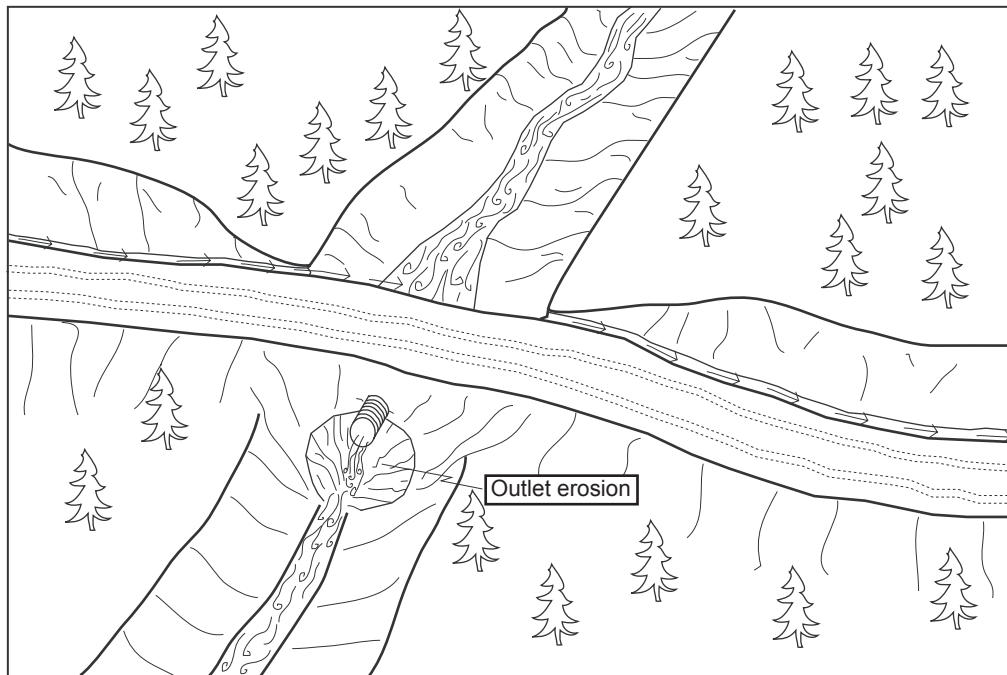
- A - No diversion potential with critical dip installed near hingeline
- B - Road surface and ditch disconnected from stream by rolling dip and ditch relief culvert
- C - 100-year culvert set at base of fill



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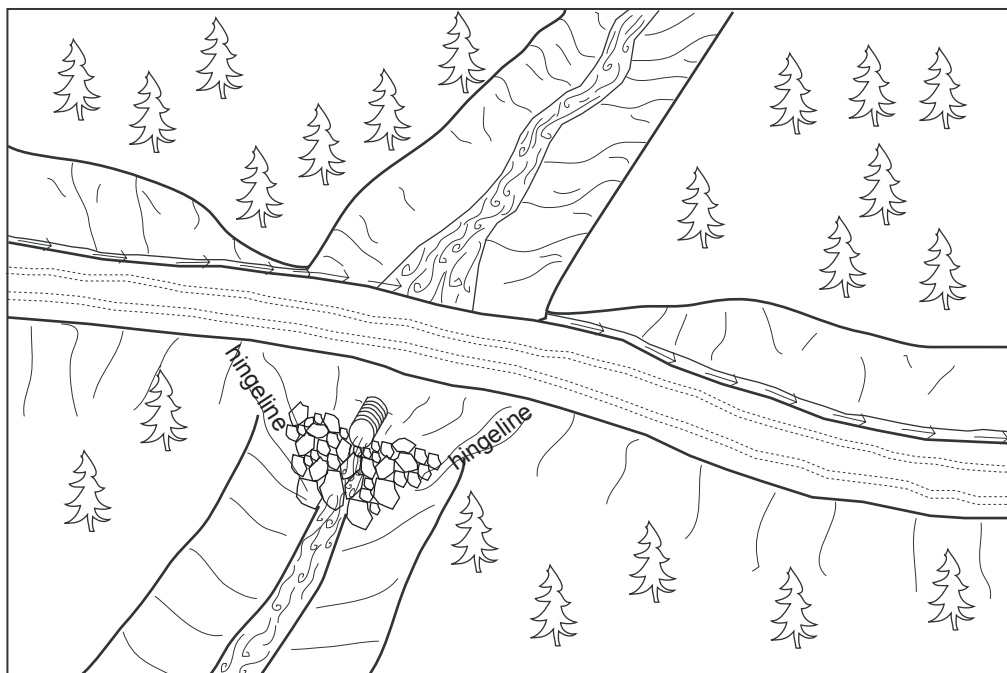
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## Armoring Fill Faces to Upgrade Stream Crossings



**Problem:** Culvert set high in outboard fill has resulted in scour of the outboard fill face and natural channel.

**Conditions:** The existing stream crossing has a culvert sufficient in diameter to manage design stream flows and has a functional life.



**Action:** The area of scour is backfilled with rip-rap to provide protection in the form of energy dissipation for the remaining fill face and channel.

**Treatment Specifications:**

- 1) Placement of rip-rap should be between the left and right hingelines and extend from a keyway excavated below the existing channel base level at the base of the fill slope up and under the existing culvert.
- 2) Rock size and volume is determined on a site by site basis based on estimated discharge and existing stream bed particle size range (See accompanying road log).

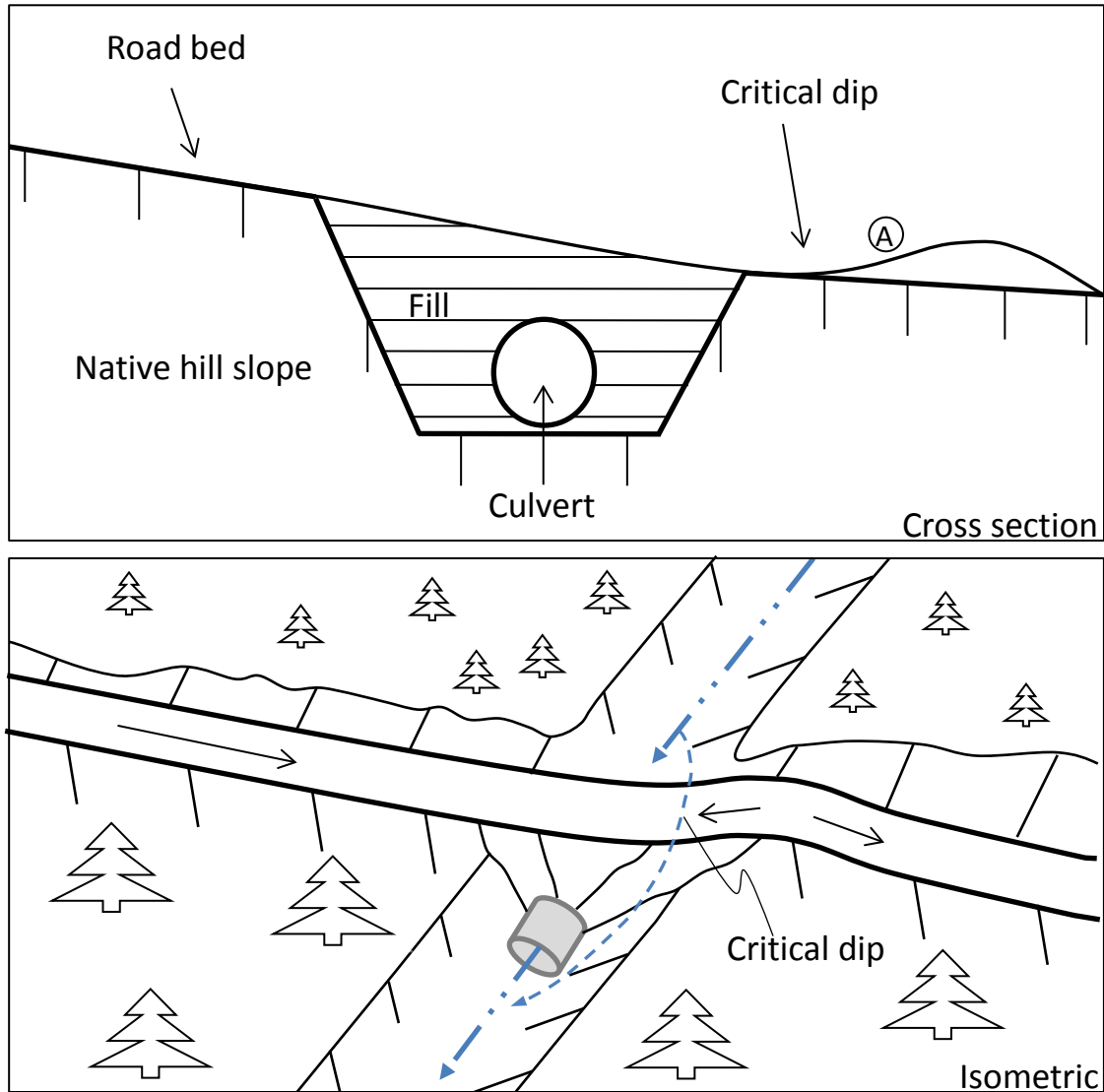
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**PWA Typical Drawing #1b**

# Typical Critical Dip Design for Stream Crossings with Diversion Potential

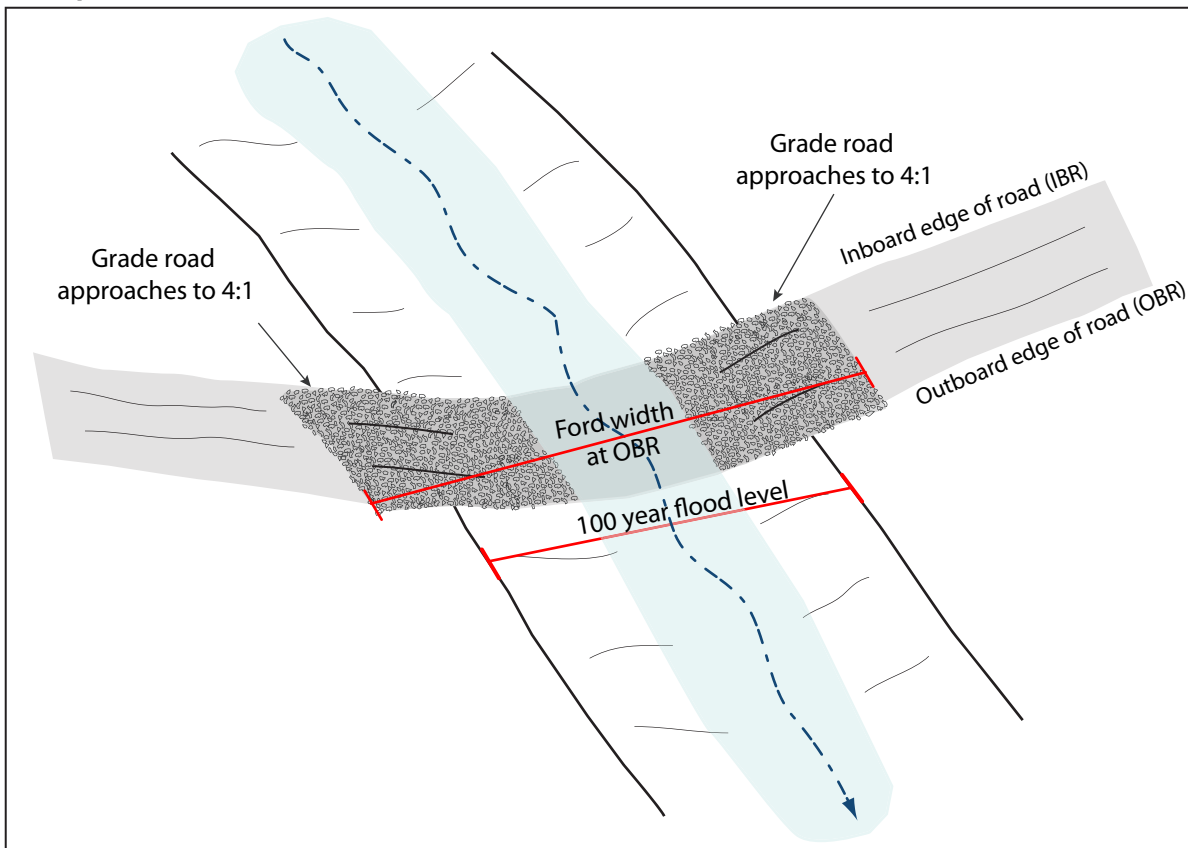


## Critical Dip Construction:

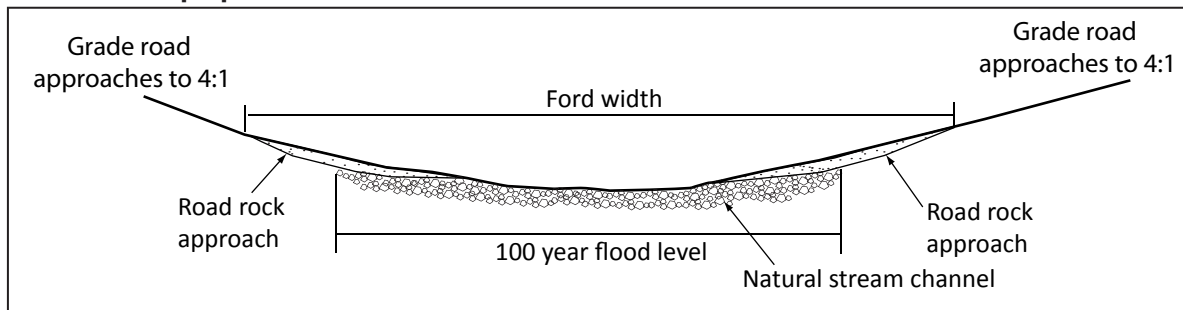
1. Critical dip will be constructed on the lower side of crossing.
2. Critical dip will extend from the cutbank to the outside edge of the road surface. Be sure to fill inboard ditch, if present.
3. Critical dip will have a reverse grade ① from cutbank to outside edge of road to ensure flow will not divert outside of crossing.
4. The rise in the reverse grade will be carried for about 10 to 20 feet and then return to original slope.
5. The transition from axis of bottom, through rising grade, to falling grade, will be in the road distance of at least 15 to 30 feet.
6. Critical dips are usually built perpendicular to the road surface to ensure that flow is directed back into the stream channel.

# Typical Ford Crossing Installation

**Oblique view**



**Cross-section perpendicular to watercourse**



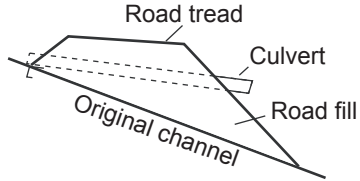
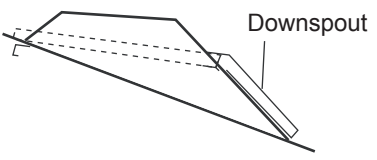
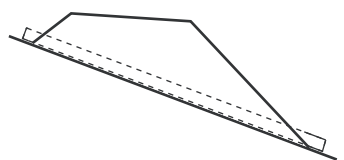
## **Steps for ford crossing construction:**

1. Remove any existing structures (culverts, logs, large boulders, etc.)
2. Remove all road fill as you dip through the crossing to reach natural stream channel.
3. Establish a "U" shape across the channel at the width specified in the road logs.
4. Grade road approaches to specified slope angle (e.g., 4:1). Approaches may or may not be rocked; follow specifications in the road logs.

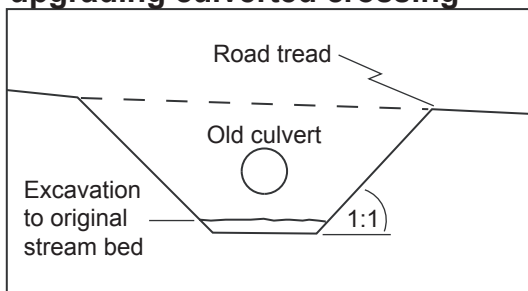
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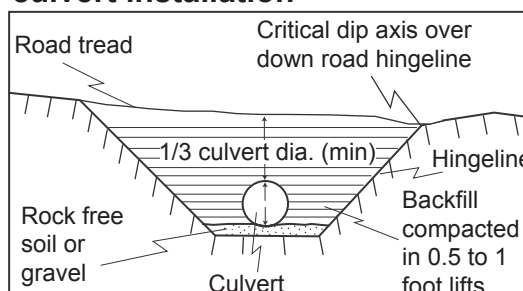
# Typical Design of a Non-fish Bearing Culverted Stream Crossing

Existing	Upgraded	Upgraded (preferred)
 <ol style="list-style-type: none"> <li>1. Culvert not placed at channel grade.</li> <li>2. culvert does not extend past base of fill.</li> </ol>	 <ol style="list-style-type: none"> <li>1. Culvert not placed at channel grade.</li> <li>2. Downspout added to extend outlet past road fill.</li> </ol>	 <ol style="list-style-type: none"> <li>1. Culvert placed at channel grade.</li> <li>2. Culvert inlet and outlet rest on, or partially in, the original streambed.</li> </ol>

## Excavation in preparation for upgrading culverted crossing



## Upgraded stream crossing culvert installation



Note:

Road upgrading tasks typically include upgrading stream crossings by installing larger culverts and inlet protection (trash barriers) to prevent plugging. Culvert sizing for the 100-year peak storm flow should be determined by both field observation and calculations using a procedure such as the Rational Formula.

## Stream crossing culvert Installation

1. Culverts shall be aligned with natural stream channels to ensure proper function, and prevent bank erosion and plugging by debris.
2. Culverts shall be placed at the base of the fill and the grade of the original streambed, or downspouted past the base of the fill.
3. Culverts shall be set slightly below the original stream grade so that the water drops several inches as it enters the pipe.
5. To allow for sagging after burial, a camber shall be between 1.5 to 3 inches per 10 feet culvert pipe length.
6. Backfill material shall be free of rocks, limbs or other debris that could dent or puncture the pipe or allow water to seep around pipe.
7. First one end then the other end of the culvert shall be covered and secured. The center is covered last.
8. Backfill material shall be tamped and compacted throughout the entire process:
  - Base and side wall material will be compacted before the pipe is placed in its bed.
  - Backfill compacting will be done in 0.5 - 1 foot lifts until 1/3 of the diameter of the culvert has been covered. A gas powered tamper can be used for this work.
9. Inlets and outlets shall be armored with rock or mulched and seeded with grass as needed.
10. Trash protectors shall be installed just upstream from the culvert where there is a hazard of floating debris plugging the culvert.
11. Layers of fill will be pushed over the crossing until the final designed road grade is achieved, at a minimum of 1/3 to 1/2 the culvert diameter.

## Erosion control measures for culvert replacement

Both mechanical and vegetative measures will be employed to minimize accelerated erosion from stream crossing and ditch relief culvert upgrading. Erosion control measures implemented will be evaluated on a site by site basis. Erosion control measures include but are not limited to:

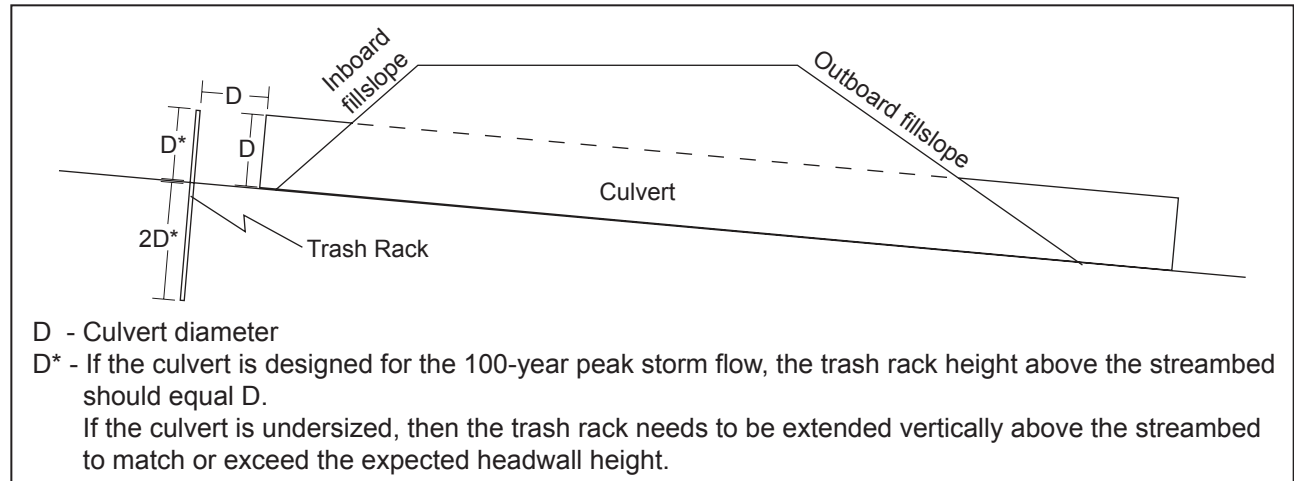
1. Minimizing soil exposure by limiting excavation areas and heavy equipment disturbance.
2. Installing filter windrows of slash at the base of the road fill to minimize the movement of eroded soil to downslope areas and stream channels.
3. Retaining rooted trees and shrubs at the base of the fill as "anchor" for the fill and filter windrows.
4. Bare slopes created by construction operations will be protected until vegetation can stabilize the surface. Surface erosion on exposed cuts and fills will be minimized by mulching, seeding, planting, compacting, armoring, and/or benching prior to the first rains.
5. Excess or unusable soil will be stored in long term spoil disposal locations that are not limited by factors such as excessive moisture, steep slopes greater than 10%, archeology potential, or proximity to a watercourse.
6. On running streams, water will be pumped or diverted past the crossing and into the downstream channel during the construction process.
7. Straw bales and/or silt fencing will be employed where necessary to control runoff within the construction zone.

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# Typical Design of a Single-post Culvert Inlet Trash Rack

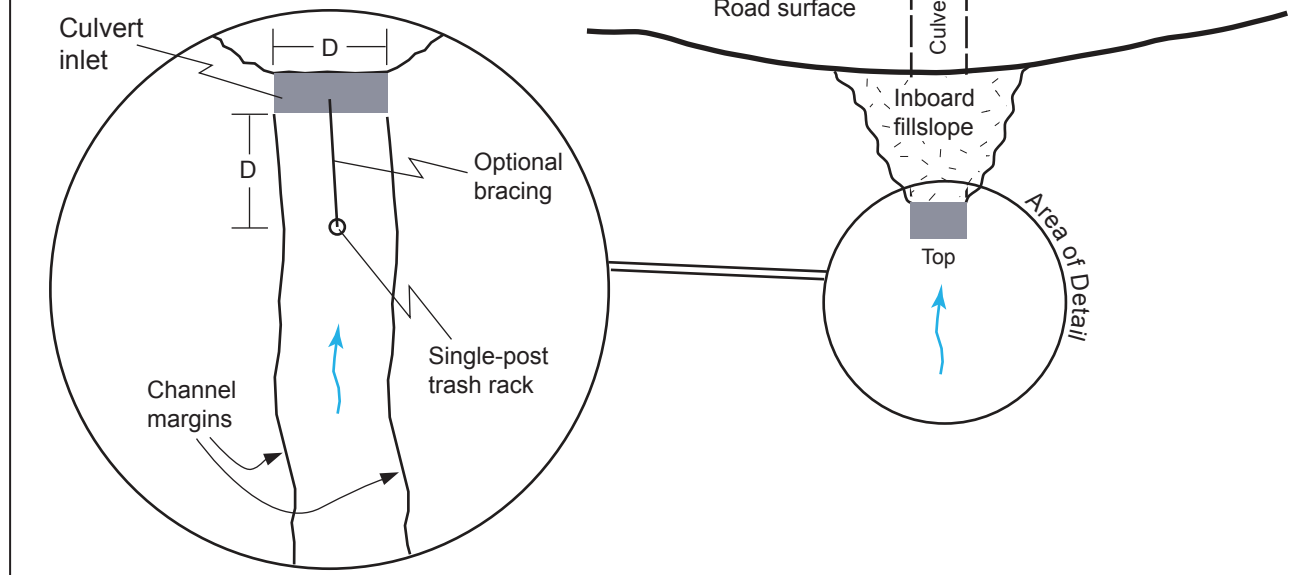
## Cross section view



## Plan view

### Notes:

1. Many materials can be used for a single-post trash rack including old railroad track, galvanized pipe, and fence posts.
2. The diameter of single-post trash racks should be sized based on the size of expected woody debris. As a basic rule of thumb, the diameter of the trash rack should be equal to the diameter of the expected woody debris up to 4 inches.

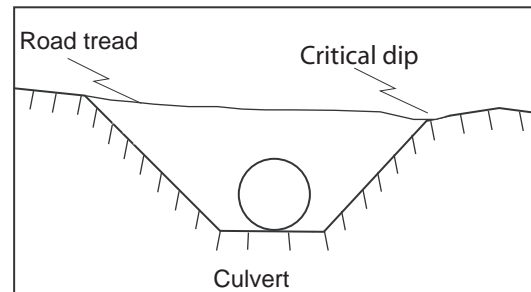
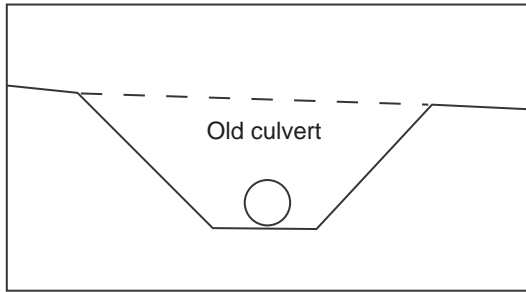


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# Typical Design of Upgraded Stream Crossings



## Stream crossing culvert Installation

1. Culverts shall be aligned with natural stream channels to ensure proper function, and prevent bank erosion and plugging by debris.
2. Culverts shall be placed at the base of the fill and the grade of the original streambed or downspouted past the base of the fill.
3. Culverts shall be set slightly below the original stream grade so that the water drops several inches as it enters the pipe.
5. To allow for sagging after burial, a camber shall be between 1.5 to 3 inches per 10 feet culvert pipe length.
6. Backfill material shall be free of rocks, limbs or other debris that could dent or puncture the pipe or allow water to seep around pipe.
7. First one end and then the other end of the culvert shall be covered and secured. The center is covered last.
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  - backfill compacting will be done in 0.5 - 1 foot lifts until 1/3 of the diameter of the culvert has been covered. A gas powered tamper can be used for this work.
9. Inlets and outlets shall be armored with rock or mulched and seeded with grass as needed.
10. Trash protectors shall be installed just upstream from the culvert where there is a hazard of floating debris plugging the culvert.
11. Layers of fill will be pushed over the crossing until the final designed road grade is achieved, at a minimum of 1/3 to 1/2 the culvert diameter.

### Note:

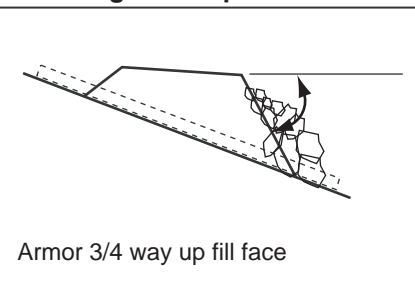
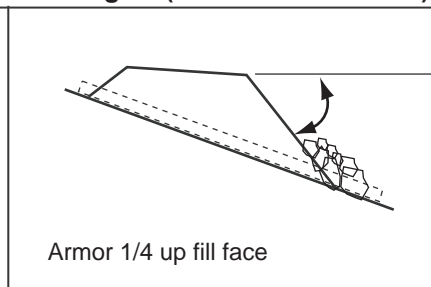
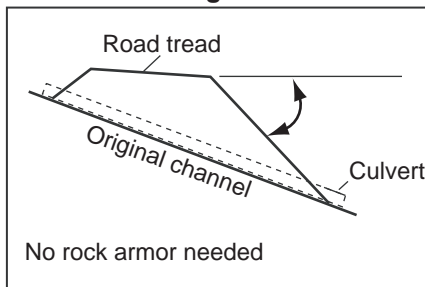
Road upgrading tasks typically include upgrading stream crossings by installing larger culverts and inlet protection (trash barriers) to prevent plugging. Culvert sizing for the 100-year peak storm flow should be determined by both field observation and calculations using a procedure such as the Rational Formula.

## Armoring fill faces

Fill angles  $\leq 2:1$

Fill angles (between 2:1 & 1.5:1)

Fill angles steeper than 1.5:1



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## Typical Design of Ford and Armored Fill Stream Crossings

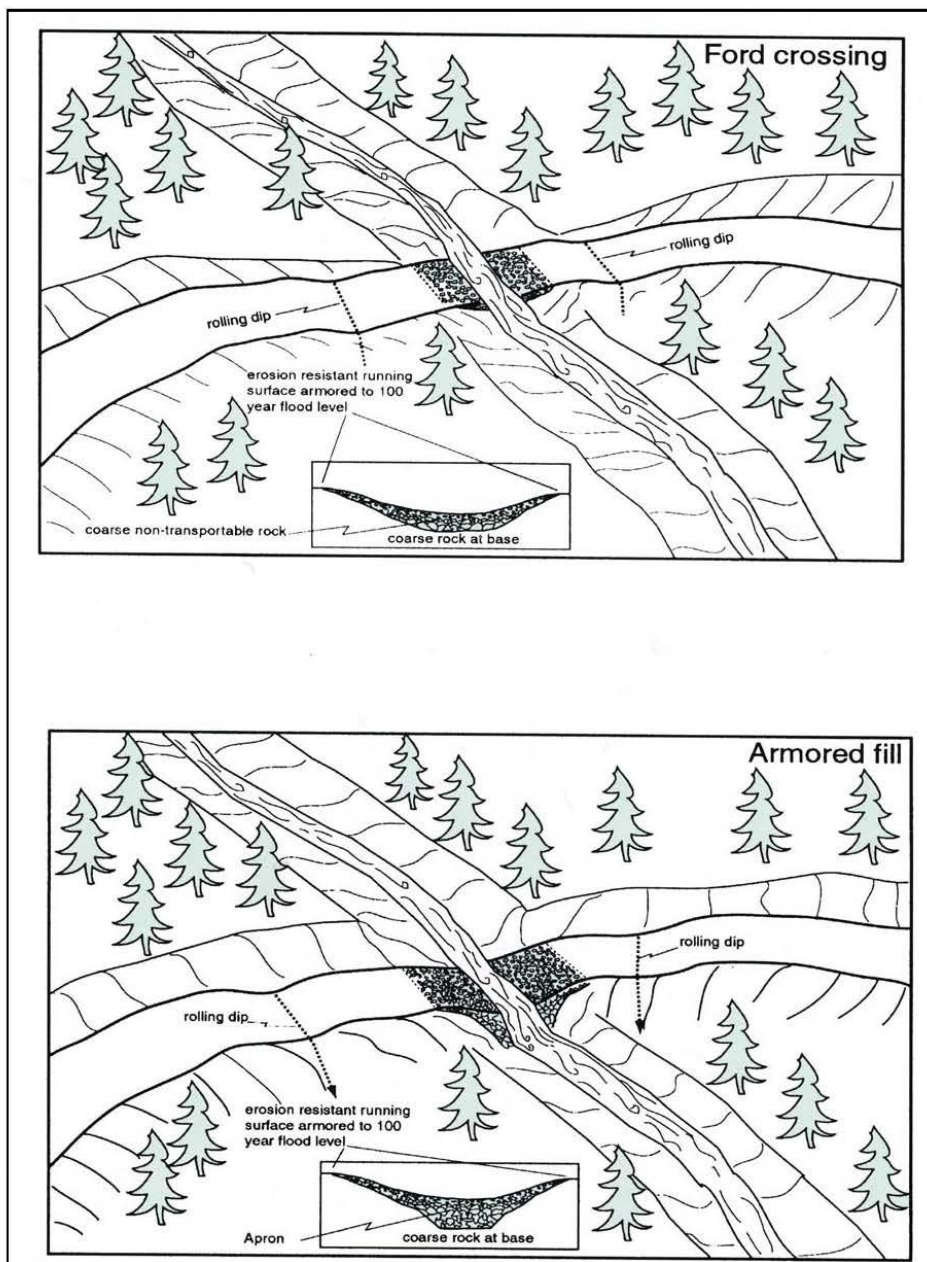
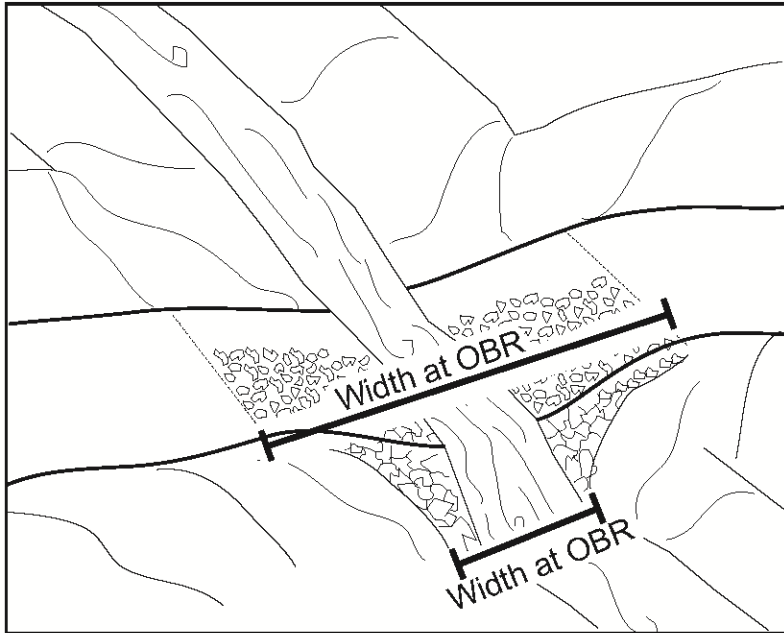


Figure X-15. CDFW California Salmonid Stream Habitat Restoration Manual.

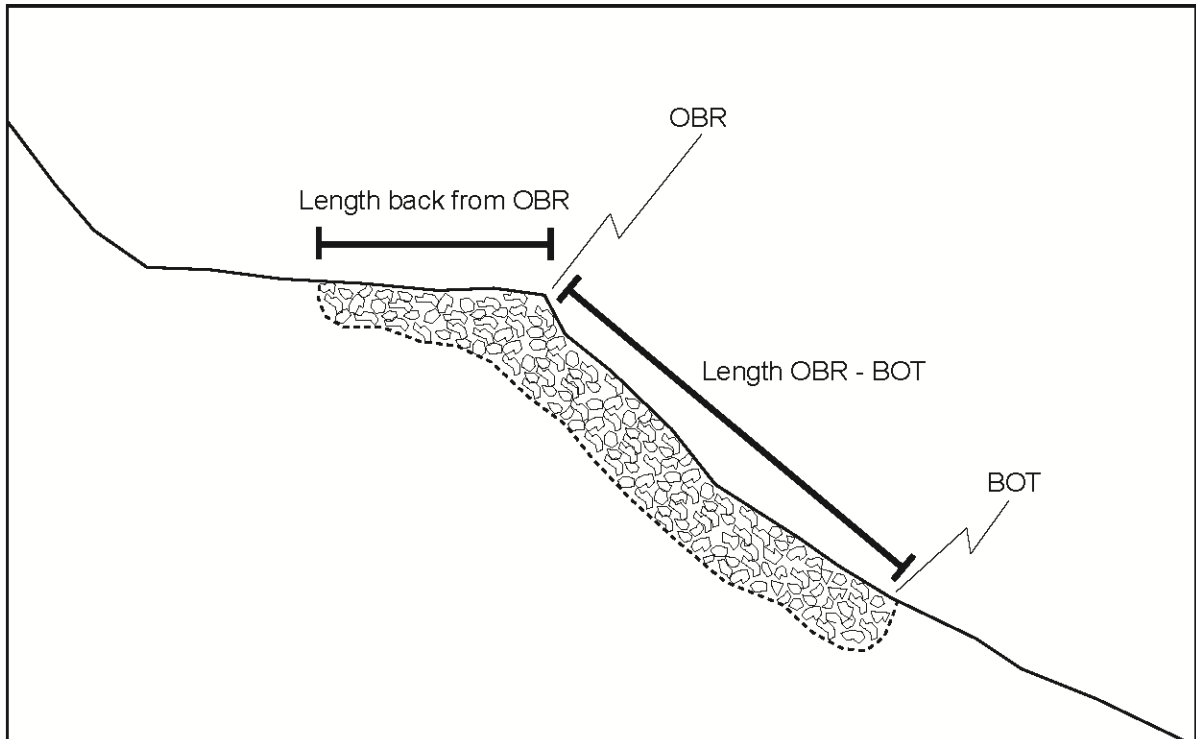
# Typical Dimensions Referred to for Armored Fill Crossings

## Widths in oblique view



OBR - Outboard edge of road

## Lengths in profile view

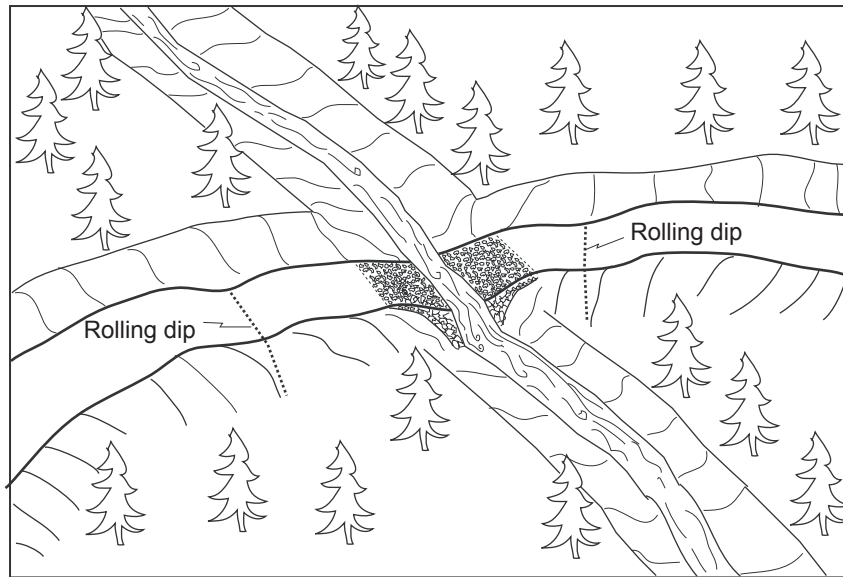


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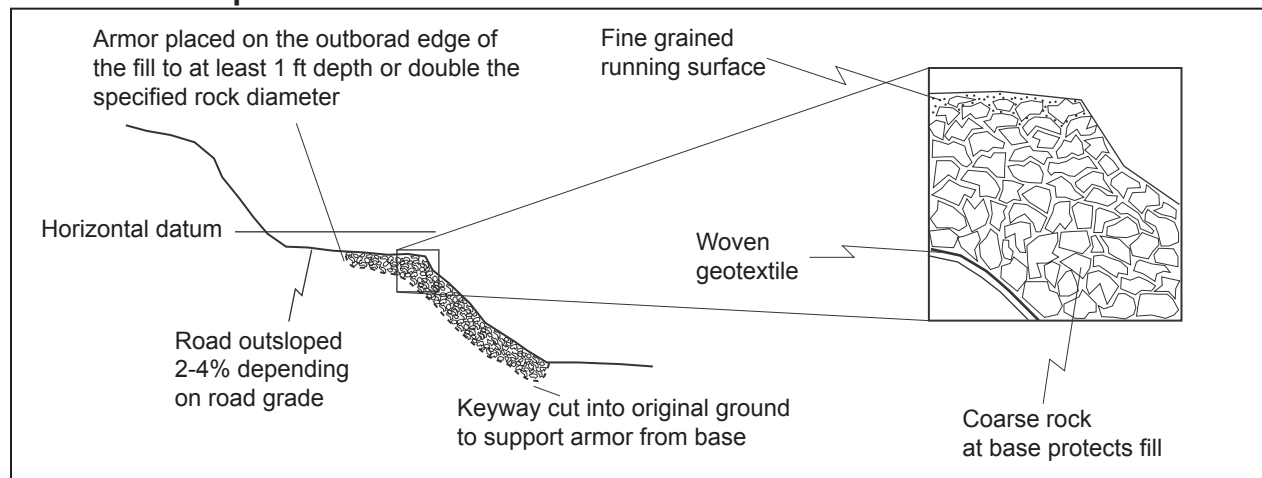
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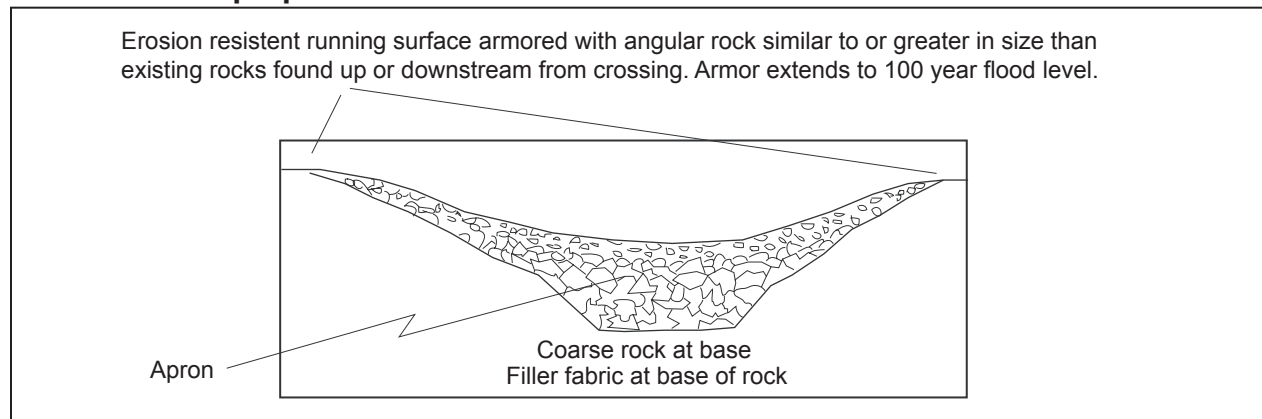
## Typical Armored Fill Crossing Installation



### Cross section parallel to watercourse



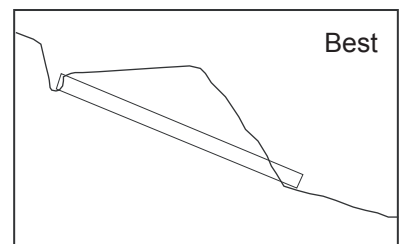
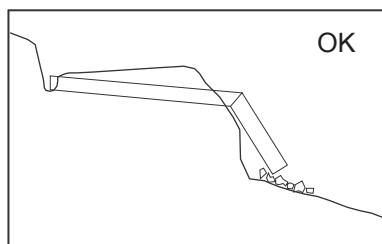
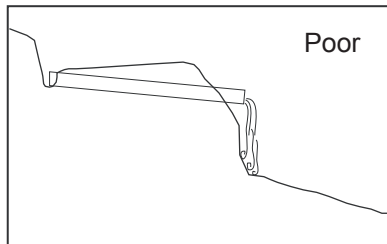
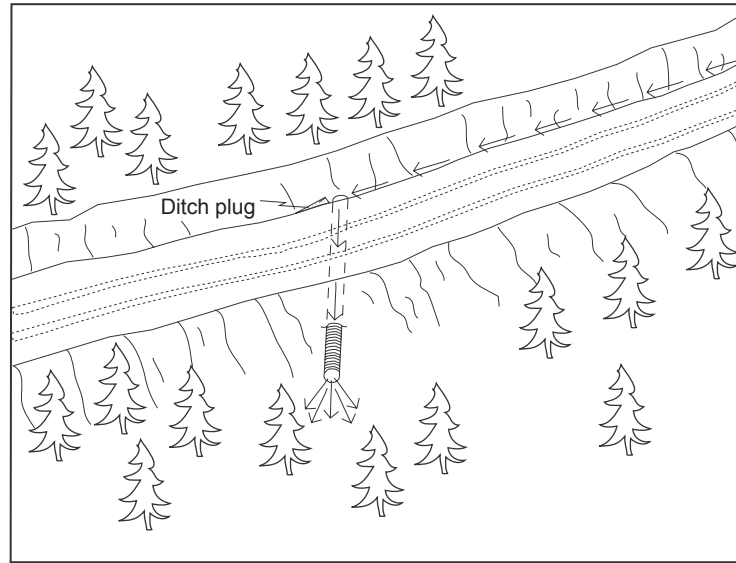
### Cross section perpendicular to watercourse



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## Typical Ditch Relief Culvert Installation



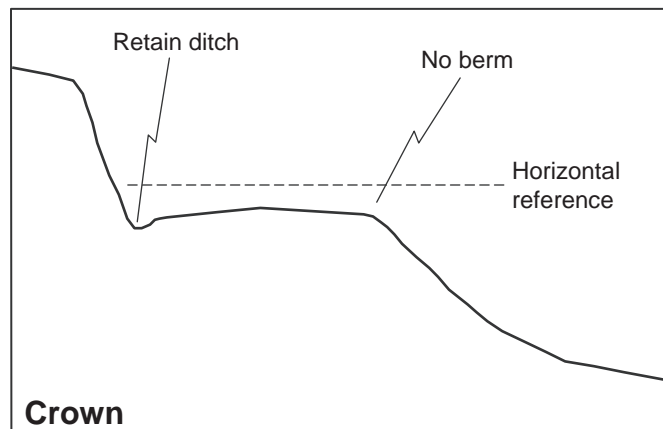
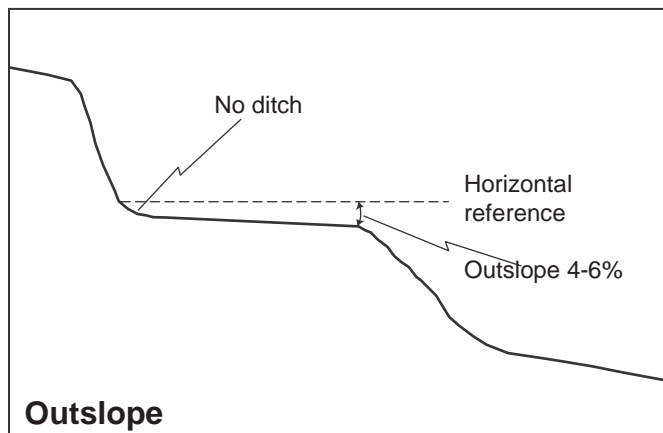
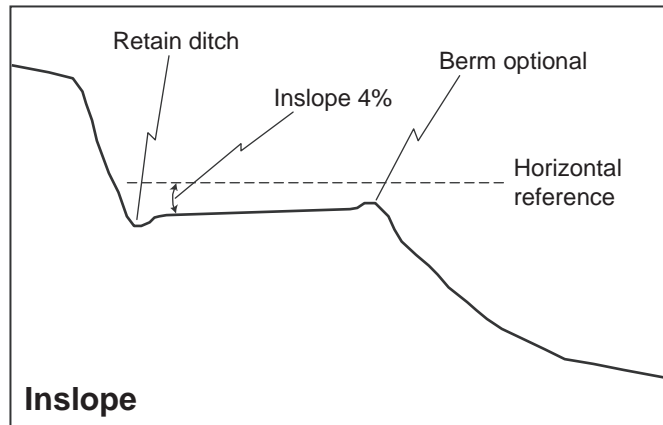
### Ditch relief culvert installation

- 1) The same basic steps followed for stream crossing installation shall be employed.
- 2) Culverts shall be installed at a 30 degree angle to the ditch to lessen the chance of inlet erosion and plugging.
- 3) Culverts shall be seated on the natural slope or at a minimum depth of 5 feet at the outside edge of the road, whichever is less.
- 4) At a minimum, culverts shall be installed at a slope of 2 to 4 percent steeper than the approaching ditch grade, or at least 5 inches every 10 feet.
- 5) Backfill shall be compacted from the bed to a depth of 1 foot or 1/3 of the culvert diameter, which ever is greater, over the top of the culvert.
- 6) Culvert outlets shall extend beyond the base of the road fill (or a flume downspout will be used).  
Culverts will be seated on the natural slope or at a depth of 5 feet at the outside edge of the road, whichever is less.

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# Typical Designs for Using Road Shape to Control Road Runoff



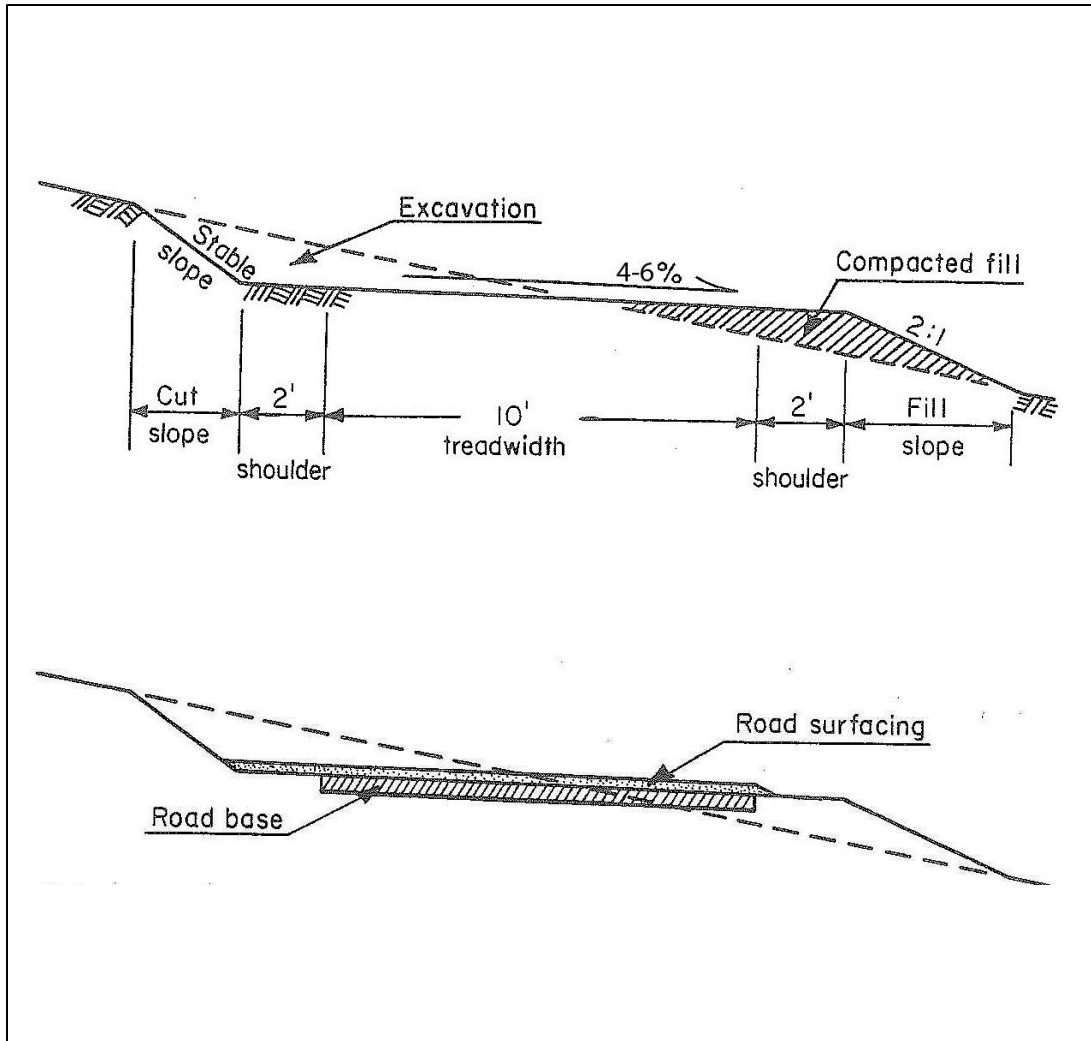
Outsloping Pitch for Roads Up to 8% Grade		
Road grade	Unsurfaced roads	Surfaced roads
4% or less	3/8" per foot	1/2" per foot
5%	1/2" per foot	5/8" per foot
6%	5/8" per foot	3/4" per foot
7%	3/4" per foot	7/8" per foot
8% or more	1" per foot	1 1/4" per foot

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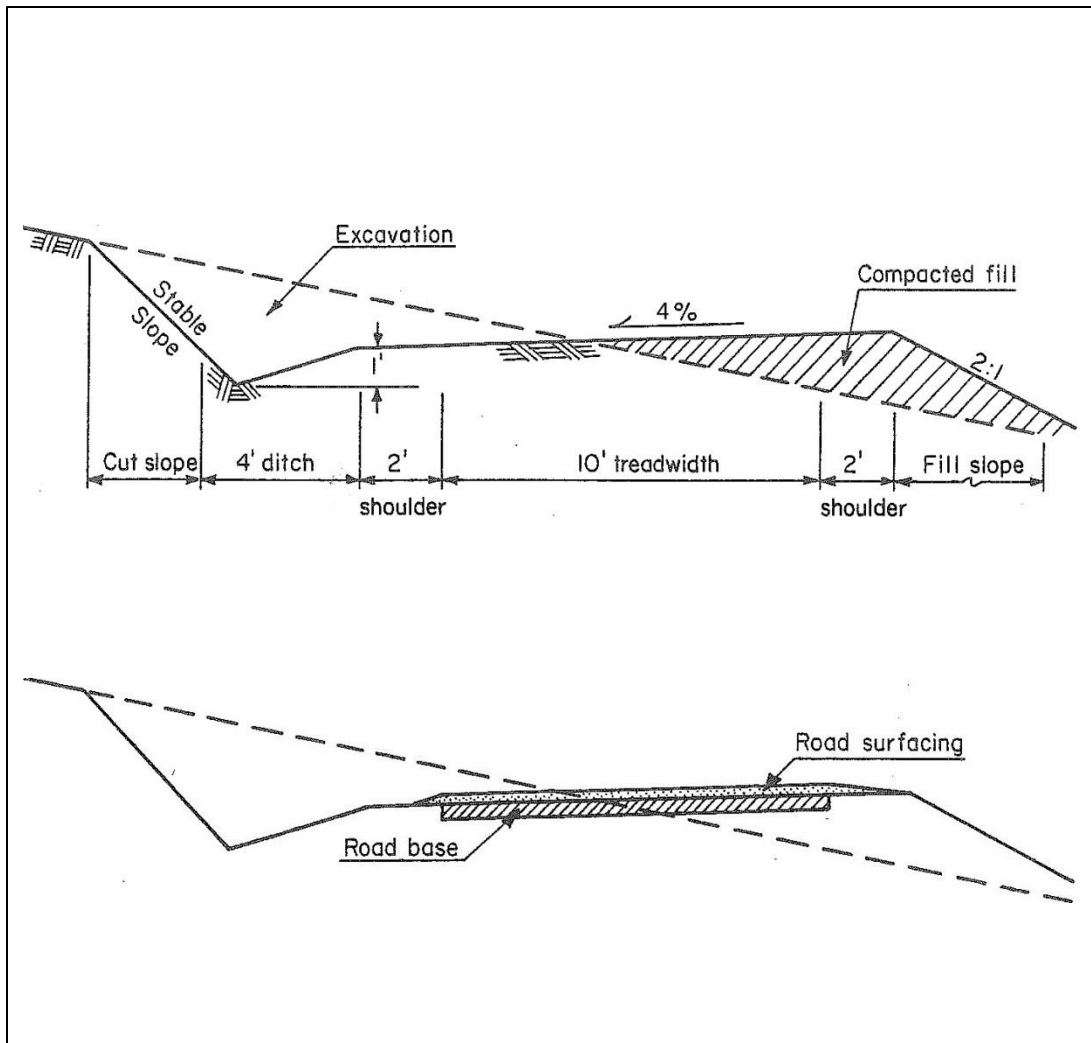
## Typical Design for Outsloped Road



### Outsloped Road Notes:

1. Road tread will have at least a 4% outslope, steepening to 6% outslope along outside shoulder to promote drainage.
2. Edge berms from grading will be completely removed – OR – install compacted edge berm with drainage outlets every 150'.
3. All road surface and fills will be compacted to 95% of ASTM D-698 before final grading.
4. Road base and surface to be designed for road use and site conditions.
5. Cut and fill slopes will be vegetated.
6. For two-lane road, add 6' of treadwidth.
7. For turnout, add 10' to treadwidth.

## Typical Design for Insloped Road

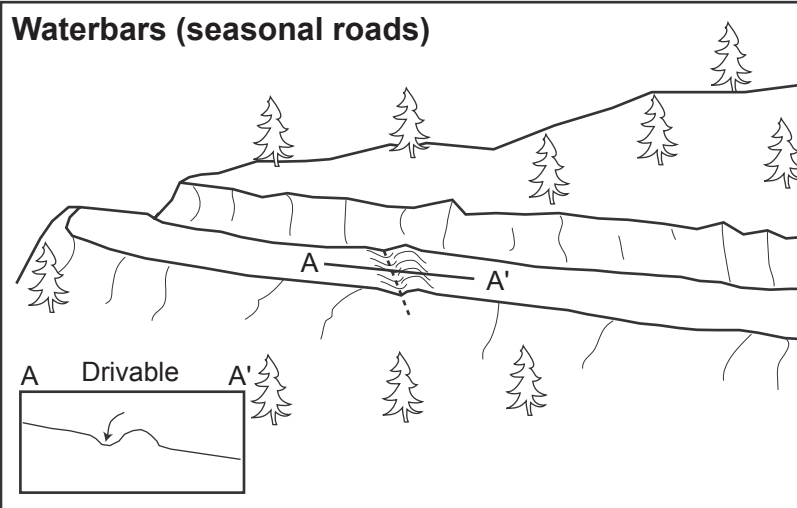


### Insloped Road Notes:

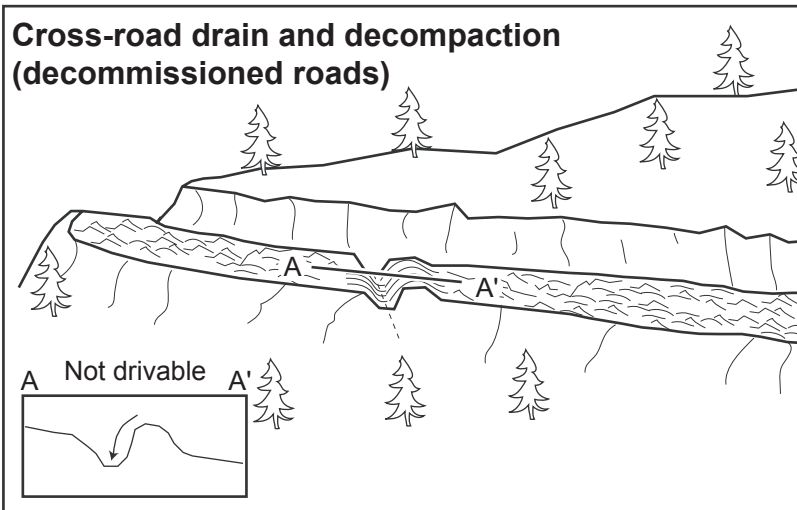
1. Road tread will have at least a 4% inslope.
2. Inboard ditch will be cut with an average 1' depth and 4' width.
3. Inboard ditch will be drained every 150' with ditch relief culverts.
4. All road surface and fills will be compacted to 95% of ASTM D-698 before final grading.
5. Road base and surface to be designed for road use and site conditions.
6. Cut and fill slopes will be vegetated.
7. For two-lane road, add 6' of treadwidth.
8. For turnout, add 10' to treadwidth.

## Typical Methods for Dispersing Road Surface Runoff with Waterbars, Cross-road Drains, and Rolling Dips

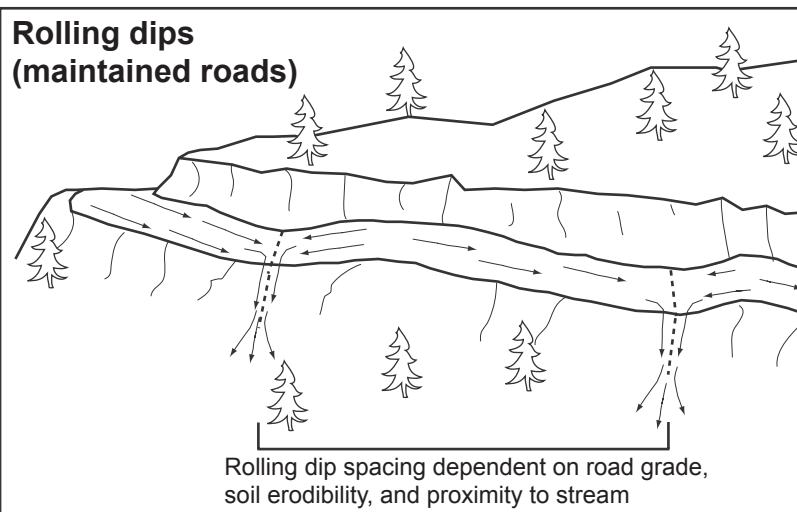
**Waterbars (seasonal roads)**



**Cross-road drain and decompaction (decommissioned roads)**



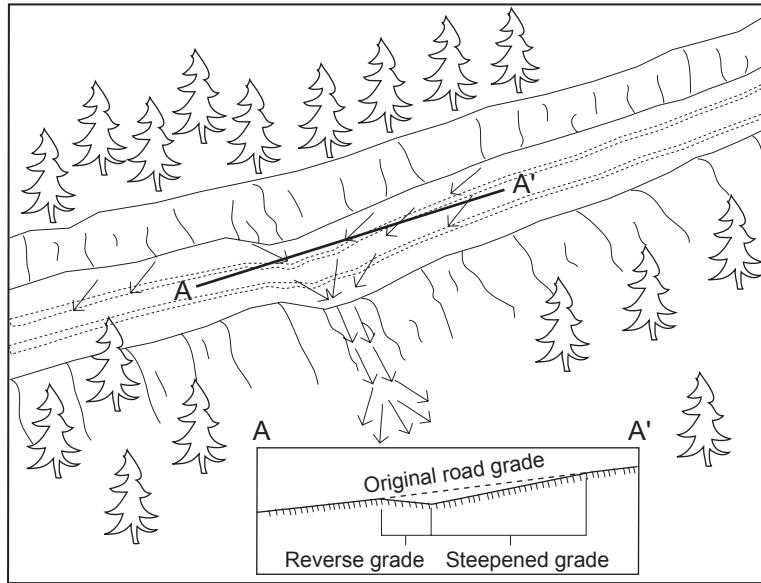
**Rolling dips (maintained roads)**



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## Typical Road Surface Drainage by Rolling Dips



### Rolling dip installation:

1. Rolling dips will be installed in the roadbed as needed to drain the road surface.
2. Rolling dips will be sloped either into the ditch or to the outside of the road edge as required to properly drain the road.
3. Rolling dips are usually built at 30 to 45 degree angles to the road alignment with cross road grade of at least 1% greater than the grade of the road.
4. Excavation for the dips will be done with a medium-size bulldozer or similar equipment.
5. Excavation of the dips will begin 50 to 100 feet up road from where the axis of the dip is planned as per guidelines established in the rolling dip dimensions table.
6. Material will be progressively excavated from the roadbed, steepening the grade until the axis is reached.
7. The depth of the dip will be determined by the grade of the road (see table below).
8. On the down road side of the rolling dip axis, a grade change will be installed to prevent the runoff from continuing down the road (see figure above).
9. The rise in the reverse grade will be carried for about 10 to 20 feet and then return to the original slope.
10. The transition from axis to bottom, through rising grade to falling grade, will be in a road distance of at least 15 to 30 feet.

**Table of rolling dip dimensions by road grade**

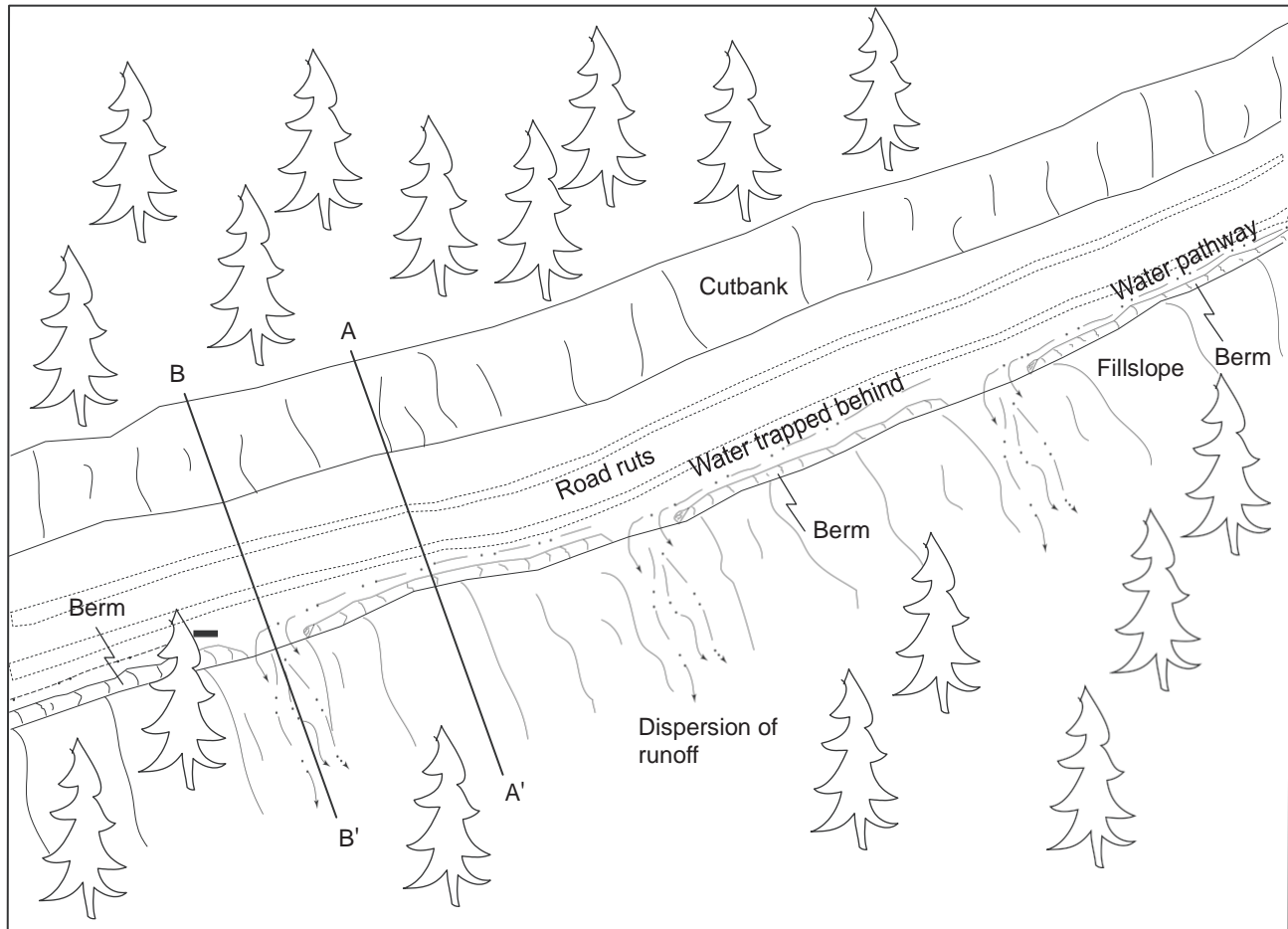
Road grade %	Upslope approach distance (from up road start to trough) ft	Reverse grade distance (from trough to crest) ft	Depth at trough outlet (below average road grade) ft	Depth at trough inlet (below average road grade) ft
<6	55	15 - 20	0.9	0.3
8	65	15 - 20	1.0	0.2
10	75	15 - 20	1.1	0.01
12	85	20 - 25	1.2	0.01
>12	100	20 - 25	1.3	0.01

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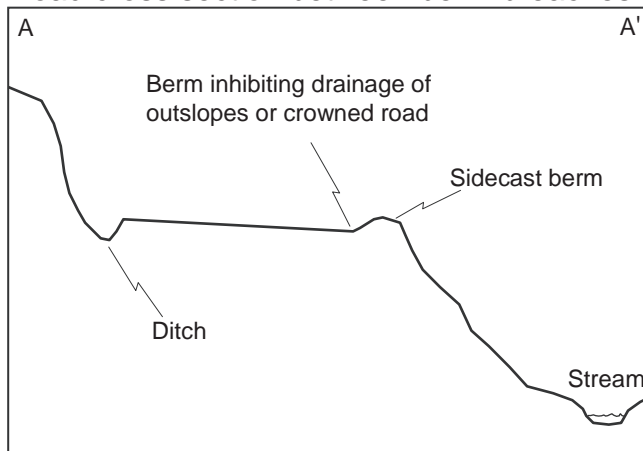
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## Typical Sidecast or Excavation Methods for Removing Outboard Berms on a Maintained Road

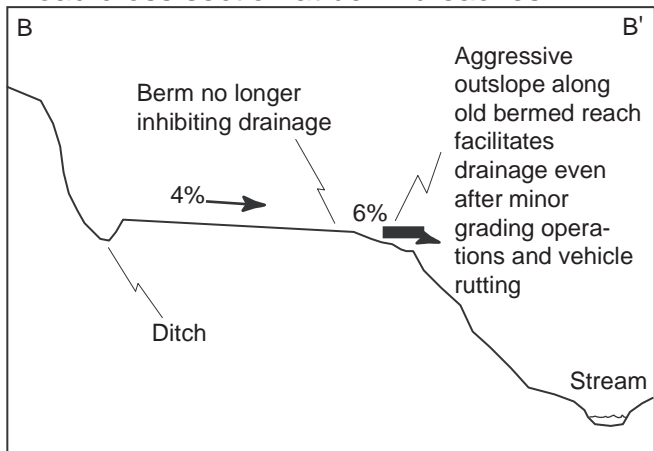
1. On gentle road segments berms can be removed continuously (see B-B').
2. On steep road segments, where safety is a concern, the berm can be frequently breached (see A-A' & B-B')  
Berm breaches should be spaced every 30 to 100 feet to provide adequate drainage of the road system while maintaining a semi-continuous berm for vehicle safety.



### Road cross section between berm breaches



### Road cross section at berm breaches

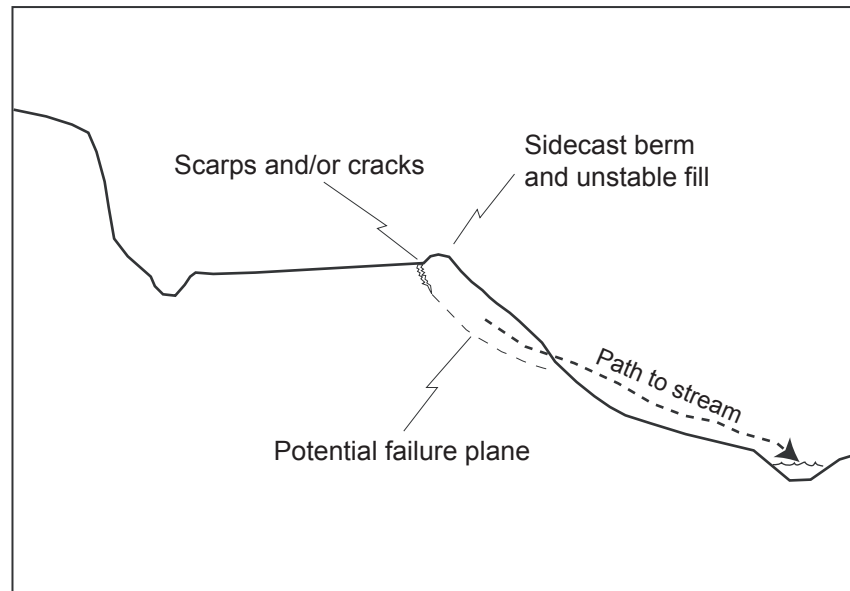


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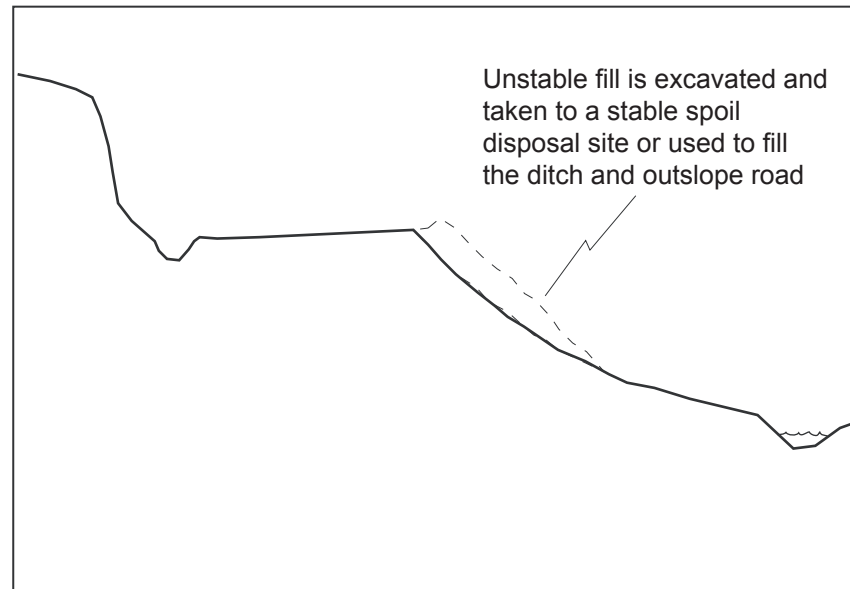
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# Typical Excavation of Unstable Fillslope on an Upgraded Road

**Before**



**After**



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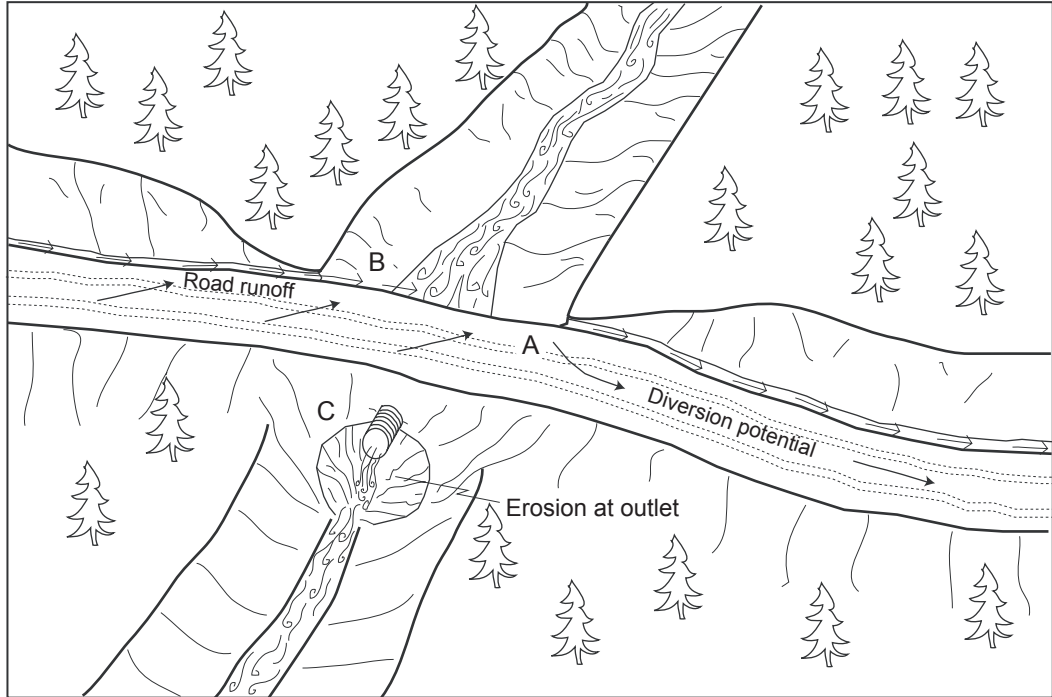
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# Typical Problems and Applied Treatments for a Decommissioned Stream Crossing

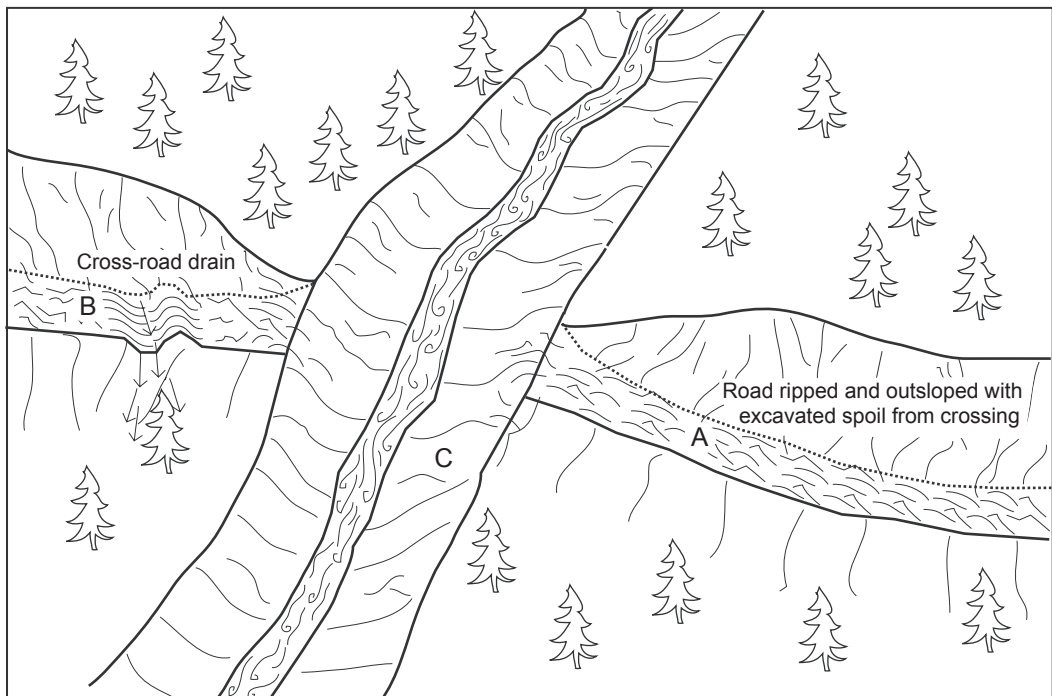
## Problem condition (before)

- A - Diversion potential
- B - Road surface and ditch drain to stream
- C - Undersized culvert high in fill with outlet erosion



## Treatment standards (after)

- A - Diversion prevented by road surface ripping and outsloping using excavated spoils
- B - Road surface and ditch disconnected from stream by road surface decompaction and cross-road drains
- C - Stream crossing fill completely excavated

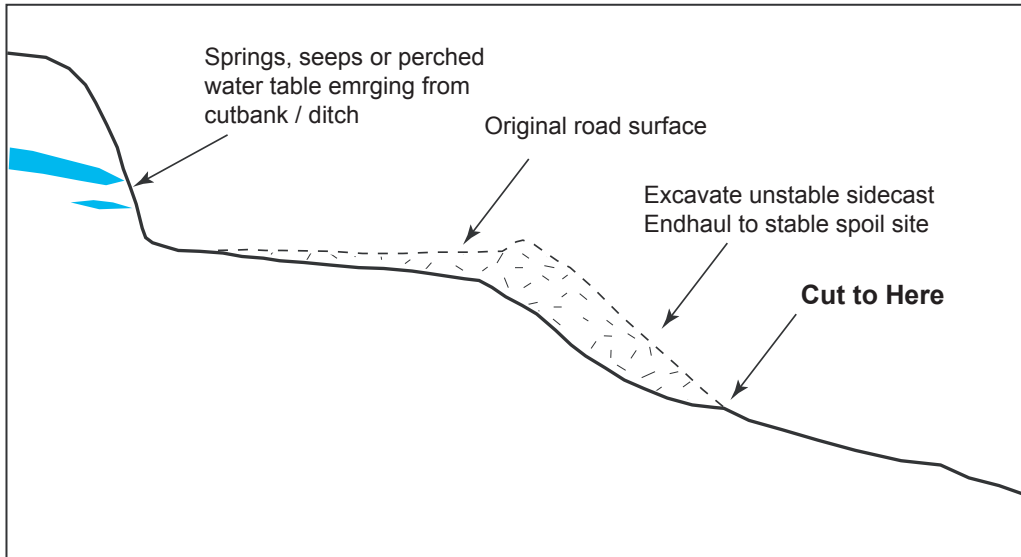


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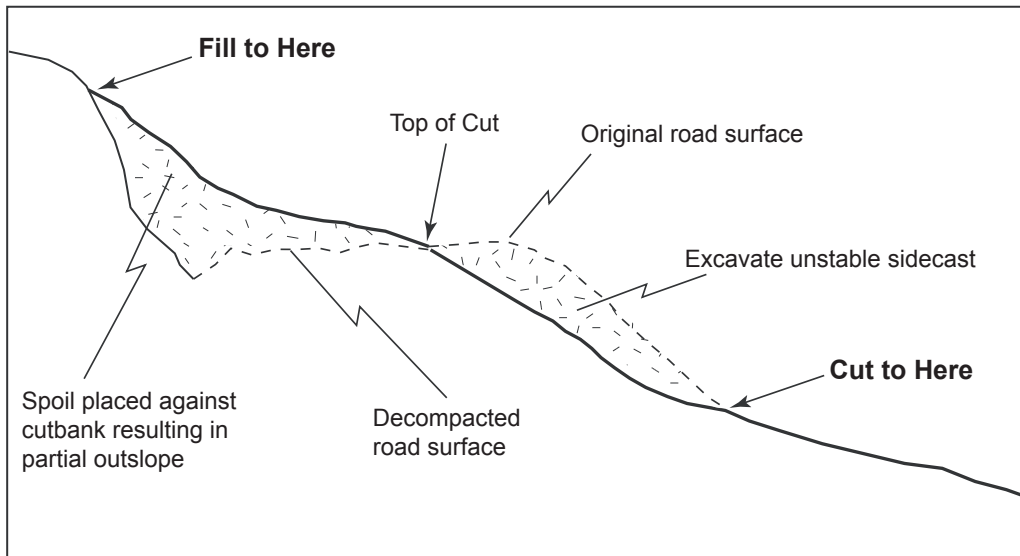
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# Typical Design for Road Decommissioning Treatments Employing Export and In-Place Outsloping Techniques

## Export outslope (EPOS)



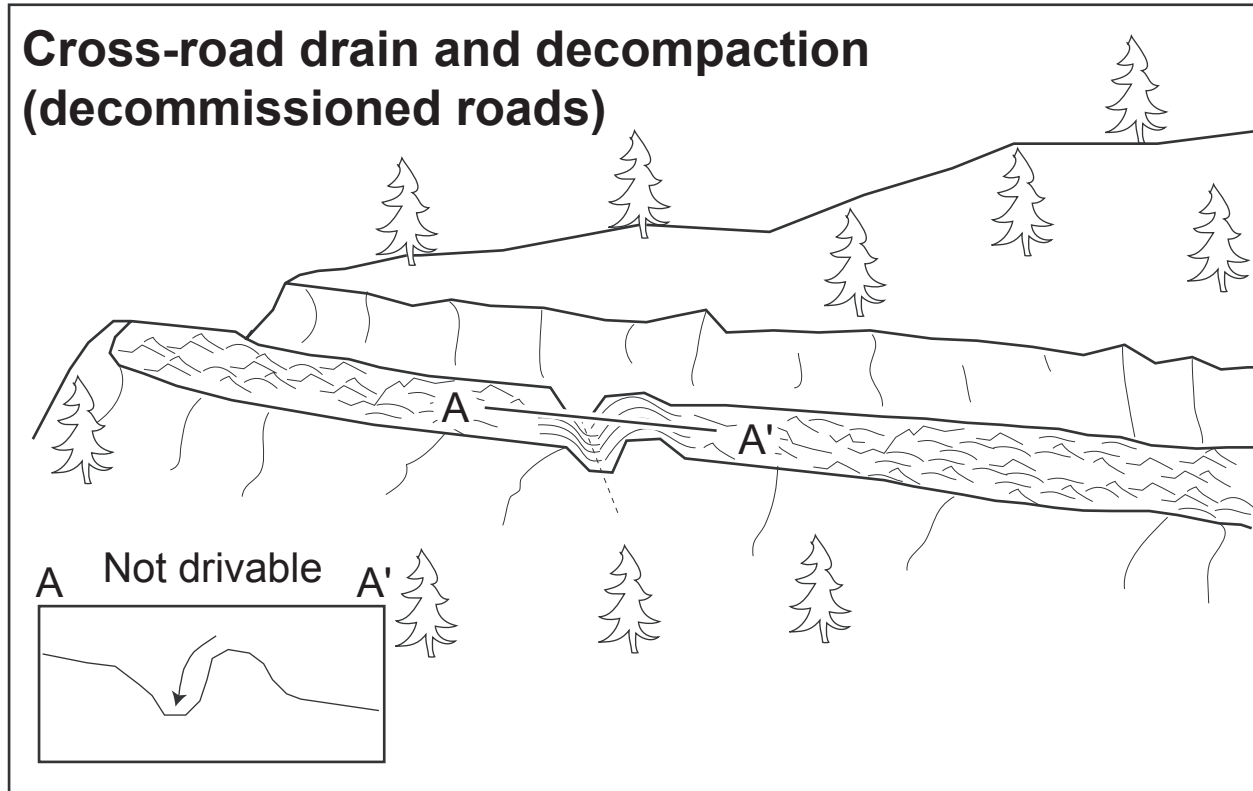
## In-place outslope (IPOS)



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## Cross-road drain and decompaction (decommissioned roads)



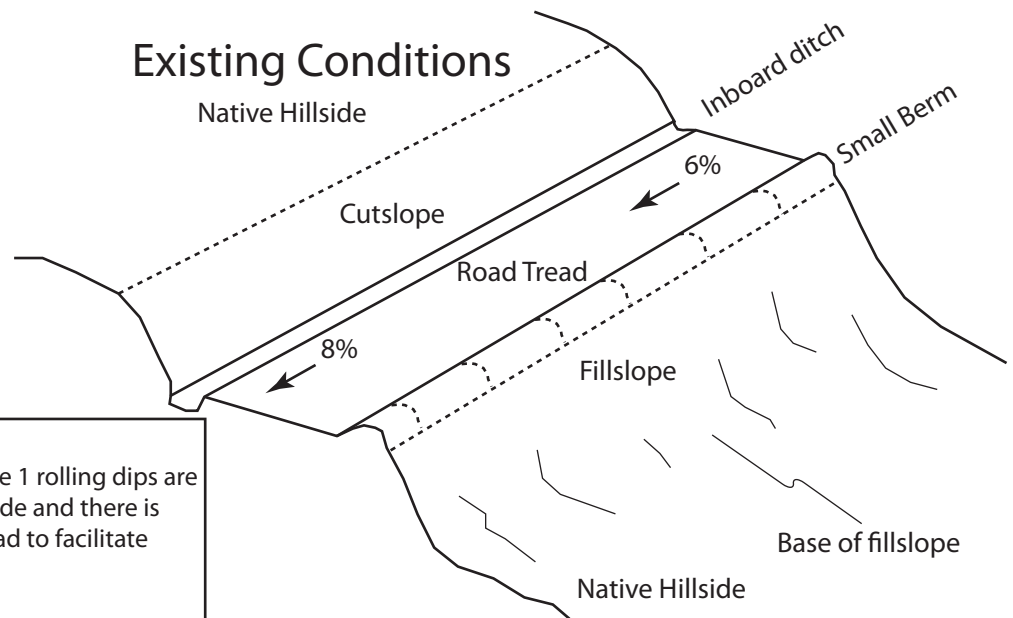
*Cross road drain* construction will ensure gullies, springs, road runoff and other concentrated flow will no longer collect over long lengths of road causing gully erosion and sediment delivery to streams. Cross road drains will be constructed at approximately 75 ft spacing intervals and these cross road drains will direct road surface runoff off the road onto stable hillslope locations.

*Ripping* the road surface 16 to 24 inches deep will increase road surface infiltration rates, decompact the road surface, and prevent concentrated runoff. Road ripping will also pulverize the compacted road surface or hardpan and allow for vegetation to establish and recover naturally.

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# Standard (Type 1) Rolling Dip Construction



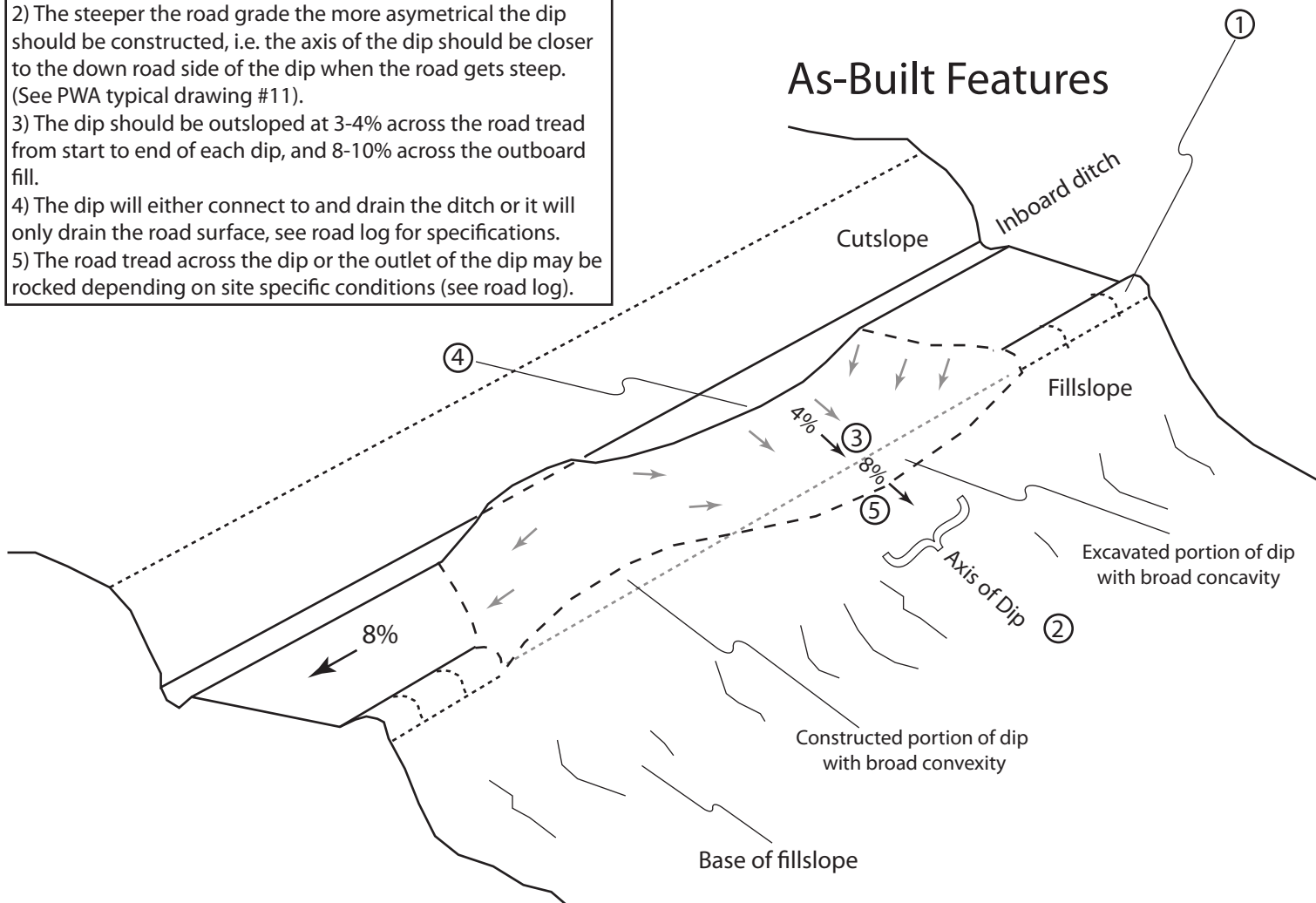
## Notes

**Rolling dip type 1 existing conditions:** Type 1 rolling dips are utilized when roads are less than 12-14% grade and there is proximal outfall adjacent to the outboard road to facilitate road drainage.

### Design Notes:

- 1) The berm should be removed for the entire length of the dip.
- 2) The steeper the road grade the more asymmetrical the dip should be constructed, i.e. the axis of the dip should be closer to the down road side of the dip when the road gets steep. (See PWA typical drawing #11).
- 3) The dip should be outsloped at 3-4% across the road tread from start to end of each dip, and 8-10% across the outboard fill.
- 4) The dip will either connect to and drain the ditch or it will only drain the road surface, see road log for specifications.
- 5) The road tread across the dip or the outlet of the dip may be rocked depending on site specific conditions (see road log).

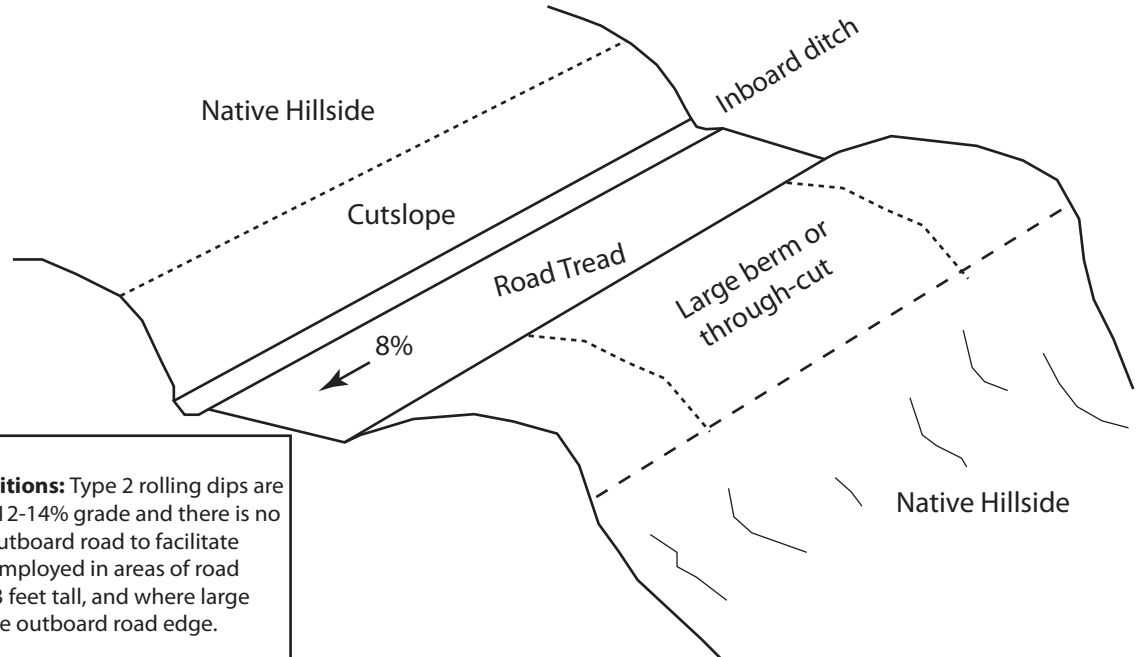
## As-Built Features



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# Type 2 Rolling Dip Construction (Through-cut or thick berm road reaches)



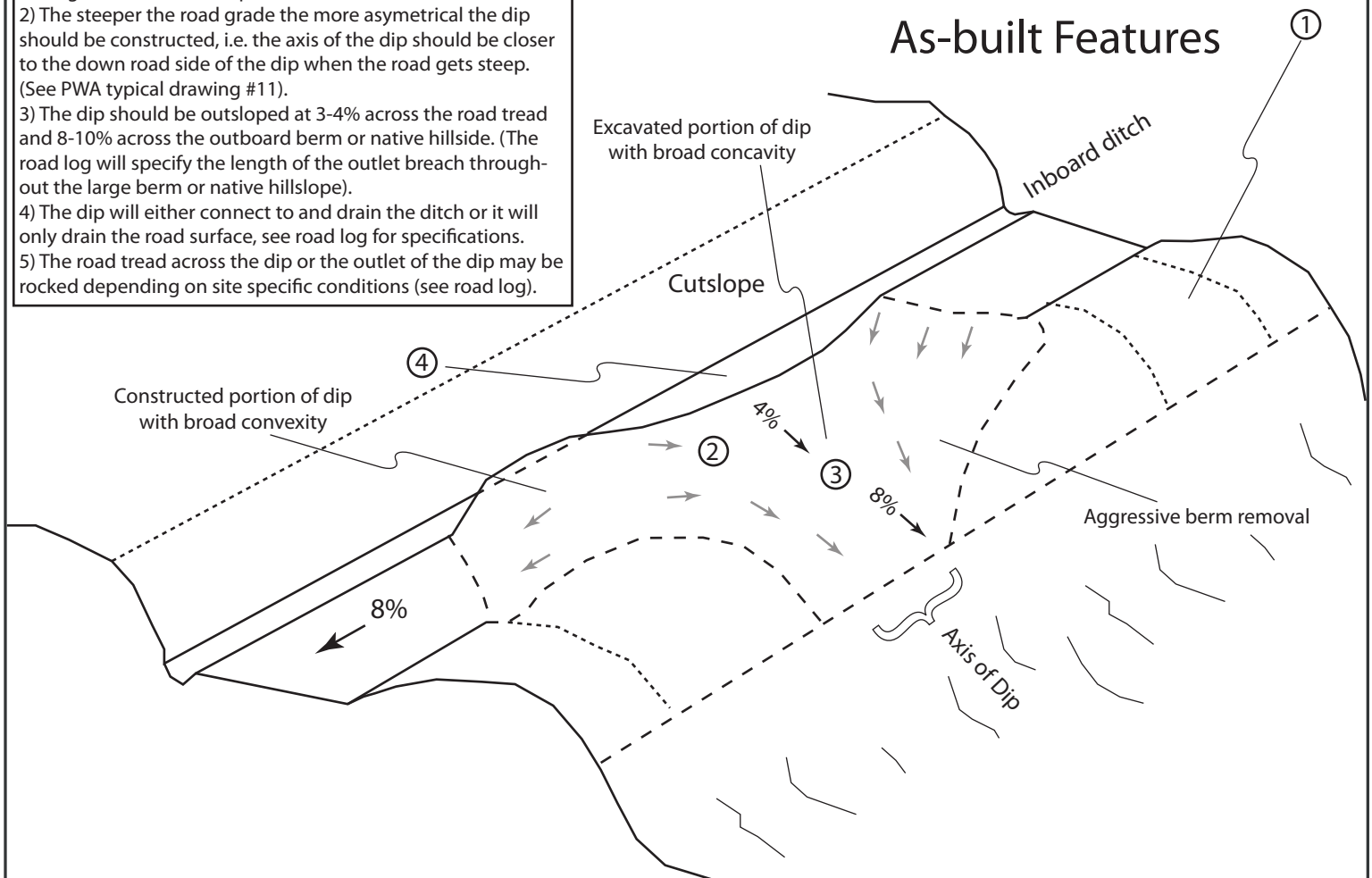
## Notes

**Rolling dip type 2 existing conditions:** Type 2 rolling dips are utilized when roads are less than 12-14% grade and there is no proximal outfall adjacent to the outboard road to facilitate road drainage. These should be employed in areas of road through-cuts generally less than 3 feet tall, and where large wide and/or tall berms exist on the outboard road edge.

## Design Notes:

- 1) The berm or native hillside should be removed for the entire length of the excavated portion of the dip, or, at a minimum through the axis of the dip.
- 2) The steeper the road grade the more asymmetrical the dip should be constructed, i.e. the axis of the dip should be closer to the down road side of the dip when the road gets steep.
- (See PWA typical drawing #11).
- 3) The dip should be outsloped at 3-4% across the road tread and 8-10% across the outboard berm or native hillside. (The road log will specify the length of the outlet breach throughout the large berm or native hillside).
- 4) The dip will either connect to and drain the ditch or it will only drain the road surface, see road log for specifications.
- 5) The road tread across the dip or the outlet of the dip may be rocked depending on site specific conditions (see road log).

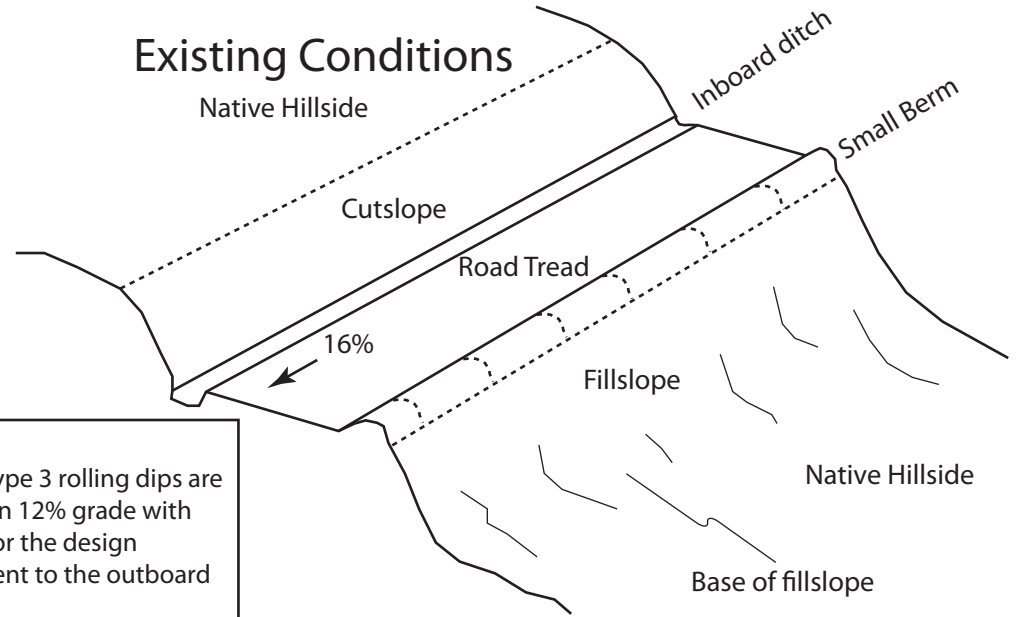
## As-built Features



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# Type 3 Rolling Dip Construction (steep slope outslope)

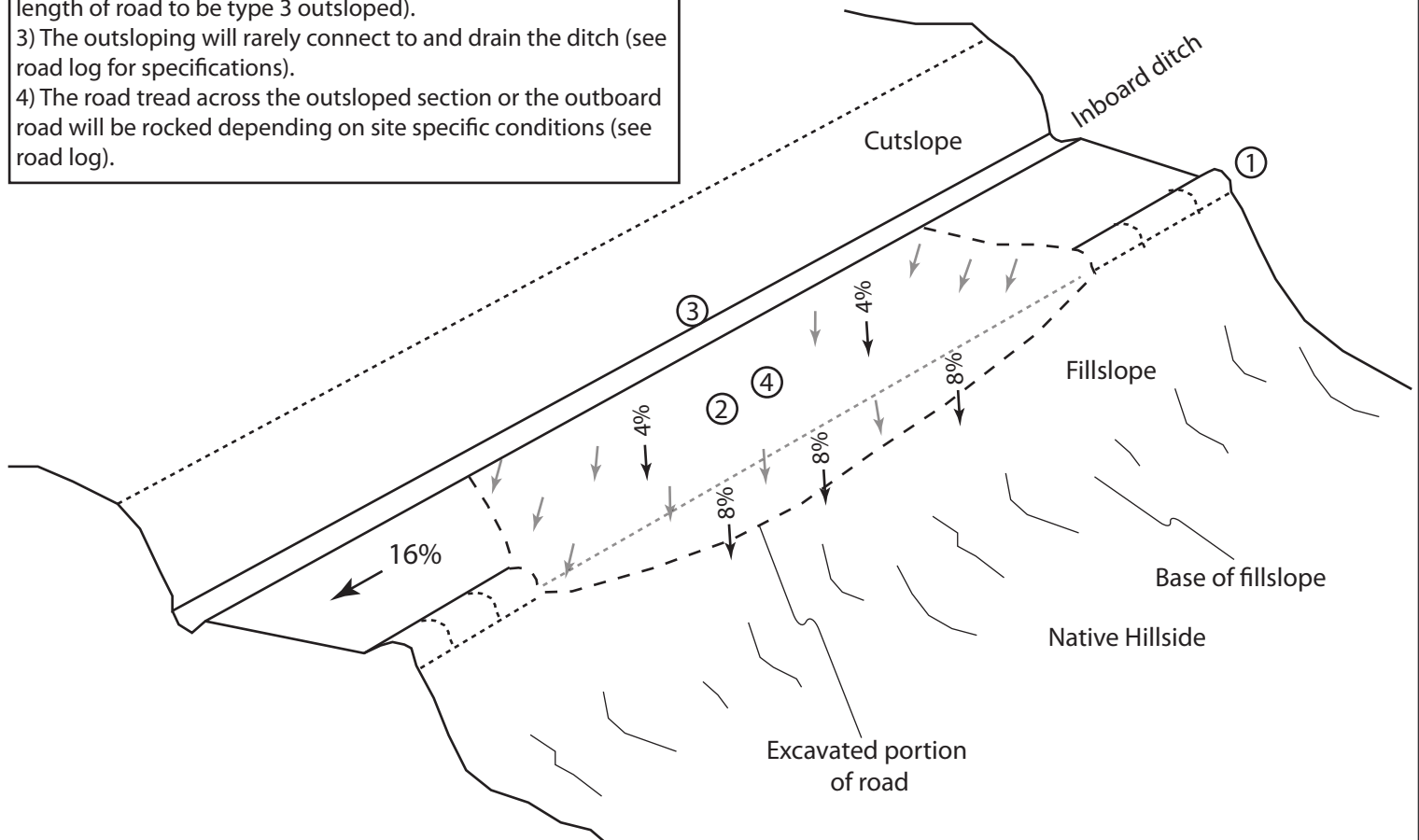


## Notes

**Rolling dip type 3 existing conditions:** Type 3 rolling dips are utilized when roads grades are steeper than 12% grade with little opportunity to create reverse grade for the design vehicle, and there is proximal outfall adjacent to the outboard road to facilitate road drainage.

### Design Notes:

- 1) The berm should be removed for the entire length of the outsloped section.
- 2) The dip should be outsloped at 2-4% across the road tread and 4-8% across the outboard fill. (The road log will specify the length of road to be type 3 outsloped).
- 3) The outsloping will rarely connect to and drain the ditch (see road log for specifications).
- 4) The road tread across the outsloped section or the outboard road will be rocked depending on site specific conditions (see road log).



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# Appendix M

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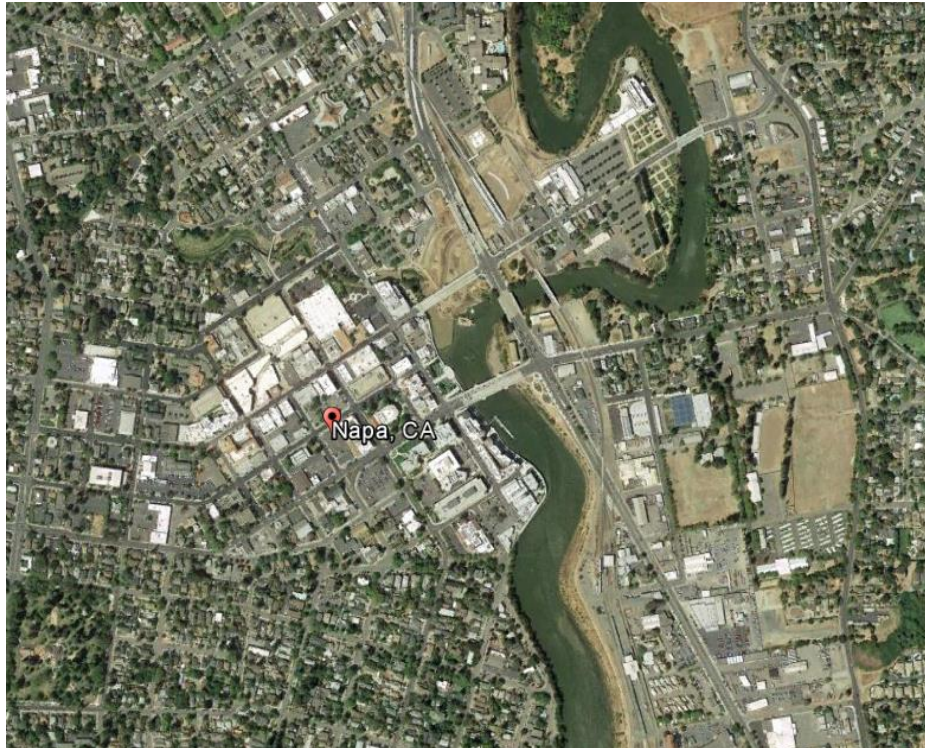
## Final Operations, Maintenance, Repair, Replacement, and Rehabilitation Manual for the Napa River / Napa Creek Flood Protection Project

*(Note: Appendices of the OMRRR Manual are not included herein due to file size.  
Appendices are available upon request.)*



**FINAL MANUAL**  
**OPERATIONS, MAINTENANCE, REPAIR,**  
**REPLACEMENT AND REHABILITATION MANUAL**

**FOR THE**  
**NAPA RIVER / NAPA CREEK FLOOD PROTECTION PROJECT**  
**NAPA, CALIFORNIA**



---

**APRIL 2018**



**US Army Corps**  
**of Engineers®**  
Sacramento District

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**Acronyms and Abbreviations**

ACE	Annual Chance of Exceedance
BO	biological opinion
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIDH	cast-in-drilled-holes
CIP	cast-in-place
CIPi	California Invasive Plant Inventory
Corps	U.S. Army Corps of Engineers (see also USACE)
CRK	Creek
CWA	Clean Water Act
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ER	Engineering Regulation
ETL	Engineering Technical Letter
FEA	flowage easement area
FEMA	Federal Emergency Management Agency
FRM	Flood Risk Management
FSEIS/-EIR	Final Supplemental Environmental Impact Statement/Environmental Impact Report
GDM	General Design Memorandum
HEC-RAS	Hydraulic Engineering Center's River Analysis System
HPTRM	High Performance Turf Reinforcement Mat
HTRW	Hazardous, Toxic and Radioactive Waste
H&H	hydraulics and hydrology
IPCP	Invasive Plant Control Plan
LIS	Levee Inspection System
LRR	Limited Reevaluation Report
MMP	Mitigation and Monitoring Plan
MOU	Memorandum of Understanding
FCD	Napa County Flood Control and Water Conservation District (NCFCWCD)
NED	National Economic Development
NGVD of 1929	National Geodetic Vertical Datum
NMFS	National Marine Fisheries Service
NSD	Napa Sanitation District
NVWT	Napa Valley Wine Train
O&M	Operations and Maintenance
OMRR&R	operations, maintenance, repair, replacement and rehabilitation
PCA	Project Cooperation Agreement
PED	pre-construction engineering and design
RC	reinforced concrete
RR&R	repair, replacement and rehabilitation
RS	River Station
RWQCB	Regional Water Quality Control Board
SEIS/EIR	Supplemental Environmental Impact Statement/Environmental Impact Report
SGDM	Supplemental General Design Memorandum



SMHM	salt marsh harvest mouse
SPD	USACE South Pacific Division
SPK	USACE Sacramento District
SPN	USACE San Francisco District
SRA	shaded riverine aquatic habitat
SWOA	South Wetland Opportunity Area
USACE	U.S. Army Corps of Engineers (see also Corps)
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VRSS	vegetated reinforced soil slopes
WDR	Waste Discharge Requirements
WSE	water surface elevation

**Glossary**

acre-foot	The volume of water required to cover 1 acre to a depth of 1 foot (approximately 325,000 gallons).
adaptive management	Adjusting project strategy as needed to achieve mitigation objectives while the project is being implemented.
adverse impacts	Unfavorable, harmful, or detrimental changes in environmental conditions caused by project or municipal activities.
anadromous fish	Fish, such as salmon, steelhead, and shad that inhabit marine waters during juvenile and adult life stages, and migrate to fresh water to spawn.
Anchored High Performance Turf Reinforcement Mat (HPTRM)	A high-strength, woven, three-dimensional mat of polypropylene yarns anchored to the underlying soil with locked cable strand anchors. An anchored HPTRM, combined with a grass vegetative cover, anchors soil in place to prevent erosion under high water flow conditions.
armored; armoring	A facing layer or protective cover of concrete structural features placed to prevent erosion or the sloughing off of an embankment. Also, a layer or large stones, broken rocks or boulders, or precast blocks placed in specific random fashion on a river to protection against flowing water.
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.
bank repair	Maintenance of existing bank protection structures with in-kind, in-place materials. This type of maintenance occurs when such structures fail.
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.
berm	A short earthen embankment structure, which may or may not be built against a dike or levee.
biotechnical bank stabilization areas	Sections of a water channel that are strengthened through the introduction of specific plants, trees, and shrubs.
box culvert	A water conduit in the shape of a rectangular concrete box.
bypass culvert	A flood protection conduit through which all or a portion of a channel's flow is diverted from one point and reintroduced into the channel at the downstream end of the conduit to reduce the impact to the channel during flood.

bypass	A flood protection feature through which a portion, or all, of a channel's flow is diverted from one point and reintroduced into the channel at another point to reduce the flow in a section of the channel during floods.
channel	A natural or engineered bed of a stream, river, or harbor which acts as a conduit or route for the conveyance of water or other liquid medium.
channel erosion	Includes the processes of stream bank erosion, streambed scour, and degradation.
channel geometry	The natural or engineered shape of a waterway, which is used to convey water or other liquid medium.
Chinook salmon	The largest species of the salmon family. Inhabits the northwest Pacific Ocean and spawns in rivers and streams of North America. The species has a number of runs classified by the season in which they migrate into rivers to spawn. Winter run, spring run, fall run, and late-fall run are known to occur in California.
Clean Water Act	Formally known as the Federal Water Pollution Control Act, it constitutes the basic water pollution control statute for the United States.
confluence	A junction of two or more streams or rivers.
crib	A box constructed of timber that is filled with earth, stone, or heavy material.
cultural resources	Refers to the tangible remains left behind by past human activities. This includes prehistoric and historic archeological sites, and historic buildings, structures, and objects. Archeological sites consist of artifacts, plant and faunal remains, trash deposits, and a variety of features. An artifact is any object made or altered by humans in the past that may be picked up and moved. These may include prehistoric objects made of stone, bone, shell, pottery, or perishable materials; and historic objects such as cans, glass, ceramics, tools, and so forth. Features are human creations that are functionally or logistically tied to a certain location. A feature cannot be moved without destroying its integrity. Features may be such things as hearths or fire pits, house structures, storage pits, trash deposits, historic structures, walls, mines, or any other aspect of the built environment.
culvert	Any covered structure not classified as a bridge which conveys a waterway under a road or other paved area.
debris	Large objects such as recently fallen trees and branches, broken concrete, riprap, shopping carts, or objects greater in size than 1 cubic foot. It does not include established in-water Large Woody Debris (large ecologically valuable downed wood) and established in-water small woody debris (small ecologically valuable wood).
degradation	The lowering of the streambed by erosive processes such as scouring by flowing water, removal of channel bed materials, or down cutting of natural

	stream channels. Such action may initiate erosion of tributary channels, causing damage similar to that due to gully erosion and valley trenching.
design capacity	An engineering term used to describe the magnitude of stream flow that a modified channel was designed to convey.
design flood	The flood magnitude selected for use as a criterion in designing flood damage risk reduction measures. The largest flood that a given project is designed to pass safely.
design flow	The magnitude of stream flow that is used in design of channel improvements and structures across the channels.
design profile distance	Vertical distance between the top of an embankment adjoining a channel and the water level in the channel.
dike	A set-back earthen embankment structure whose purpose is to replicate the pre-project condition of embankments located along the riverbank that were removed or breached as part of project construction. Dikes are not flood protection features.
down cutting	The erosive effect of water against the river channel and their protective features; incision.
drainage area	Area that drains into a body of water such as a stream or a reservoir.
earthen channel	A waterway lined with soil and rock.
endangered or threatened species	A species or subspecies of plant or animal whose prospects of survival and reproduction are in immediate jeopardy or threatened with jeopardy throughout all or a significant portion of its range.
Environmental Impact Report	A detailed statement prepared under the California Environmental Quality Act describing and analyzing the significant environmental impacts of a project and discussing ways to mitigate or avoid the effects.
Environmental Impact Statement	A detailed written statement, required by Section 102(2)(C) of the National Environmental Policy Act, analyzing the environmental impacts of a proposed action, adverse effects that cannot be avoided, alternative courses of action, short-term uses of the environment versus the maintenance of long-term productivity, and any irreversible and irretrievable commitment of resources.
erosion	The wearing away of land surface by running water including rainfall, surface runoff, drainage, or wind.
flap gates	Typically installed on outlets that are 6 inches or larger in diameter to allow storm water to discharge and prevent flood water from flowing back into the drainage system.

fish passage	Structure intended to allow or enhance the movement of anadromous fish in their upstream and downstream migrations past dams and other barriers; includes fish ladders, bypass pipelines, and associated structures.
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 terrace	Low-lying areas adjacent to a stream or river channel that are flooded during high flows in a channel.
floodwall	A wall constructed along a channel to prevent flooding of the surroundings areas.
freeboard (levee)	The height of the physical top of levee above the design water surface elevation, and serves as a factor of safety for containing water in the stream without overtopping the levee.
freeboard(railways/ bridges)	The distance from top of design water level and bottom of railway/bridge to allow debris to flow without blockage conditions.
freeboard berm	A berm, not constructed against a dike or levee, whose purpose is to provide design profile freeboard during the project design flood event.
gabion	A wire cage, usually rectangular, filled with cobbles and used as a component for water control structures or for channel and bank protection.
gaging station	A structure on a stream, canal, lake, or reservoir where systematic observations of gage height or discharge are obtained.
grade control structure	Typically either a weir, chute, or pipe constructed within the confines of a gully or waterway. These structures allow water to move from a higher to a lower elevation over a short distance while preventing erosion or gouging of the waterway.
groundwater	A term used to describe water which is found below ground in soil and rock pore spaces and in rock fractures.
habitat	The place where an animal or plant normally lives, among its associated species and support systems, often characterized by a dominant plant and co-dominant form, such as riparian habitat.
HEC-RAS	HEC-RAS (Hydrologic Engineering Center's River Analysis System) is a software program used to model the water surface profile for this project.
invert	A creek or channel bottom.
levee	An embankment constructed to prevent a river or stream from flooding adjacent lands.

low-flow channel	A section of stream that carries the more frequent, periodic stream flows.
marshplain terrace	A tidally-inundated graded terrace below the floodwalls and along the Napa River, which provides scour protection of the floodwalls and provides environmental habitat.
Mason's lilaeopsis	A species of flowering plant in the carrot family which is endemic to California which is threatened by environmental factors such as erosion and flood control activities.
mitigation	An action taken to moderate, reduce, or 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; or (e) compensating for the impact by replacing or providing substitute resources or environments.
NCFCWCD	The NCFCWCD (Napa County Flood Control and Water Conservation District) is the local sponsor for the authorized project. In this document the acronym has been shorted to Flood Control District (FCD).
natural channel	A watercourse without any significant improvements or modifications and very little evidence of historical alterations.
overbank	The area of land between the waterside toe of a setback dike or levee and the top of the stream bank.
peak flows	The maximum discharge of a stream during a specified period of time or for a given storm event.
Planting Berm	A berm constructed against a dike or levee whose purpose is to supplement the structural dike or levee section to allow vegetation planting adjacent to the dike or levee.
plunge pool	A pool created by water passing over or through a complete or nearly complete channel obstruction, and dropping steeply into the streambed below, scouring out a basin in the stream substrate where the flow radiates from the point of water entry (Armantrout, 1998).
Project	A project is made up of one or more flood damage reduction systems that were constructed under the same authorization. In this case, the Project is all features that are both authorized and have been constructed to for the Napa River/Napa Creek Project.
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.



riparian habitat	Woody vegetation, especially trees and shrubs, that grow in riparian areas, such as along the edges of open water bodies (e.g., lakes, rivers, or ditches) or on levees. USACE typically considers riparian habitat as that vegetation growing below the upper top of the bank. Vegetation landward of this zone is upland vegetation/habitat.
riprap	Strategically interlocked rock or concrete of varying size, typically brought to a site and used to provide slope armoring to protect channel banks, drainage outlets, and other structures from erosion and scouring forces.
runoff (surface)	The flow of water across the land surface and in stream channels. Occurs only after the local storage capacity of the landscape has been exceeded and includes both overland flow and stream flow.
saltmarsh harvest mouse	A small rodent listed as endangered under the Federal and California Endangered Species Acts requiring special provisions for inspections (Section 10.6) and maintenance work including mowing (Section 10.6.1) in the Site 1 area where this mouse is expected to inhabit.
scour	The clearing and erosional 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.
segment	A segment is defined as a discrete portion of a flood damage reduction system that is operated and maintained by a single entity. A segment can be made up of one or more features, including levee/dike embankments, floodwalls, channels, pump stations, closure structures etc.
shaded riverine aquatic cover	Provides habitat complexity and diversity in the form of in-stream cover and a source of food for young fish, and has been defined as the nearshore aquatic area occurring at the interface between a river and adjacent woody riparian habitat; principal attributes include (1) the adjacent bank composed of naturally erodible material, (2) riparian vegetation that either overhangs or protrudes into the water, and (3) the water containing variable amounts of woody material (i.e., logs, branches, and roots).
spawning gravel	Rocks and pebbles deposited in streambeds that are the proper size for anadromous fish to use as they lay their eggs.
station	A station is a standard channel location system used by the FCD 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 Project. For example, station 43+56 would be a point 4,356 feet upstream of the 0 point.
stoplog	A mechanical device installed between the ends of floodwalls used to prevent flood water from reaching beyond the location of the device.
streambed	The part of a stream over which water moves.
superintendent	A FCD staff person responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water.
system	A system is made up of one or more segments that collectively provide flood damage reduction to a defined area. Failure of one segment within a system constitutes failure of the entire system. Failure of one system does not affect another system.
toe	The line of a natural or fill slope where it intersects with the natural ground.
vegetation management	Vegetation growing onsite is monitored, controlled, or enhanced by the following safety guidelines and regulations, and by the Napa Project's plan for short-term and long-term horticultural goals. Vegetation growing on and near flood protection features (levees, dikes) must be maintained in accordance with in Section 10.7.3 of this Manual. Vegetation management includes the monitoring and documenting of the health and vigor of the native plants, noting competing exotic species to be later controlled, and observing other factors, such as weather and the degree of public access allowed. Mowing, grazing, scheduling prescribed burns, and spot-spraying herbicide treatments are implemented to help native species establish the site.
velocity	Speed with which water flows in a channel. It depends on several factors, such as slope, smoothness and uniformity of channel, area of flow, and wetted perimeter.
vortex rock weirs	A weir constructed such that water flows from a small opening at its base, causing the water to form a whirlpool as it collects behind the weir.
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.
weir	A dam, wall, or other structure in a waterway for the purpose of storing, diverting, or measuring water.
weed	Vegetative growth including all non-native and invasive grasses, forbs and other herbaceous plants, and non-native woody vegetation that has not been

planted and competes for environmental and microclimate elements necessary for healthy plant growth of installed plants, such as soil moisture and sunlight.

## SECTION 1 – GENERAL

### 1.1 INTRODUCTION

This section provides a general description of the Napa River, California Project (Project). The non-Federal sponsor is the Napa County Flood Control and Water Conservation District, NCFCWCD, hereby referred to as the Flood Control District (FCD) throughout this document. The FCD is responsible for operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of the completed project. United States Army Corps of Engineers (USACE) has managed the construction work which has directly affected the city of Napa. The manual is in final interim status meaning this is a final document for the existing flood control features with an interim status due to an incomplete flood control project. The interim status of this manual means that the hydraulic model is incomplete and it is not possible to fully develop without all of the project features (which affect the final geometry and conveyance of the river). The number of unknown features which affect the hydraulics of the river cannot be foreseen during model construct. Therefore, until the project is fully constructed the model cannot be fully developed without being able to capture all of the floodwalls, levees, geometric details, final elevations, and materials (manmade and natural) in the hydraulic model.

### 1.2 GENERAL DESCRIPTION

The Napa Project is authorized to provide flood damage risk reduction and recreation. The Napa Project provides flood risk management by reconnecting the Napa River to its floodplain, creating wetlands throughout the area, maintaining fish and wildlife habitats, and retaining the natural characteristics of the river. The Napa Project involves about 6.7 miles of the Napa River and two-thirds of a mile along Napa Creek. Key features of this Project include Sites 1A, 1B, 2 East (2E), 2 West (2W), the Dry Bypass and Napa Creek. The various features are provided for in Figure 5-1. This included creating marshplain and floodplain terraces, two bypass culverts along Napa Creek, and construction of levees, dikes, floodwalls, biotechnical bank stabilization, two new railroad bridges, utility relocations, building demolitions, maintenance roads, recreation trails, and flood closure gates. A summary of key flood control features is provided in SECTION 8. Once complete, the project is intended to provide flood damage risk reduction to the City of Napa. Mitigation is not necessary because the project does not cause long term adverse impacts to habitat that would require mitigation.

### 1.3 DOCUMENT ORGANIZATION

This manual provides information, guidance, and requirements for the OMRR&R of the Project. The manual is in accordance with the USACE Engineer Regulation (ER) 1110-2-401, "Operation, Maintenance, Repair, Replacement and Rehabilitation Manual for Projects and Separable Elements Managed by Project Sponsors," (1994).

### 1.4 REFERENCES TO APPROVED REGULATIONS

This manual is submitted in accordance with the provisions of the *Code of Federal Regulations* Title 33, Chapter II - Corps of Engineers, Department of the Army, Part 208 - Flood Control Regulations (33 CFR 208) (Appendix H:1). The regulations describe obligations assumed by the non-Federal sponsor, project superintendent, and USACE District Engineer, San Francisco District (SPN). These regulations are incorporated by reference into this OMRR&R.

## SECTION 2 – AUTHORIZATION

### 2.1 PROJECT AUTHORIZING & FUNDING LEGISLATION

The project was authorized by Section 204 of the Flood Control Act of 1965 (Pub.L. 89-298) for the purposes of flood control and recreation (Appendix H:4)

"The project for the Napa River, California, is hereby authorized substantially in accordance with the recommendations of the Chief of Engineers in House Document Numbered 222, Eighty-ninth Congress, at an estimated cost of \$14,950,000."

Section 136 of the Water Resources Development Act (WRDA) of 1976 (Pub. L. 94-587) authorized the addition of fish and wildlife mitigation and improvements to Napa Creek:

“(a) The project for flood control on the Napa River, Napa County, California, authorized by section 204 of the Flood Control Act of 1965, is hereby modified to authorize and direct the Secretary of the Army, acting through the Chief of Engineers, to acquire approximately 577 acres of land for the purpose of mitigating adverse impacts on fish and wildlife occasioned by the project. The non-federal share of the cost of such lands shall be the percentage as that required for the overall project.

(b) Such project is further modified to include construction by the Secretary of the Army acting through the Chief of Engineers, of the Napa Creek watershed project of the Soil Conservation Service approved June 25, 1962.

(c) No part of the cost of the modified project authorized by this section shall include the cost of the Secretary of the Army, acting through the Chief of Engineers, performing maintenance dredging for the navigation project for the Napa River.”

The WRDA 1976 modification was apparently intended to allow the implementation of the plan presented in a General Design Memorandum (GDM) completed in 1975, but that plan was not implemented. There was no further change in the Congressional authorization after 1976. The approved plan that was followed during final project design and construction was identified as the Selected Plan in the Final Supplemental GDM (SGDM) for the Napa River/Napa Creek Flood Protection Project dated October 1998. The SGDM was a stand-alone revision of the 1975 GDM. The 1998 SGDM included major changes in the overall project plan from that presented in the 1965 authorizing document (H. Doc. 89-222), including reductions in the project length and design level of performance. The Record of Decision for the SGDM was approved by the USACE Director of Civil Works on June 9, 1999 (Appendix H:2). As described in the SGDM, the approved plan includes dike removal, one-side overbank excavation, biotechnical bank stabilization, a dry bypass channel, levees and floodwalls, bridge relocations, pump stations, utility relocations, building demolition, maintenance roads, and recreation trails for the approximately 6.9 mile reach of the Napa River from Highway 29 to Trancas Street. The plan also includes approximately two-thirds of a mile of channel modifications with bypass culverts for Napa Creek. The approved plan does not include compensatory fish and wildlife mitigation as authorized by WRDA 1976 because the project design features, including plantings, were expected to offset adverse effects. The approved plan was identified as the National Economic Development (NED) Plan and was intended to provide a 100-year level of flood protection to the City of Napa (downstream to Imola Avenue) while maintaining or enhancing the river's natural processes and features.

The constructed project includes several significant design refinements relative to the SGDM approved plan, including: addition of the Vineyard Dike; deletion of 3560 feet of maintenance road/recreation trail south of Newport Marina; and relocation of railroad track near Tulocay Creek and Imola Avenue. The

reasons for these design changes were documented in a Limited Reevaluation Report approved by South Pacific Division in 2012.

Federal construction funding was provided through multiple appropriation Acts beginning in FY2000. The Project Cooperation Agreement between the Department of the Army and the Flood Control District for the project was signed on February 1, 2000 (Appendix B:1). PED and Construction were cost-shared with the non-Federal sponsor in accordance with WRDA 1976, as amended.

## **2.2 PROJECT APPROVALS AND ENVIRONMENTAL DOCUMENTS**

The following approvals and environmental documents are necessary to construct, operate, and maintain the Project:

- The National Marine Fisheries Service (NMFS) issued a Biological Opinion (BO) on December 14, 1998 as pursuant to Section 7 of the Endangered Species Act (16 U.S.C. 1536[c]) of 1973, as amended. (See Appendix E:2)
- The Final Supplemental Environmental Impact Statement/Environmental Impact Report (FSEIS-EIR), dated March 1999, evaluated the environmental effects of the Project under National Environmental Policy Act and California Environmental Quality Act (USACE, 1999). (See Appendix E:10)
  - The Record of Decision approving the FSEIS-EIR was signed by the USACE Director of Civil Works on June 9, 1999. (See Appendix H:2)
- Section 404 of the Clean Water Act (CWA) was complied with through a Section 404(b)(1) analysis, which was completed in December 1997. The 404(b)(1) analysis can be found in Appendix D: of the FSEIS-EIR. (See Appendix E:10)
- The U.S. Fish & Wildlife Service (USFWS) issued a BO pursuant to (see Appendix E:3) pursuant to Section 7 of the Endangered Species Act (16 U.S.C. 1536[c]) of 1973, as amended,. (See Appendix E:3)
- Both USFWS and NMFS issued BO's with pertinent conservation measures necessary for construction, and operations and maintenance procedures. Subsequent species that have since become listed (Western yellow billed cuckoo) do not have nesting habitat within the Napa project area. Therefore, reconsultation with the resource agencies is not necessary. The current O&M manual contains the conservation measures required by previous USFWS and NMFS BO's.
- The Water Quality Certification Waste Discharge Requirements (CWA Section 401) was obtained on September 15, 1999 from the California Regional Water Quality Control Board (RWQCB). (See Appendix E:4)
- The California Department of Fish & Wildlife (CDFW) issued a Streambed Alteration Agreement (Section 1602 of the Fish and Game Code) to the FCD on August 8, 2000. This agreement has been subsequently renewed several times. (See Appendix E:5)



## SECTION 3 – LOCATION

### 3.1 PROJECT LOCATION

The Project is located in Napa County, California, with the majority of the project work occurring within the downtown portion of the city of Napa. The Napa River limits of the Project are from Trancas street, north of the Napa River oxbow, and extends approximately 6.7 miles downstream (south) to the State Highway 29 bridge which crosses Napa River. The Project also includes approximately two-thirds of a mile along Napa Creek upstream of the confluence with the Napa River..

### 3.2 PROJECT CONTROL DATA

The majority of the Project features were constructed using the horizontal and vertical controls based on North American Datum of 1927 (NAD 27) and National Geodetic Vertical Datum of 1929 (NGVD29), respectively. The Napa Dry Bypass project was designed and constructed using North American Vertical Datum of 1988, (NAVD88).

A datum conversion equation of Elevation (NAVD88) = Elevation (NGVD29) + 2.39' feet has been used to convert from NGVD29 to NAVD88 for features constructed in NGVD29. See Appendix G:1 for the Sacramento District Datum Documentation Report. Flood stage elevations listed throughout the manual will be based on the NAVD 88 datum.



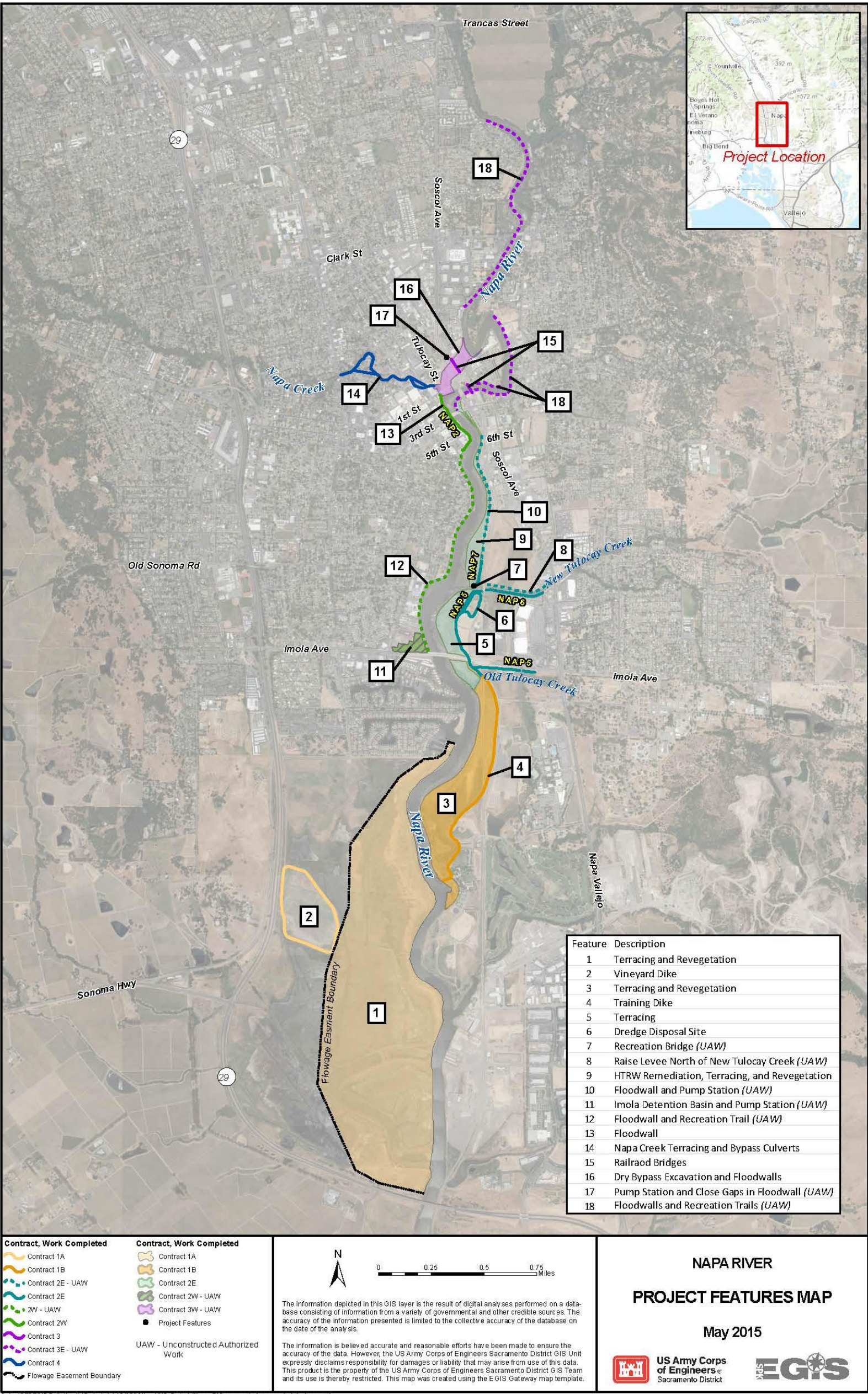


Figure 3-1: Project Features Map



**SECTION 4 – PERTINENT INFORMATION****4.1 PROJECT HISTORY**

The Federal Government first became involved with the Napa River in 1938 when “preliminary examinations and surveys” were authorized by the Secretary of War. Six years later, House Document 626 of the 78th Congress was released. The report recommended channel improvements for reaches of the Napa River and Conn Creek, and construction of a dam to create a 37,000 acre-foot flood damage reduction and water conservation reservoir on Conn Creek. Although these features were authorized by the Flood Control Act of 1944, Congress never appropriated construction funds. During 1948, the City of Napa built a dam on Conn Creek to establish a 31,000 acre-foot water conservation reservoir.

The flood of 1955 compelled the House of Representatives Committee on Public Works to request the Board of Rivers and Harbors “to review reports on Napa River and its tributaries” and “determine the need for modification of the recommendations in such reports and the advisability of adopting further improvements for flood control and allied purposes in view of the heavy damages caused by recent floods.” The committee’s request was fulfilled in 1963 by the Review Report for Flood Control and Allied Purposes, which recommends that previously authorized flood control improvements above Soscol, California, be rescinded and that the Federal Government “should adopt a project in the basin below Trancas Street for flood control and recreation purposes.”

Three years passed before funding for “Advanced Engineering and Design (FY67)” was provided and in September 1975 a General Design Memorandum (GDM) and EIS was completed. The 1975 plan included recreation features that were requested by the FCD. The 1975 plan was opposed by voters by referendum election in 1976 and again in 1977. After its second defeat, the Napa Project was placed on inactive status at the request of the FCD.

The 1986 flood, which forced the evacuation of some 5,000 residents, took three lives, and caused an estimated \$100 million in county damages, revived public interest in flood damage reduction. Subsequently, in letters dated February 9, 1987 and April 9, 1987, the FCD requested that the Napa Project be reactivated. The Project was reactivated in October 1988 and PED activities were initiated. This effort led to preparation of an initial draft SGDM and SEIS/EIR. The plan in these documents included a levee and channel modification project which sought to provide flood risk reduction to the City. These documents underwent public review in April 1995 and received numerous comments. The major concerns expressed in these comments dealt with salinity intrusion due to channel deepening, degradation of water quality in the river oxbow due to construction of a “wet” bypass channel, and disposal of contaminated dredge material. Because of these concerns, resource agencies and several local groups requested modifications to the plan. The San Francisco Bay RWQCB, which must provide a Section 401 Water Quality Certification, stated: “Without major improvements in the project and Draft SEIS/EIR as currently submitted, approval of this project will be difficult.”

To foster community consensus regarding modification for flood damage reduction for the City of Napa, the FCD and other local groups created a community-wide coalition to consider various ways to refine the plan proposed in the initial draft SGDM so that it would be more acceptable to the community and resource agencies. The Community Coalition, with the assistance of outside consultants, resource agency personnel, and USACE as a resource, held numerous meetings from January 1996 to May 1997 to develop refinements to the SGDM’s National Economic Development (NED) plan. The result of these meetings is the current refined plan. This plan provides flood damage reduction, eliminates the primary environmental concerns of the previously developed plan, and provides significant associated environmental quality outputs. The revised plan, as described in the final SGDM and SEIS/EIR, was also more acceptable to the resource

agencies with regard to maintaining water quality and avoiding further damage to the Napa River ecosystem. Because of the changes to the plan it was decided to revise the SGDM and SEIS/EIR and again issue them for public review. The 1998 SGDM was approved by the U.S. Army Director of Civil Works on June 8, 1998.

There have been no further changes in the project authorization since 1976. The 1998 SGDM included major changes in the overall project plan from the plan presented in the 1965 authorizing document (Pub. Law 89-298, see Appendix H:4) The Limited Revaluation Report (LRR) (USACE, 2012) describes the changes to the project since the 1998 SGDM.

## **4.2 WATERSHED PHYSIOGRAPHY**

The Napa River drains a watershed of more than 400 square miles as it flows from Mt. St. Helena to San Pablo Bay and on to San Francisco Bay. The drainage basin runs 50 miles north to south, ranges from 5 to 10 miles in width. The Napa River originates near Mount St. Helena, follows the valley, and empties into the Mare Island Strait which flows into the tidal marshlands and sloughs of San Pablo Bay.

Napa Creek is a tributary to the Napa River in the city of Napa. Its headwaters rise in the Mayacamas Mountains on the west side of the valley and flow southeasterly to discharge through a narrow, meandering channel into the Napa River, downstream of the Oxbow area. The Napa Creek drainage area is approximately 15 square miles.

## **4.3 CLIMATE AND WEATHER**

The climate of the Napa Valley is moderate and low levels of smog with temperatures ranging from an average high of 83° Fahrenheit (F) during July-September to an average low of 39° F in January.<sup>1</sup> The average rainfall is 27.71 inches per year, with the majority of the rainfall occurring from November to March with December being the wettest month.<sup>2</sup>

## **4.4 ENVIRONMENTAL**

The project has environmental impacts on sensitive habitats including riparian woodland, estuarine and freshwater aquatic habitats, and wetland habitats. Implementation of the project has been fully coordinated with the concerned resource agencies. Some resource agencies, such as the Regional Water Quality Control Board and the U.S. Fish and Wildlife Service, have the authority to review final designs pursuant to Federal environmental laws. Upon review of the final designs for construction contracts, design changes have sometimes been required to resolve resource agency concerns, often resulting in increased monitoring and maintenance activities to further avoid impacts to listed species.

## **4.5 RUNOFF CHARACTERISTICS**

Stream flow of flood-producing magnitude is the result of precipitation over the entire river basin for a period in excess of 12 hours. After the periods of most intense rainfall, maximum river stages and discharges in the city can be expected from 8 to 14 hours later. Streamflow in the southern part of the Napa River is also affected by tide conditions, which can affect the river as far upstream as Trancas Street. Napa River peak flood flows occur near Mount St. Helena about four hours after the most intense storm precipitation. Peak flood flows occur about two hours later at Oak Knoll Avenue, relative to the peak at

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<sup>1</sup> Source: [www.weather.com](http://www.weather.com)

<sup>2</sup> Source: Western Regional Climate Center (normal's 1981–2010, extremes 1893–present)

Mount St. Helena, and about three or four hours later at Imola Avenue, relative to the peak at Mount St. Helena.

#### **4.6 TIDAL INFLUENCES**

Within the city of Napa, Napa River can be characterized as a tidal influenced estuarine system. Upstream of Trancas Street, the Napa River is largely freshwater. As the river proceeds through the city, the water quality transitions to a brackish marsh. Tidal influences on the river affect both discharges to San Pablo Bay and water surface elevations (WSE) extending upstream approximately 0.5 miles north of the city.<sup>3</sup>

To account for sea level rise, water surface profiles in the year 2067 (end of period of analysis, project year 50) resulted in a 1.04 ft sea level rise at the 1% Annual Chance Exceedance (ACE) for the Napa River mouth. This would generate only a 0.12 ft water surface increase at Napa River Station 685+00 which is near the Imola Avenue bridge. The effect of this small increase in starting WSE on design elevations would be negligible.<sup>4</sup> (Reference LRR, 2012)

Table 11-1 shows the computed probability flows at river reaches downstream of Trancas Street. All flows except the 0.1% Annual Chance of Exceedance (ACE) event were used in the analysis to define the discharge-frequency relationship input to the Flood Damage Reduction Analysis (FDA)-based economic analysis to evaluate project performance.

#### **4.7 CHANNEL STABILITY**

##### **4.7.1 Napa River**

The Project uses engineered and bio-engineered bank and channel stabilization to resist erosion, prevent bank degradation and provide protection to man-made improvements at select locations along the project reach. These features include concrete and rock lined channels, rock riffles, slope protection riprap, slope protection vegetation, floodwalls, and marsh plain terrace vegetation and are designed to reduce the amount of sediment deposited downstream of 3<sup>rd</sup> Street.

##### **4.7.2 Napa River Dry Bypass**

The Napa Dry Bypass channel is comprised of a man-made channel which is planted with a varied plant community. Planting includes Brackish Emergent Marsh, Upland Native and Native grasses, and turf planted over high performance turf reinforcement matting (HPTRM) material. In addition, various shrubs and trees are planted to stabilize the channel. The channel bottom will be protected by HPTRM and concrete sidewalks. Rock is placed at the inlet and outlet of the channel which are also protected by permanent, capped, sheet piling at both toes. Due to high velocities anticipated within the bypass channel, concrete energy dissipaters are included below the Napa Valley Wine Train (NVWT) Dry Bypass bridge see Figure 5-10 and Figure 5-11.

##### **4.7.3 Napa Creek**

The Napa Creek channel is planted with native and non-native trees and brush. Channel stability will be provided by a number of methods including In-Water Wood Structures, vegetated reinforced soil slopes (VRSS), planted and non-planted rock protection structures, planted rock grade control structures (riffles), and reinforced concrete inlet, outlet and retaining walls.

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<sup>3</sup> City of Napa, 2009 Hazard and Mitigation Plan

<sup>4</sup>USACE SPK, 2012 Limited Reevaluation Report Napa River/ Napa Creek Flood Protection Project

## **4.8 HYDRAULIC DESIGN**

All Napa River project features are designed for the completed fully-built conditions. For the completed fully-built Project, flood risk reduction features are designed to adequately and safely pass the Risk & Uncertainty (R&U) flood events, the 1% flood event at 95% assurance with 2 feet of freeboard or at 90% assurance with 3 feet of freeboard. The Project's FRM on the Napa River extends from about one-half mile below Trancas Street to just north of Highway 29.

Hydraulic design for Napa Creek employs the approach for channel improvements for a natural stream without the installation of a levee or floodwalls. The channel conveyance capacity is increased through the construction of upper and lower bypasses. Napa Creek channel is designed to reduced flood damage risk for up to a 1/200-ACE event with localized minor overtopping. Acceptable shear stress and velocity ranges are also included in the hydraulic design considerations and procedures to verify that the proposed bank treatments are suitable and appropriate for Napa Creek.

The Napa River project is currently in interim condition. In its current state of completion, the Napa Project does not provide the design level of FRM. It is possible for the currently completed sections to provide increased FRM protection for portions of downtown, however this does not equate to the same level of FRM until the completion of the entire project. The only exception to this is Napa Creek where the design level of protection has been achieved since it is isolated from the greater Napa River Flood Risk Management System.

### **4.8.1 Projects within Downtown Napa**

#### **4.8.1.1 Site 2W: Hatt to 1<sup>st</sup> Street**

During the design of Site 2W: Hatt to 1<sup>st</sup> Street, there were concerns of the boat dock in Napa River between 3<sup>rd</sup> and 4<sup>th</sup> streets causing flow obstruction during high water events. Noble Consultants, Napa city's consultant developed a HEC-RAS model with the boat dock improvements incorporated. USACE SPK reviewed the City's consultants work and agreed the boat dock design showed no adverse impacts on design WSE. See Appendix I:14 for the technical memorandum.

#### **4.8.1.2 Site 3: NVWT Hydraulic Design**

The NVWT Phase II Relocation project ("Project") constructed two new railroad bridges in downtown Napa. The previous railroad bridge over Napa River was a combination original timber trestle and newer steel span that dates back to the late nineteenth and early twentieth century. The old bridge created a significant flow constriction within the river, raising water levels upstream and through downtown Napa. The old bridge was replaced with a new concrete bridge (the Napa River Bridge), with the tracks approximately four to five feet higher and only two flow efficient piers within the river. The Dry Bypass Channel required the construction of a second railroad bridge (over the Dry Bypass Bridge) where before no bridge existed and the tracks were an obstruction to flow in the bypass prior to its construction.

#### **4.8.1.3 Site 3: Dry Bypass Hydraulic Design**

During the design phase of the Dry Bypass project, McMillen LLC was contracted to perform an updated hydraulic analysis using a two dimensional steady state finite-element surface-water modeling system (FESWMS) of the Napa Dry Bypass. See Appendix I:4 for additional analysis information and results.



#### **4.8.1.4 Site 4: Napa Creek Hydraulic Design**

Flood protection on Napa Creek extends from the confluence of the Napa River upstream approximately two-thirds of a mile along Napa Creek to the Jefferson Street Bridge. The flood reduction features for Napa Creek include upper and lower bypass culverts with elevated weir entrances, channel improvements in the form of an excavated flood conveyance terrace, and the removal of constrictive bridges and architectural features and implementation of bio-engineered structures.

Erosion protection treatments for Napa Creek include:

- (1) Channel bank grading combined with vegetation planting for an effective stabilization treatment when sufficient room for laying back the bank is available
- (2) Floodplain benches were implemented to provide continuous plantable surfaces that promote the establishment of overstory and understory vegetation to increase riparian habitat in the system.
- (3) In-stream rock and boulder structures placed in the channel to provide aquatic habitat, promote hydraulic diversity, and help prevent channel incision due to downcutting.
- (4) Incorporate in-stream woody material to protect banks against erosion, reduce flow impingement at outside of bends, and provide habitat structure for fish and aquatic invertebrates.

Northwest Hydraulic Consultants performed a study completed in May 13, 2010 which contained preliminary bank stabilization design and summaries of the H&H analysis performed for Napa Creek within and adjacent to the project limits (see Appendix I:1). The downstream bypass inlet was later modified by the Lower Bypass Inlet Study performed by Northwest Hydraulic Consultants (see Appendix I:2).

#### **4.8.2 Projects outside Downtown Napa**

Sites 1A, 1B and 2E all increase conveyance and excavating channel banks to form flood conveyance terraces. Dikes constructed in Sites 1A and 1B match pre-project dike elevations and do not provide additional flood protection.

### **4.9 UNCONSTRUCTED AUTHORIZED FEATURES**

Below is a list of authorized features included in the SGDM which have not been constructed. The unconstructed features have not yet received Congressional appropriations to be added to the existing project. To date a sufficient portion of the project has been completed to qualify as needing an interim operation and maintenance manual.

- Site 2E: Gravity drain structure through Imola levee, floodwalls, pump station, shoreline stabilization and trail on east bank of Napa River, pedestrian bridge over New Tulocay Creek and north levee raise on New Tulocay Creek. (New Tulocay Creek to 3<sup>rd</sup> Street)
- Site 2W: Floodwalls, pump station, detention basin, shoreline stabilization, and trail on right bank of Napa River. (500 feet south of Imola Avenue to Hatt Building)
- Site 3W: Floodwalls/levees north of the Oxbow, bank stabilization, detention basin, and a combination maintenance road/recreation trail to Trancas Street. A pump station located just north of the bypass floodwalls between Soscol Ave and the Railroad tracks.
- Site 3W: completion of gaps in the Dry Bypass floodwall (see Appendix I:3)
- Throughout the Project: Planned 6-inch to 72-inch reinforced concrete drainage pipes (note Table 17-1 of the SGDM).

## **4.10 USACE LEVEE SAFETY PROGRAM & LEVEE INSPECTION SYSTEM (LIS)**

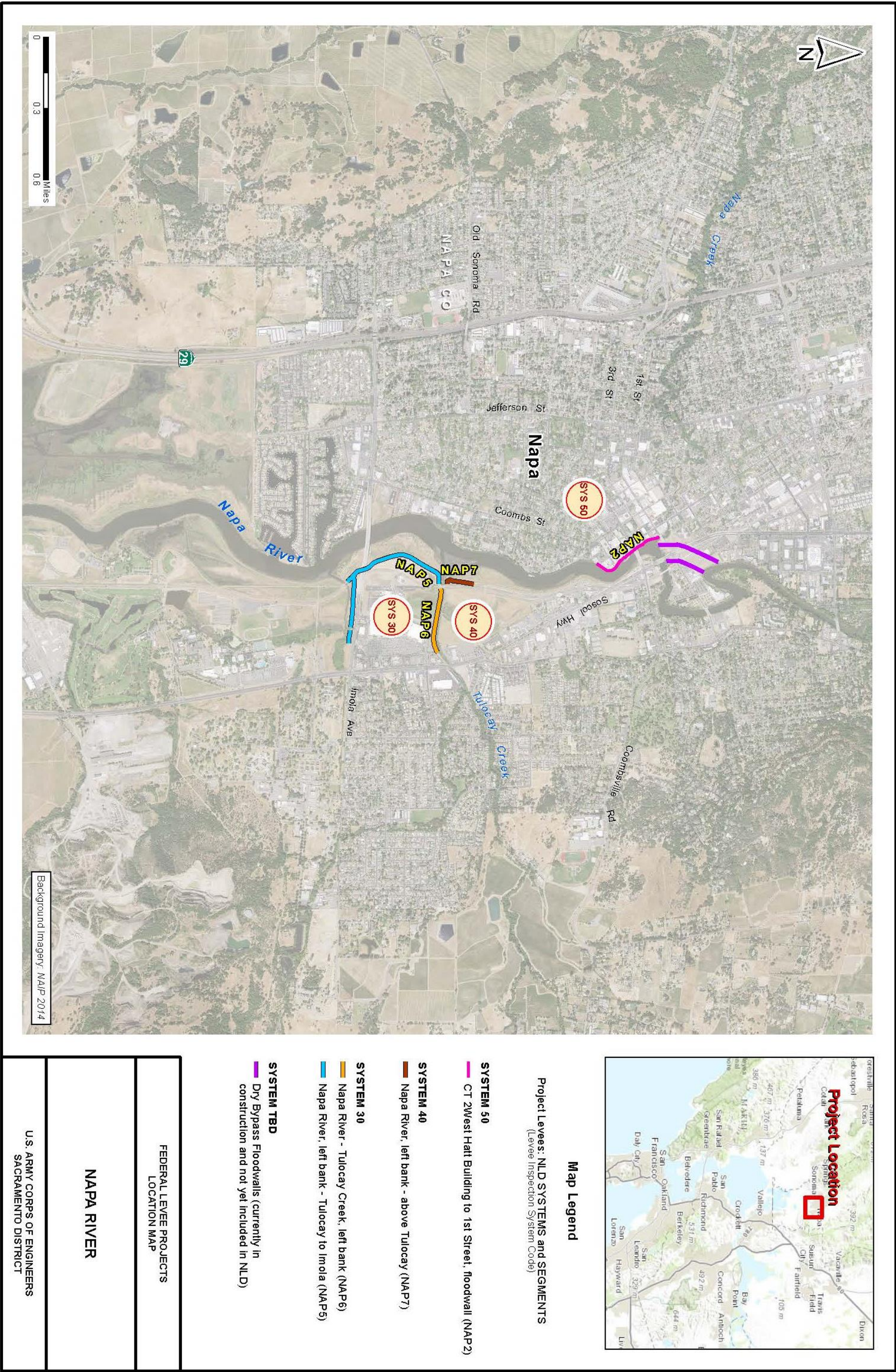
### **4.10.1 Project, System, and Segment Delineations**

For purposes of the USACE Levee Safety Program, flood damage reduction features, such as levees and floodwalls, are divided into projects, systems, and segments as defined below.

- **Project:** A project is made up of one or more flood damage reduction systems that were constructed under the same authorization.
- **Segment:** A segment is defined as a discrete portion of a flood damage reduction system that is operated and maintained by a single entity. A segment can be made up of one or more features, including levee embankments, floodwalls, channels, pump stations, closure structures etc.
- **System:** A system is made up of one or more segments that collectively provide flood damage reduction to a defined area. Failure of one segment within a system constitutes failure of the entire system. Failure of one system does not affect another system.

USACE Periodic and Routine Inspections are done by segment. Each segment has a four-character Levee Inspection System (LIS) code assigned to it. See **Figure 4-1**.





**Figure 4-1: Napa Levee Safety System and Levee Inspection Program Map**



#### **4.11 FLOOD HISTORY**

Almost all of the land adjacent to the Napa River through the city of Napa is subject to flooding. Numerous damaging floods have been recorded since 1862 on the Napa River. Seven major floods occurred between 1862 and 1900. The 15 most recent serious floods occurred in 1942, 1943, 1955, 1962, 1963, 1965, 1967, 1973, 1978, 1982, 1983, 1986, 1995, 1997, and 2005. The February 1986 flood was estimated to have been a 35-year event. The flood resulted in 3 people dead, 27 injured, 5,000 evacuations, 250 homes destroyed, and another 2,500 residences damaged county wide, totaling \$100 million in damages. The most recent flooding occurred on December 31, 2005.

#### **4.12 MONITORING STATIONS**

Installation, locations and functioning of monitoring stations are included in SECTION 11– Surveillance

**SECTION 5 – CONSTRUCTION HISTORY**



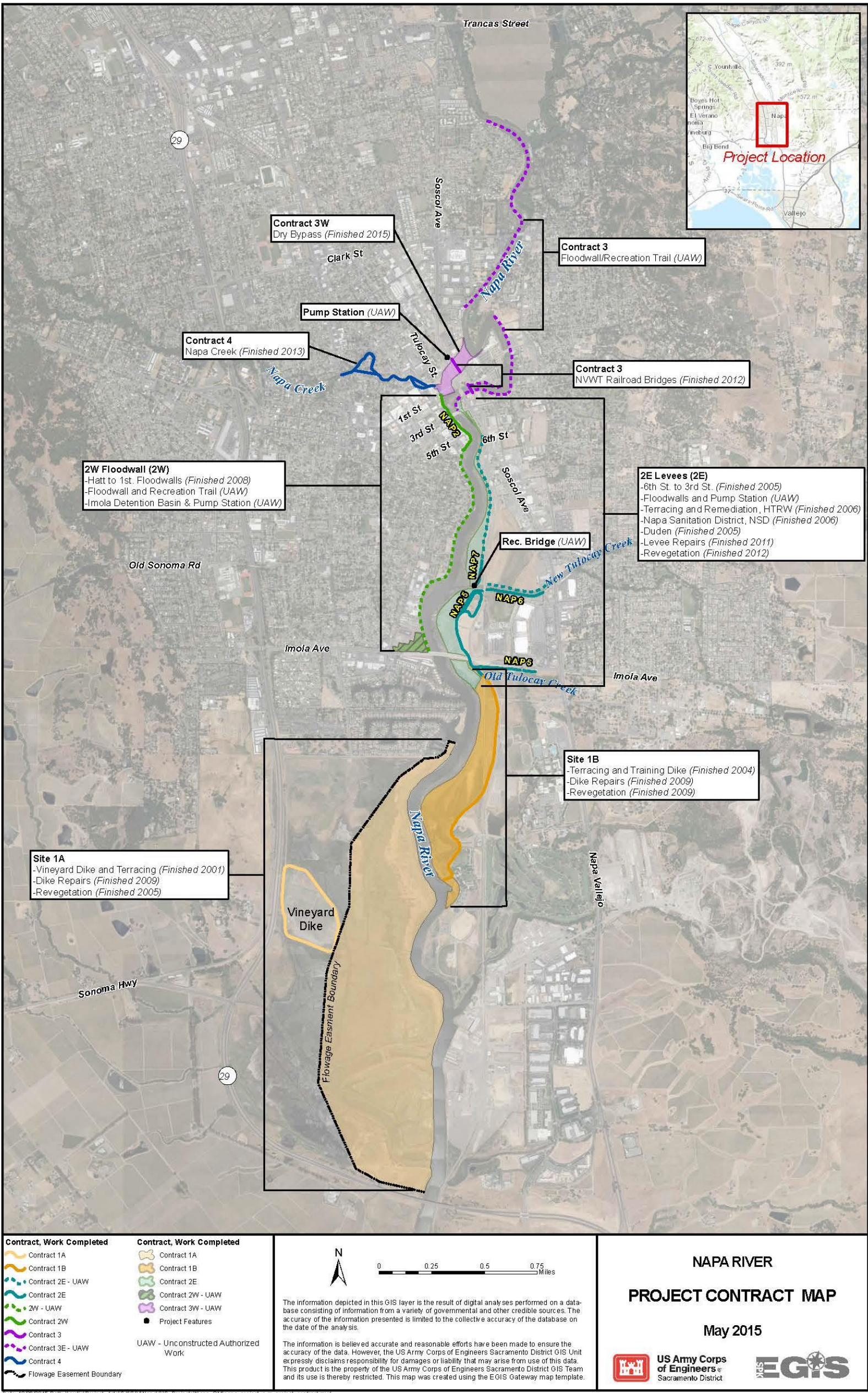


Figure 5-1: Project Site Map



### 5.1 CONSTRUCTION HISTORY

Table 5-1 summarizes the construction history for the project. Table 5-2 identifies all of the revegetation contracts. The USACE, Sacramento District, was responsible for construction of the projects.

### 5.2 CONSTRUCTION CONTRACT SUMMARY

**Table 5-1: Construction Contract Summary**

Contract	Contract Number	Start	Finish	Contract Award Amount	Contract Mods	Total Contract Amount	Contractor	Project Engineer	Resident Engineer	Contracting Officer
1A (HWY 29 to Imola)	DACW05-00-C-0031	Jul 2000	Jan 2001	\$2,717,189	\$243,902	\$2,961,091	S.D. Carmack Dirtmoving PO Box 278 Live Oak, CA 95953	Len Ramsey	Ralph Cameron	Linda Hales
1B	DACW05-03-C-0007	Jun 2003	May 2004	\$2,546,591	\$99,191	\$2,447,400	Mass Ex Const Co. 700 River Street, Suite 1 Santa Cruz, CA 95060	Robert Myers	Greg Schulz	Ronald Schunk
2 East (6 <sup>th</sup> to 3 <sup>rd</sup> )	W91238-04-C-0023	Jul 2004	Sep 2005	\$2,199,553	\$357,433	\$2,556,986	S.D. Carmack Dirtmoving 10460 Live Oak Blvd. Live Oak, CA 95953	Robert Myers	Cathy Wise	Ronald Schunk
2 East (Duden)	W91238-05-C-0012	Mar 2005	Nov 2005	\$2,909,670	\$1,039,937	\$3,949,608	J.A. Gallegos Construction 2412 Foothill Blvd, SPC 64 Calistoga, CA 94515-1233	Robert Myers	Cathy Wise	Ronald Schunk
2 East (NSD)	W91238-05-C-0019	Jun 2005	Oct 2006	\$2,488,565	\$366,584	\$2,855,149	TPA-CKY Joint Venture 302 W. 5 <sup>th</sup> Street #310 San Pedro, CA 94507	Robert Myers	Cathy Wise	Ronald Schunk
2E HTRW Phase I	99-D-0012	Apr 2007	Nov 2007	\$8,443,653.33 (Fed) \$772,256.50 (NF)				Curtis Payton	Floyd Bolton	
2E HTRW Phase II	03-F-0067	Dec 2007	Nov 2007	\$11,780,980.52 (Fed) \$451,126.48 (NF)				Curtis Payton	Floyd Bolton	
2E Repairs	W91238-08-D-0043	Aug 2010	Oct 2010	\$164,000	- \$29,588	\$134,412	North Star Construction and Engineering, Inc. 1282 Stabler Lane, Suite 630-109 Yuba City, CA 95993-2625	Aurelio Gavieres	Cathy Wise	Matthew Hancsarik
2West Floodwall	W91238-05-C-0020	2006	2008	\$19,251,959	\$16,620,177	\$35,872,136	R&L Brosamer, Inc. 333 Camille Avenue Alamo, CA 94507	Robert Myers	Floyd Bolton	Matthew Hancsarik

Contract	Contract Number	Start	Finish	Contract Award Amount	Contract Mods	Total Contract Amount	Contractor	Project Engineer	Resident Engineer	Contracting Officer
Contract 3 - Wine Train Relocation	W91238-08-C-0022	Sep 2008	Jul 2012	\$64,965,826	\$14,046,764	\$79,012,590	Suulutaaq Inc. 4300 B Street, Suite 205 Anchorage, AK 99503	Aurelio Gavieres	Floyd Bolton	Matthew Hancsarik
1A/1B Dike Repairs	W91238-08-D-0043	Sep 2009	Dec 2009	\$539,012	None	\$539,012	North Star Construction and Engineering, Inc. 1282 Stabler Lane #630-109 Yuba, CA 95993	Aurelio Gavieres	Floyd Bolton	Matthew Hancsarik
4 (Napa Creek)	W91238-10-C-0028	July 2010	May 2013	\$14,826,020	\$3,197,941	\$18,241,849	Proven Management Inc. 712 Sansome Street San Francisco, CA 94111	Aurelio Gavieres	Floyd Bolton	Matthew Hancsarik
Contract 3 - Napa River Dry Bypass	W91238-14-C-0002	April 2014	XX	\$16,886,857	\$2,016,400	\$18,903,257	Nordic Industries, Inc. 1437 Furneaux Rd; Olivehurst, CA 95961	Aurelio Gavieres	Floyd Bolton	Rachel Rosas

Table 5-2: Revegetation Construction Contract Summary

Contract	Contract Number	Start	Finish	Contract Award Amount	Contract Mods	Total Contract Amount	Contractor	Contracting Officer
1A	DACW05-01-C-0003	Jan 01	Jan 05	\$456,725	\$15,381	\$472,106	Hanford Applied Restoration and Construction 23195 Maffei Road Sonoma, CA 95474	Ronald Schunk
1B	W91238-05-C-0013	Nov 04	Oct 09	\$723,127	\$267,435	\$930,562	Baywood Environmental Services, Inc. 2901 Sir Francis Drake Blvd. Fairfax, CA 94930-1641	Shirley Martin
2	W91238-08-C-0009	Aug 08	Dec 2012	\$887,774	\$125,541	\$1,013,315	SMP SERVICES, INC. SHAWN PETERSON 1911 DOUGLAS BLVD #85-393 ROSEVILLE CA 95661-3714	Gregory Tom

### 5.3 SUMMARY OF COMPLETED PROJECTS

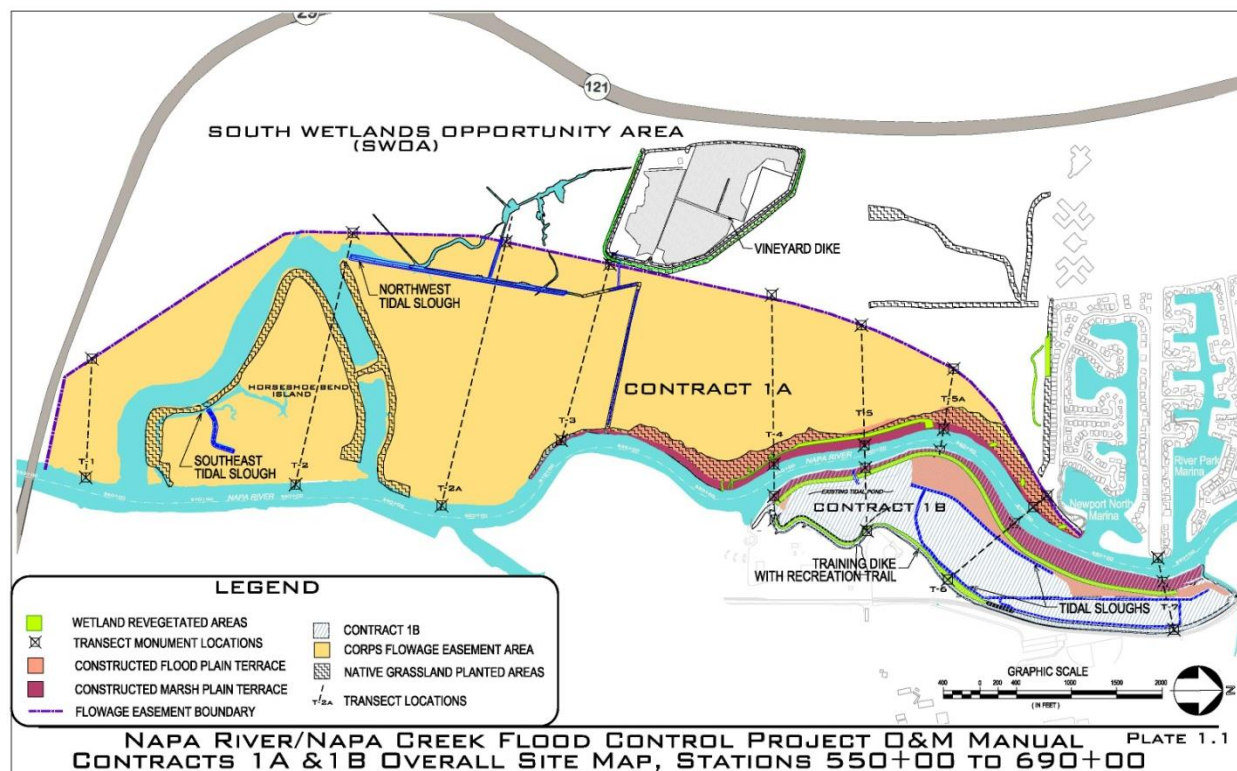
#### 5.3.1 Contract 1A

Site 1A consisted of excavating marsh and floodplains, lowering of river banks, breaching of the river bank dikes in two locations and construction of a circular non FEMA certified Vineyard Dike to protect an existing vineyard from tidal flows caused by breaching the river banks. The Vineyard Dike includes an interior drainage system to collect local surface runoff collected and discharged through pipes through the dike.

The breached river banks along the existing Horseshoe Bend create the USACE flowage easement area (FEA) as shown in Figure 5-1. Construction of the FEA required removal of two existing flap gates and complete bank removal (breaching) at two locations along the Horseshoe Bend Island channel (an old river oxbow). The 1<sup>st</sup> breach in the dike was a length of about 100 feet on the northwest (outside) bend of the channel. The second breach was on the west side of Horseshoe Bend Island on the southeast bend of the channel, where the dike was breached about 50 feet. See Figure 5-2 for site map.

##### 5.3.1.1 Site 1A - Revegetation Contract

Site 1A area was planted in the fall 2001 and had a 3-year establishment period. The project included 56 acres of native grass seeding and native plants divided into three different zones corresponding to lower (*Scirpus*, *Typha*, and *Juncus* spp.), middle (*Salicornia* and *Jaumea* spp), and upper (*Distichlis* sp) tidal vegetation zones. 15 gallon trees were installed adjacent to the marina on the northeast corner of the project adjacent to the marina (see Appendix A:3 for as-built drawings). The wetland revegetation and native grassland plantings will provide additional stability and erosion control on the berm and dike structures. Refer to Figure 5-2 for locations.



**Figure 5-2: Site 1A & 1B Site Map****5.3.2 Site 1B**

The Training Dike in the Site 1B area includes a waterside Planting Berm between approximate Napa River Stations 636+00 and 674+00 (Dike Stations 0+00 and 33+00). Small trees and shrubs were planted on the Planting Berm. An old tidal pond on the south end of the site (Napa River Station 637+00), which was previously diked and isolated from tidal fluctuation, was restored by removing the flap gate and breaching the dike.

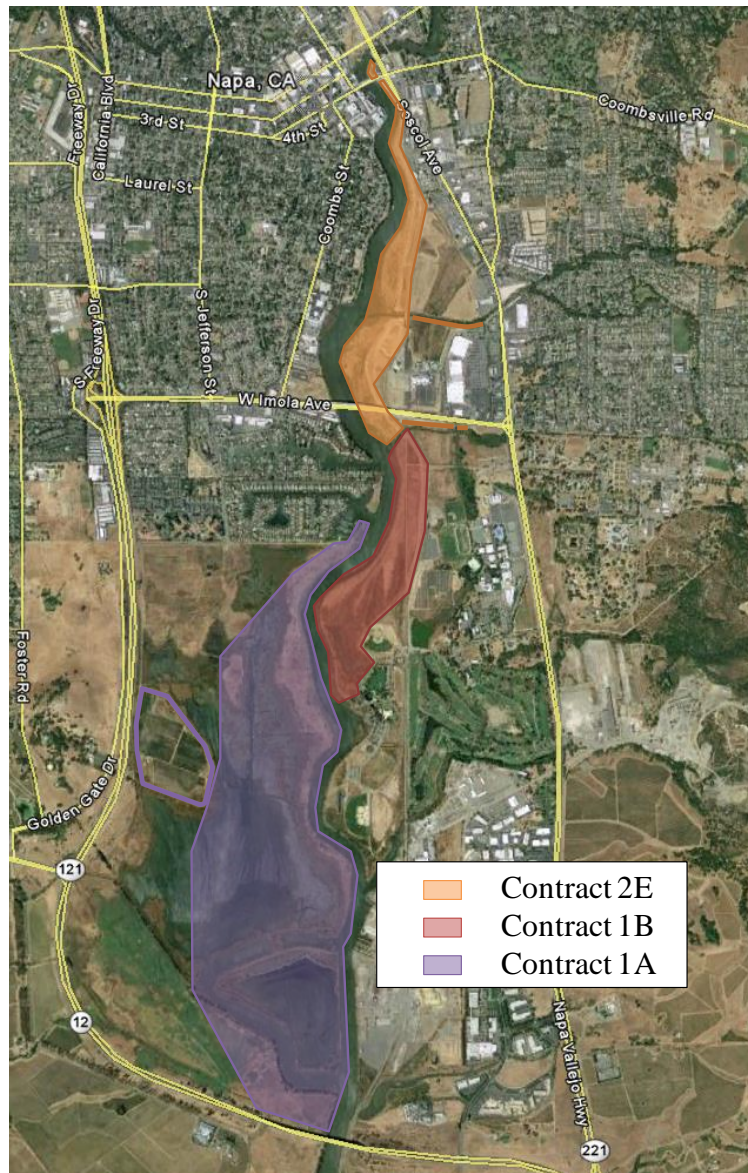
**5.3.2.1 Site 1B - Revegetation Contract**

Site 1B revegetation contract began plant installation in the spring of 2005 which was completed in June of 2005. The contract originally had a 3-year establishment period but was extended by 1.5 years ending in October 2009. The project included plantings in the marsh zone, riparian zone and upland zone. The wetland revegetation and native grassland plantings will provide additional stability and erosion control on the berm and dike structures. Refer to Figure 5-2 for locations.

**5.3.3 Site 1A & 1B Repair Work**

The Vineyard Dike in the Site 1A area and the Training Dike in the Site 1B area were repaired in 2009. The Vineyard Dike work consisted of filling rodent holes with cement/bentonite grout, adding aggregate base course to a vehicle rut on the crest, and repairing a crack in the waterside slope near the dike crest.

The Training Dike overtopped at several locations during the flood event of 2005/2006. The overtopping resulted in erosion of the landside dike slope between Dike Stations 26+50 and 32+50. The erosion was repaired in 2009 by rebuilding the landside portion of the embankment with compacted levee fill, installing an anchored HPTRM on the landside slope to prevent future erosion, seeding the rebuilt landside slope with native grasses, and replacing the aggregate base and pavement on the landside portion of the crest. Additional work on the Training Dike included filling rodent holes with cement/bentonite grout, sealing cracks in the crest road pavement and pavement overlay in two areas which had a high concentration of pavement cracks.



**Figure 5-3: Projects outside Downtown Napa**

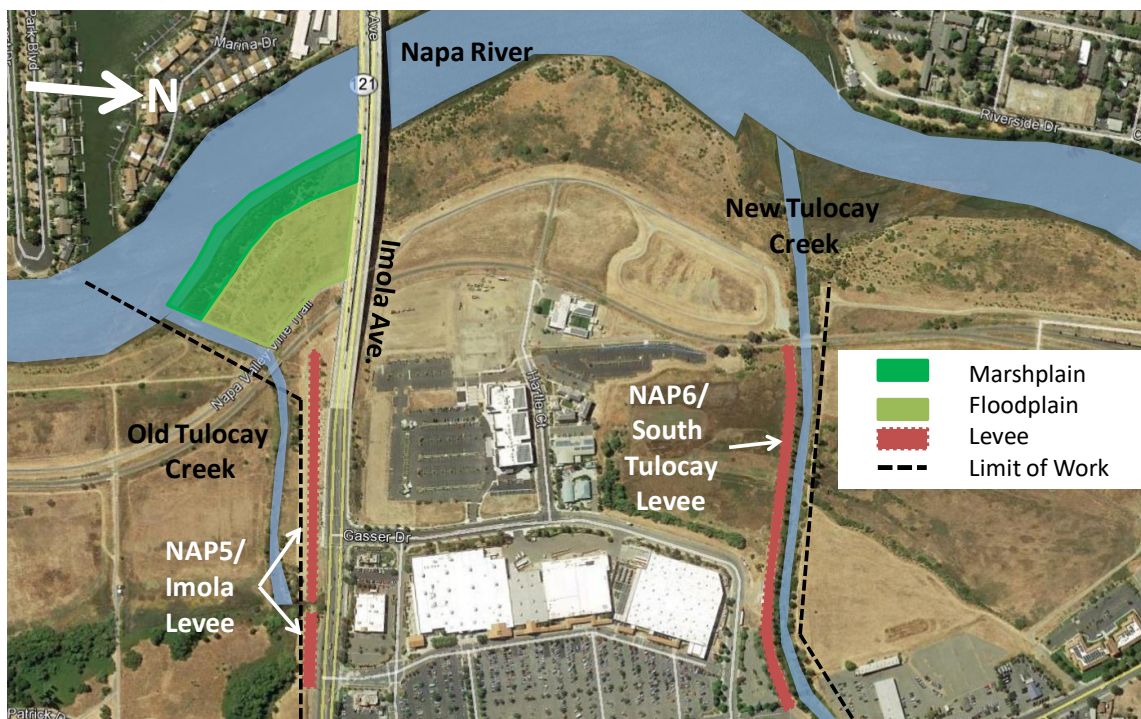
#### **5.3.4 Site 2E**

The Site 2 East River work has been broken into four separate contracts beginning at Old Tulocay Creek and ending at the crossing of Soscol Ave and Napa River. The following contracts are listed from downstream to upstream along Napa River. In some cases the contracts overlap.

- Duden
- Napa Sanitation District (NSD)
- Terracing & Remediation
- 6<sup>th</sup> to 3<sup>rd</sup> Street



### 5.3.4.1 Site 2E: Duden – Old Tulocay Creek to Imola Ave



**Figure 5-4: Site 2E - Duden Construction Features**

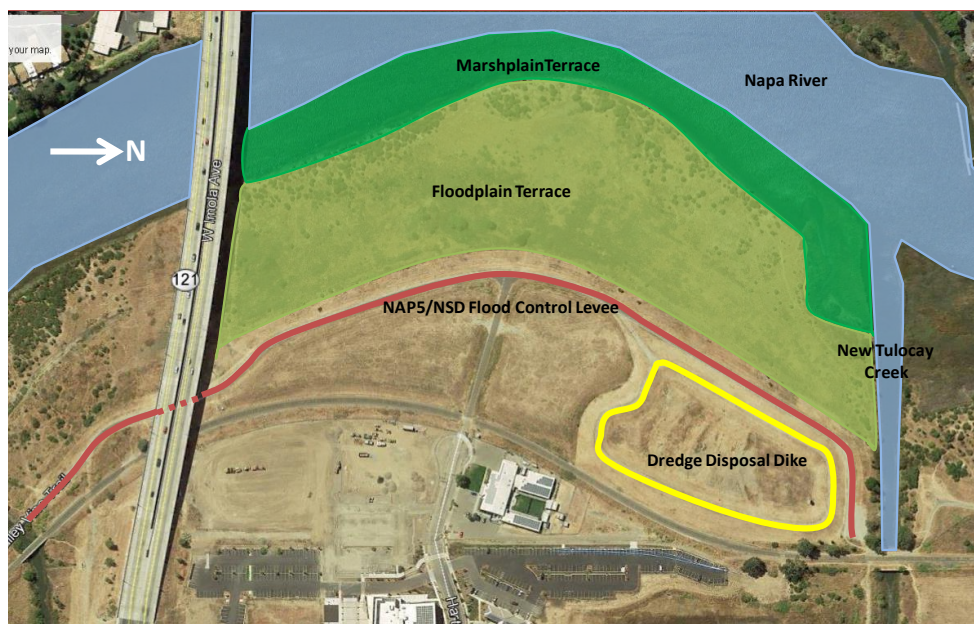
The Duden section included marshplain and floodplain terracing between Old Tulocay Creek to Imola Avenue (Napa River Station 688+00 to 700+00). The SGDM had originally identified this reach to be in the Site 1B area, but the contract, storm water pollution prevention plan, and other USACE documents placed this reach in the Site 2E area. Additionally, construction of approximately 0.25 miles of levee south of Imola Ave and the raising of the levee south of New Tulocay Creek, shown as Imola Levee and South Tulocay Levee, respectively, see Figure 5-4, was performed as part of the Site 2E Duden Contract.

Site 2E repair contract was required to correct general maintenance items. The work included repair to an erosion gully on the NAP7 Levee, filling rodent holes in Imola Levee and installation of various survey markers. See Appendix A:9 and Appendix A:10 for plans and specifications and Appendix A:26 for as built drawings.

### 5.3.4.2 Site 2E: NSD – Imola Ave to New Tulocay Creek

Figure 5-5 shows the construction area of Site 2E-NSD which included marshplain and floodplain terracing between Imola Avenue to New Tulocay Creek (Napa River Station 700+00 to 725+00) and construction of a dredge disposal dike. A 0.35 mile long flood control levee and paved recreation/maintenance trail was constructed east of the floodplain terrace and west of the dredge disposal dike. This levee extends past (south) Imola Ave an additional 500 feet to Old Tulocay Creek and connects with the pedestrian bridge construction in Site 1B. See Appendix A:11 and Appendix A:12 for additional construction details.



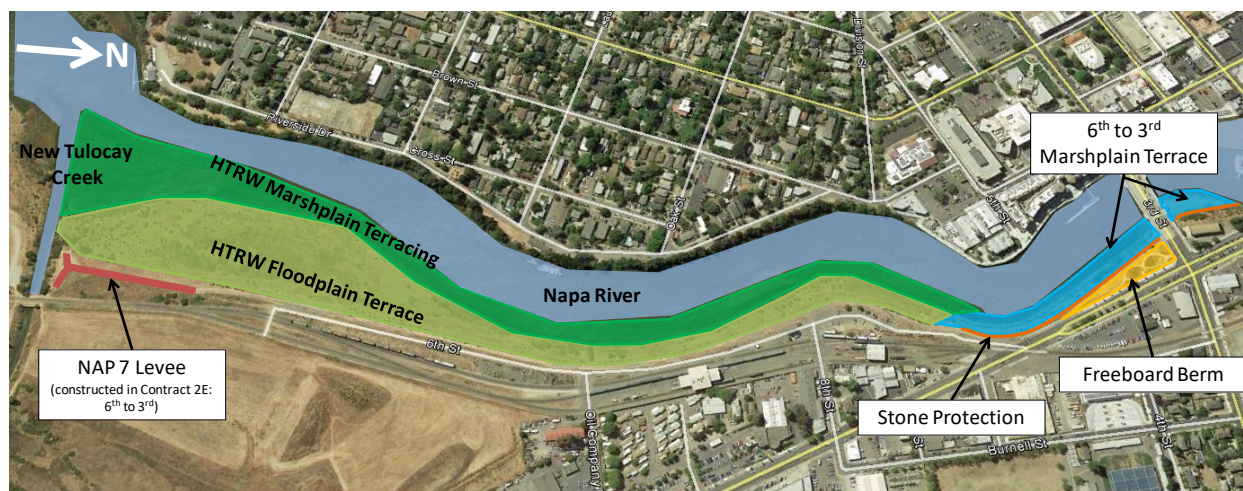


**Figure 5-5: Site 2E - NSD Construction Features**

#### 5.3.4.3 Site 2E: Remediation & Terracing (Phase I & II)

This work included cleanup of contaminated soil (Hazardous, Toxic and Radioactive Waste (HTRW)) from New Tulocay Creek north to 7<sup>th</sup> Street including the Oil Company Road area. In June 2001, CA RWQCB approved the Site Cleanup Requirements and Remedial Action Plan. In summer of 2002, Phase I of the cleanup began on the half-mile long contaminated stretch of riverbank, and Phase II began in the fall of 2003 which continued cleanup efforts and included east bank terracing between New Tulocay Creek and 7<sup>th</sup> Street (see Figure 5-6). Although as-built plans, construction plans and specifications are not available for this reach, original construction plans are included.

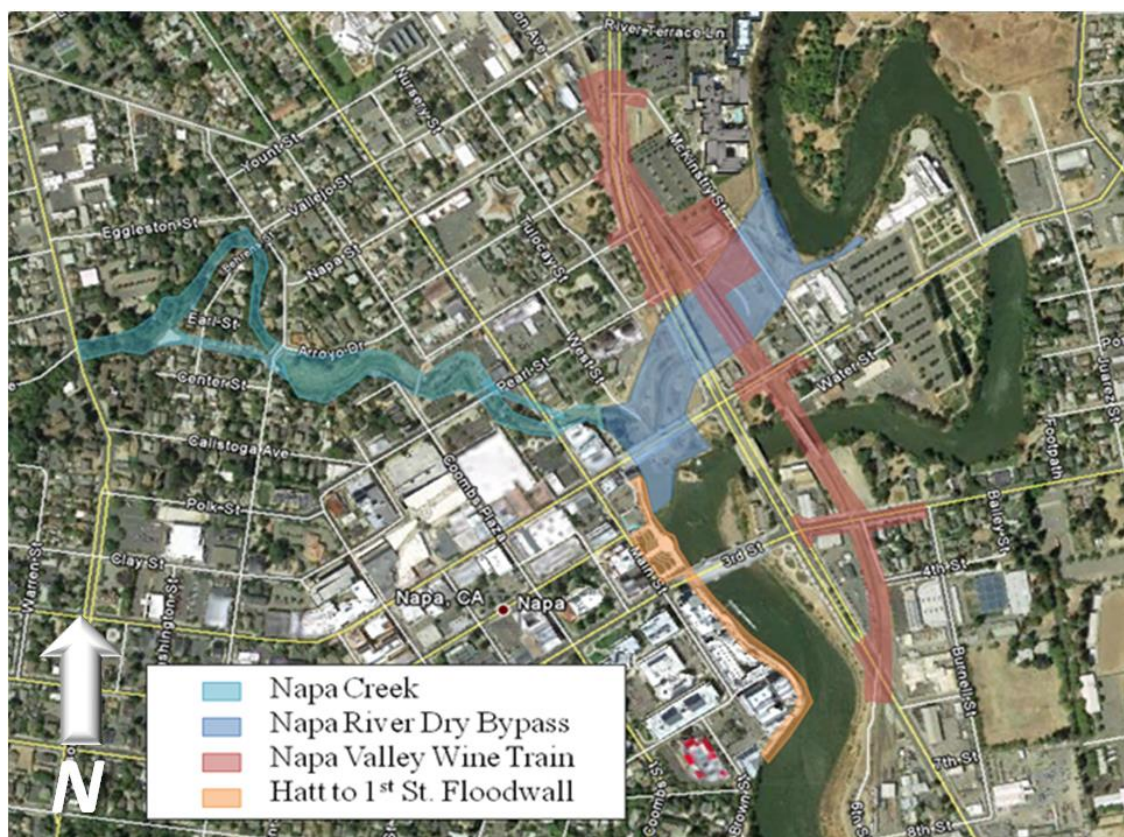
The California RWQCB required installation of groundwater monitoring wells which were installed at the direction of USACE SPK staff. The wells were turned over to the sponsor on August 22, 2012 (see transfer letter in Appendix C:2).





**Figure 5-6: Site 2E - 6<sup>th</sup> to 3<sup>rd</sup> and Terracing & Remediation****5.3.4.4 Site 2E: 6<sup>th</sup> to 3<sup>rd</sup> Street**

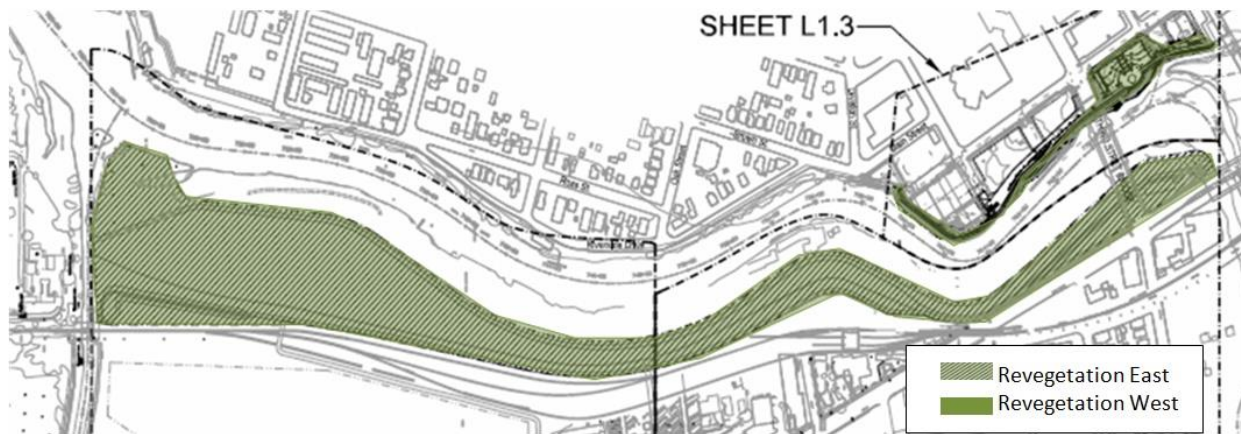
The 6<sup>th</sup> to 3<sup>rd</sup> Street Contract included marshplain terracing and construction of a freeboard berm near 3<sup>rd</sup> Street along the eastern river bank. Stone erosion protection and plantings within the stone protection were provided along the river along Napa River's eastern side slope which follows Soscol Avenue from 6<sup>th</sup> street to approximately 250 feet north of 3<sup>rd</sup> Street. Further south along Napa River, this contract included construction of a 700 foot flood control levee beginning on the north side of New Tulocay Creek. See Figure 5-6. Construction plans and specifications are available in Appendix A:13 and Appendix A:14, respectively. Although as-built plans, construction plans and specifications are not available for this reach, original construction plans are included.

**Figure 5-7: Projects within Downtown Napa****5.3.5 Site 2W – Hatt to 1<sup>st</sup> Street Floodwall**

Site 2W included construction of 2,700 feet of floodwall and promenade, Veterans Park and marshplain terrace covered with stone protection from approximately the Hatt Building on Main Street and 5<sup>th</sup> to 1<sup>st</sup> Streets. Two lighting system were included in the Promenade Area between 5<sup>th</sup> and 3<sup>rd</sup> Streets and Veterans Park. The removable stoplogs are stored within a locked structure within Veterans Park. The trigger for when to install the stop logs are in Section 9.3.7, Step 2. As-builts are available in Appendix A:15 and Appendix A:16.

### 5.3.6 Site 2 – Revegetation Contract

Work began in August 2008 in the Site 2 Revegetation Area on both east and west sides of Napa River as shown in Figure 5-8. Work included shoreline planting of water emergent plants, with areas of riparian, and upland plantings and installation of irrigation. The floodplain terrace was seeded with California native grasses. The grassland area located in between the upland and riparian zones was mowed a couple of times per year and sprayed with herbicides to control weeds. See Appendix A:17 to Appendix A:19 for construction plan, irrigation as built and specifications.



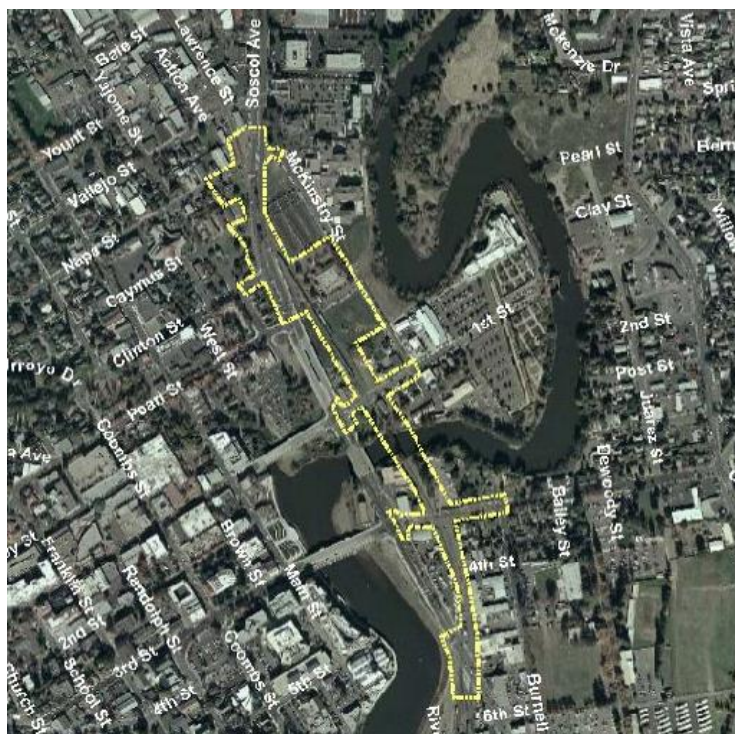
**Figure 5-8: Site 2 Revegetation Area**

### 5.3.7 Site 3 – Napa Valley Wine Train (NVWT) Relocation Project

This work included replacing the existing Napa River Railroad Bridge with a new two-track railroad bridge and the construction of a similar bridge over the future Dry Bypass Channel see Figure 5-9. Floodwalls were constructed around the NVWT Depot Building. Train tracks required realignment and the following city streets were affected (see Appendix A:22 and Appendix A:23):

- Soscol Avenue near 6<sup>th</sup> Street: Minor grade change and addition of railroad crossing panels.
- 3<sup>rd</sup> Street between Soscol Avenue and Burnell Street: 3 foot increase in grade at railroad tracks, addition of retaining walls, new utilities, new pavement.
- Lawrence Street between 3<sup>rd</sup> and 4<sup>th</sup> Streets: 2.5 foot increase in grade at 3<sup>rd</sup> Street, addition of retaining wall, new utilities, new pavement.
- Water Street adjacent to the railroad tracks: Street shortened to accommodate new track alignment.
- 1<sup>st</sup> Street between Soscol Avenue and McKinsty Street: 6 foot increase in grade at railroad tracks, addition of retaining walls, new utilities, new pavement.
- Soscol Avenue between Clinton and Napa Streets: 4 foot increase in grade change at railroad tracks, addition of retaining walls, new utilities, new pavement.
- Napa Street at Soscol Avenue: connection to Soscol Avenue closed and turned into a cul-de-sac.





**Figure 5-9: NVWT Construction Limits**

#### **5.3.8 Site 3 – Dry Bypass**

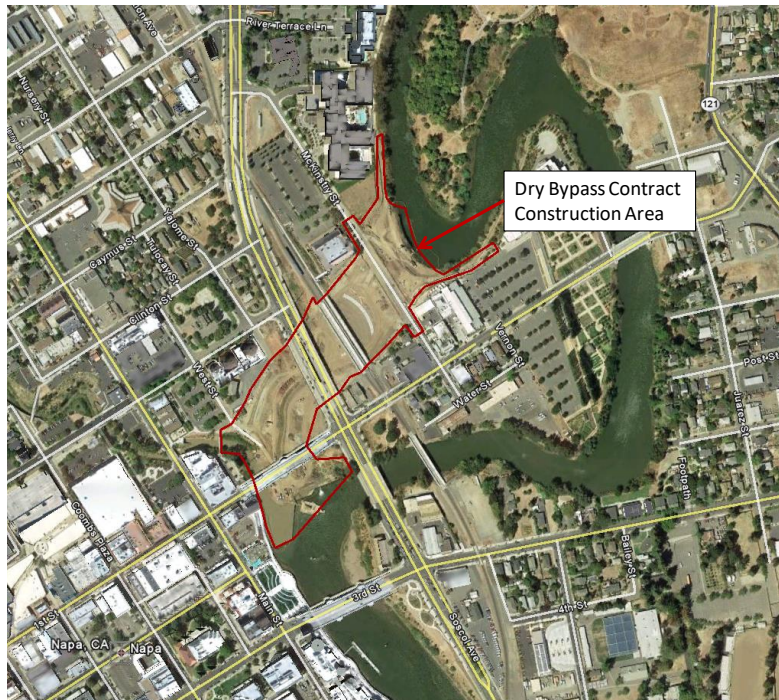
The Dry Bypass project consists of a 1,300 foot long flood channel which is between 200 and 300 feet wide and crosses below 1<sup>st</sup> Street, Soscol Avenue and NVWT Dry Bypass Bridge. To provide the proper flood protection McKinstry Street was lowered and reconstructed with floodgates which tie into floodwalls which were constructed on either side of the channel. A low flow channel was included to convey street flooding from the northern bank and allows the conveyance of local rainfall without flooding the entire bypass. Anything within the channel excluding the bridge piers is subject to damage when the bypass conveys flood flows. The pre-cast concrete culvert has removable railings added as a safety feature.

The modeling studies conducted prior to the design of the bypass indicated that the lack of interior drainage for the community once the bypass was constructed could not be addressed until a pump station was constructed to pump the interior flooding. Interior flooding is the occurrence of local floodwaters attempting to flow to the bypass and drain into Napa River. With the floodwalls in place the local drainage backs up against the floodwalls and creates a flooding issue for the community. Because a pump station was not a part of the funding for the design and construction, in order to avoid interior drainage issues, the northern portion of the floodwall was constructed with two gaps in them in order to allow interior drainage to pass into the bypass. Future design and construction work is intended to design and construct a pump station for the northern portion of the floodwall area and then close the gaps which remain in the floodwall.

The bypass is not a concrete lined channel and thus relies on various types of vegetation and turf reinforced matting (HPTRM) to secure the channel lining and prevent scour. Therefore, the vegetation is more than an aesthetic appeal and acts as a structural component along with the HPTRM to hold the channel in place. These structural components along with the irrigation system must be kept in working order for full functionality.

The inlet and outlet of the bypass are rock shaped/lined for maximum erosion protection. The inlet and outlet areas will require yearly inspection and should be inspected for rock displacement following any storm events where the bypass conveyed runoff.

Within the bypass are various concrete pathways that aid visitors to either get across the bypass or traverse within it for recreation purposes. Besides its practical appear, the pathways also serve as a structural component to the channel invert. Any damage beyond minor cracks should be repaired in order to maintain the structural integrity of the channel. See Figure 5-10, Figure 5-11, Appendix A:20 and Appendix A:21 for the project area, as built and specifications, respectively. See SECTION 10 – Maintenance and Inspection for more details on maintenance for the bypass. See Section 9.3.7 for when to begin to take action to close the bypass prior to a flood event.



**Figure 5-10: Site 3: Dry Bypass Project Limits**

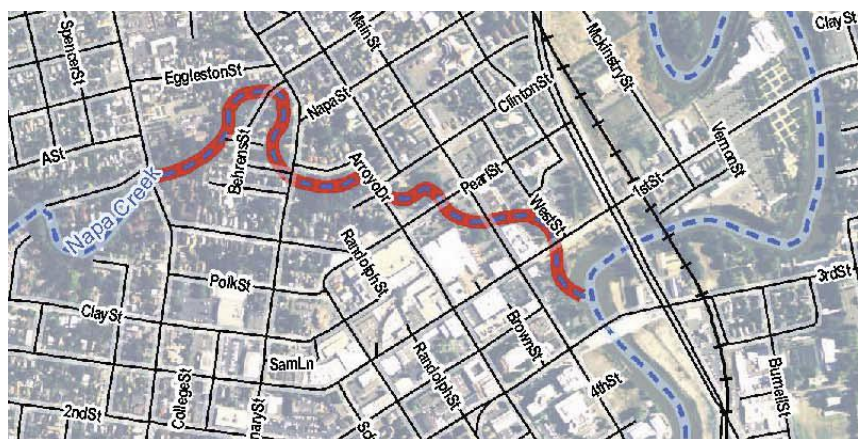




**Figure 5-11: Site 3: Dry Bypass Project Features**

### 5.3.9 Site 4 – Napa Creek

Figure 5-12 shows Napa Creek Project area included work along the Creek beginning at the Napa River confluence and continued upstream just before the Jefferson Street Bridge. The work included excavation for a vegetated floodplain terrace on the north bank, installation of two bypass culverts, bank stabilization features, bioengineered structures and installation of irrigation system. See Appendix A:24 and Appendix A:25 for contract as-builts.



**Figure 5-12: Site 4 - Napa Creek Project Area**



### **5.3.10 Post Closure Contingency Monitoring of Former HTRW Residual Soil Left in Place**

The Final Post Remedial Action Monitoring Plan (MWH, July 2003) specified monitoring activities required to be performed following the completion of the Marsh and Flood Plain terracing in Contract 2 East to evaluate the sufficiency of remedial actions completed according to the Consolidated Remedial Action Plan (MWH, 2001) and in accordance with California RWQCB Order No. 01-066 (RWQCB, June 2001). All groundwater monitoring required by the Final Post Remedial Action Monitoring Plan has been completed and the RWQCB approved the Request for Closure Report dated March 28, 2016 submitted by the Napa County Flood Control and Water Conservation District in a letter dated March 14, 2017, and required the Flood District to prepare a Post-Construction Contingency Plan to address the potential for exposure of residual soil contamination at depth located in certain defined areas of the Contract 2 East Marsh and Flood Plain.

The District's Post Closure Contingency Plan will be based upon Corps of Engineers surveyed Cross Sections 10A and 10B (See Appendix G Survey Documents) that were located based upon the presence of subsurface soils that did not meet the soil cleanup levels specified in RWQCB Order 01-066. The District is responsible to continue to monitor these locations for visual signs of erosion during Annual inspections. If evidence of erosion is noted, a survey will be conducted to measure the erosion and compare to the Corps surveyed Cross Sections established in 2007 and the results of the survey will be included in the monitoring report with an analyses of whether the subsurface residual soils exceeding the cleanup levels are at risk of exposure.

The District shall avoid soil excavation in the areas where these residual soils are present. If any such excavation is necessary, a work plan shall be prepared for RWQCB approval. The Work Plan shall outline appropriate measures for evaluation of the presence of residual contamination and soil handling and disposal.

## **5.4 SUMMARY OF ADDITIONAL FEATURES REQUIRING MAINTENANCE**

The additional features listed below should be considered for maintenance purposes:

- Napa River Railroad Bridge: Napa Valley Railroad will own the superstructure (bridge deck and all rail appurtenances), while FCD will own the substructure (bridge piers and foundation). This work was constructed during the NVWT Construction and the manual has been turned over to the FCD.
- Napa Bypass Railroad Bridge: The Napa Valley Wine Train owns the tracks and attachments which FCD owns the bridge and substructure. This work was constructed during the NVWT Construction and the manual has been turned over to the FCD.
- The South Wetland Opportunity Area (SWOA) consisting of the "west overbank lands" referred to in the SGDM was purchased by the sponsor. The FCD is responsible for operation and maintenance of the area.

## SECTION 6 – PROJECT PERFORMANCE

### 6.1 INTRODUCTION

This section describes the protection provided by the various features of the project. The prime objective of maintaining the project features is protection of the project benefits. This section describes the benefits provided by the flood damage risk reduction and recreation features of the project. It also discusses the consequences of flood conditions exceeding the project design and the mitigation and benefits related to cultural resources, environment, and recreation.

### 6.2 PROJECT MODELS

The following hydraulic models have been developed for the analysis and design of flood risk reduction features for Napa River and Napa Creek:

- (1) Without-project condition HEC-RAS 1D model for Napa River
- (2) Without-project condition HEC-RAS 1D model for Napa Creek
- (3) Interim Condition HEC-RAS 1D model for Napa River
- (4) With-project condition HEC-RAS 1D model for Napa River
- (5) With-project condition HEC-RAS 1D model for Napa Creek
- (6) With-project 2D FESWMS model for Napa River

The Napa River HEC-RAS 1D model domain extends along Napa River from RS 686+00 at River Park Marina to RS 916+60 at Trancas Street. The Napa Creek HEC-RAS 1D model domain extends along Napa Creek from RS 410 just upstream of the confluence with the Napa River to RS 5394 in Napa Creek. The 2D FESWMS model domain extends along Napa River from RS 754+00 near Riverside Drive to RS 849+00 below Lincoln Avenue Bridge.

The interim HEC-RAS model for Napa River has been developed to represent the interim project condition which include project components shown in Table 6-1.

**Table 6-1: Project Components Included in Interim Condition HEC-RAS 1D Model**

Project Component	Status	Included in Interim Condition
<b>BRIDGE</b>		
Napa River		
<i>Maxwell (Imola Avenue) Bridge</i>	Completed	Yes
<i>Third Street Bridge</i>	Completed	Yes
<i>Napa Valley Wine Train Bridge</i>	Completed	Yes
<i>First Street Bridge</i>	Completed	Yes
Oxbow Bypass		
<i>First Street Bridge</i>	Completed	Yes
<i>Soscol Avenue Bridge</i>	Completed	Yes
<i>Napa Valley Wine Train Bridge</i>	Completed	Yes
<b>OTHER PROJECT COMPONENTS</b>		
<i>All works downstream of Imola Avenue</i>	Completed	Yes
<i>All terracing on Napa River</i>	Completed	Yes

Project Component	Status	Included in Interim Condition
<i>Dry Bypass on Napa River</i>	Completed	Yes
<i>Dry Bypass Right Bank Flood Walls with 2 Gaps(on either side of Soscol Avenue)</i>	Completed	Yes
<i>Dry Bypass Left Bank Flood Walls</i>	Completed	Yes
<i>All other works on Napa River upstream of Napa Creek confluence</i>	To be studied	No
<i>All three pump stations for interior drainage</i>	To be studied	No

It should be noted that the hydraulic condition in the vicinity of the oxbow and dry bypass is predominantly 2-dimensional flow. A 2D FESWMS model was therefore developed for the with-project condition for the design of the oxbow and dry bypass portions of the project at a time when 2D hydraulic computation features were not available in HEC-RAS.

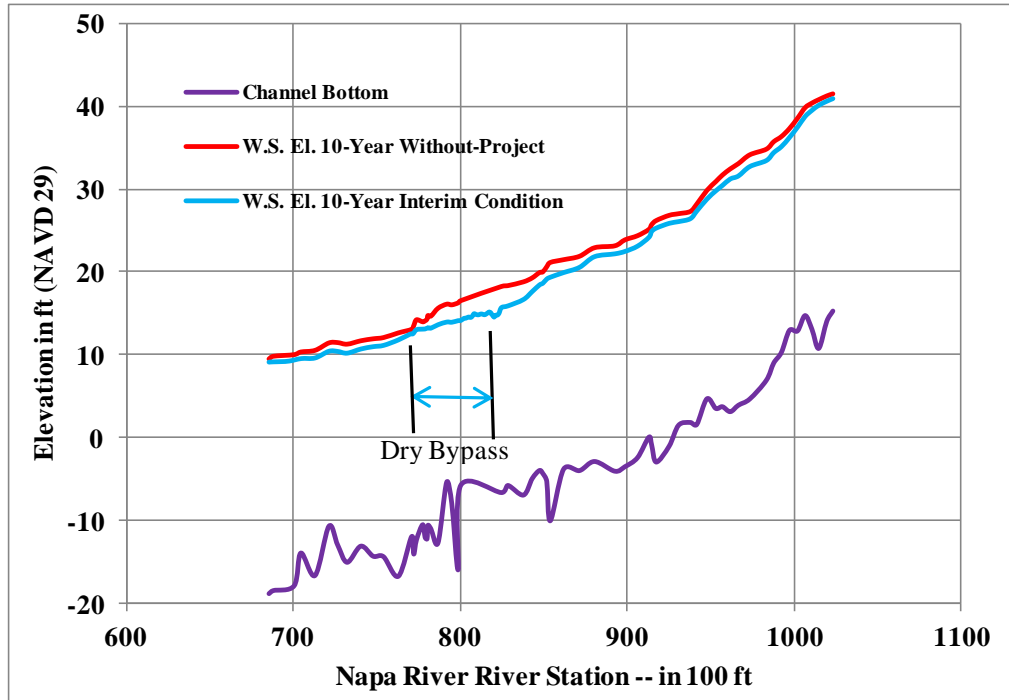
HEC-RAS 1D2D Version 5.1 has been officially released for use. It is recommended that a HEC-RAS 1D2D model for the with project condition be developed by FCD. The HEC-RAS 1D2D model should be calibrated with the results of the FEWSWMS before being adopted as the baseline hydraulic model for the completed fully-built Napa project. This model shall be utilized by the FCD as a tool to perform performance based maintenance and monitoring of the project, see SECTION 11– Surveillance.

### 6.3 PROJECT PERFORMANCE

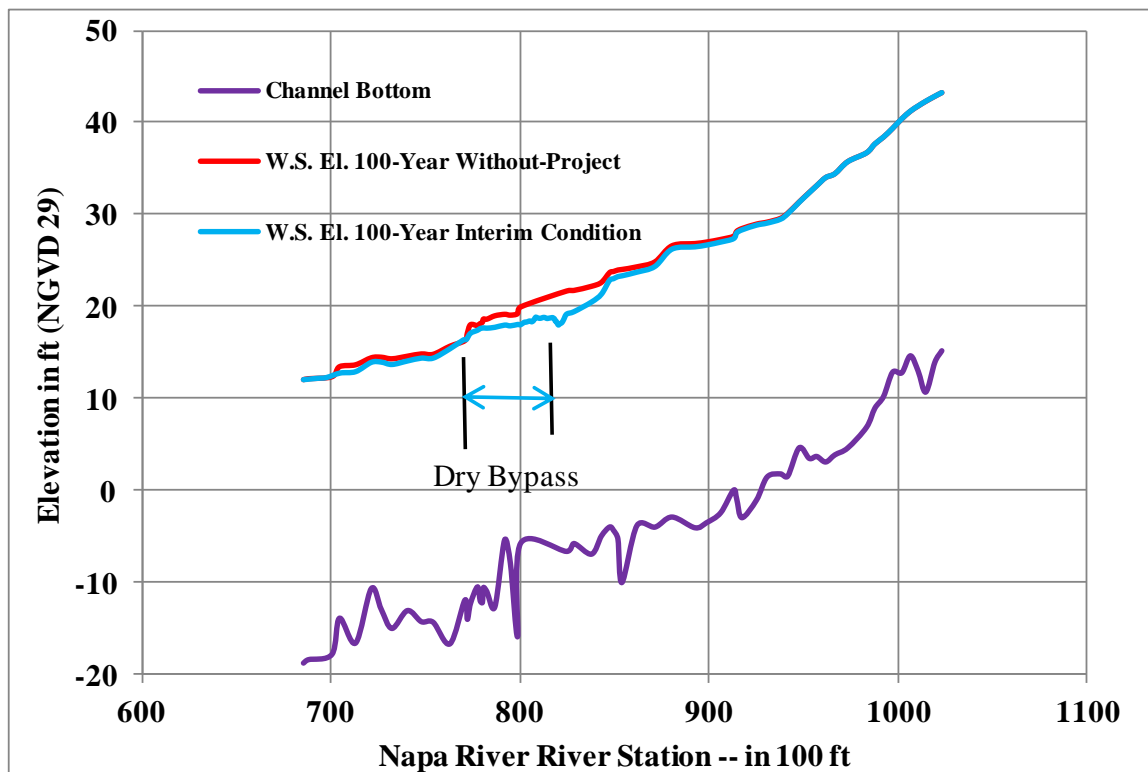
#### 6.3.1 Interim Project Performance (Napa River) and With-Project Performance (Napa Creek)

For both Napa River and Napa Creek, the performance of the project can best be illustrated by the comparison of the water surface profiles of the without-project condition and the current project condition. The current project condition for Napa River is the interim condition. The Napa Creek project is in the fully-built completed condition.

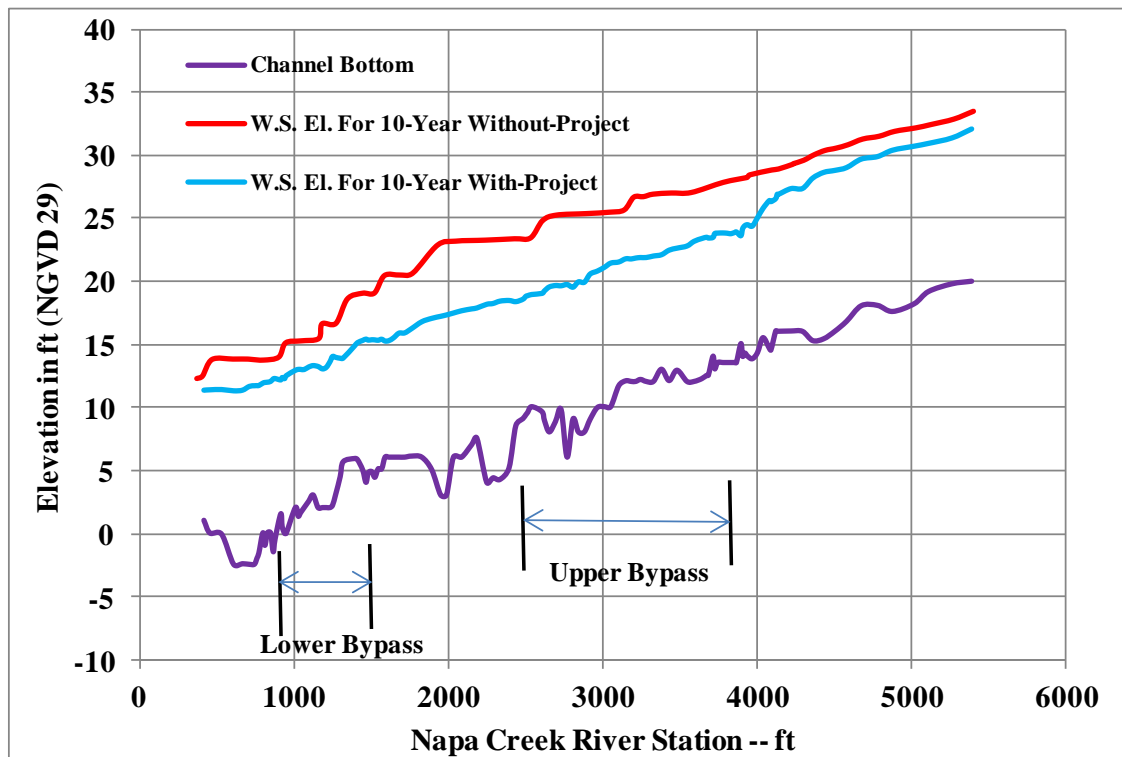
Figure 6-1 through Figure 6-4 depict the lowering of the water surface profiles in the Napa River and Napa Creek for the 1/10 and 1/100 ACE flood events as a result of the construction of flood reduction features.



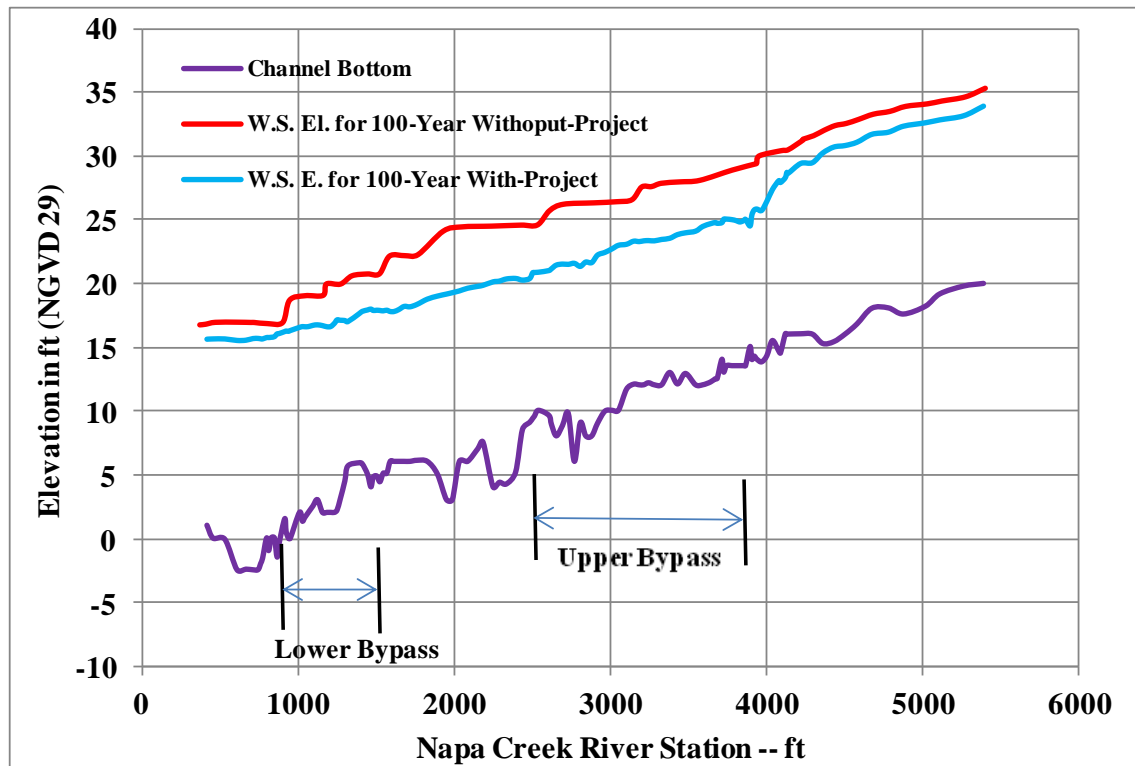
**Figure 6-1: Napa River Water Surface Profile Comparison of Without-Project & Interim-Conditions for 1/10 ACE Flood Event**



**Figure 6-2: Napa River Water Surface Profile Comparison of Without-Project & Interim-Conditions for 1/100 ACE Flood Event**



**Figure 6-3: Napa Creek Water Surface Profile Comparison of Without-Project & With-Project Conditions for 1/10 ACE Flood Event**



**Figure 6-4: Napa Creek Water Surface Profile Comparison of Without-Project & With-Project Conditions for 1/100 ACE Flood Event**

The increase in conveyance capacity through the installation of bypasses in both Napa River and Napa Creek results in the lowering of water surface profiles in the river channels shown in Figure 6-1 through Figure 6-4. As a consequence, flood risk damages are reduced.

### **6.3.2 Consequence of Flows Exceeding the Interim Condition for Napa River or Design Condition for Napa Creek**

Interim actions taken to reduce inundation risks posed by the Napa River system are needed while longer term solutions are planned and implemented. Figure 6-5 depicts the anticipated breakout points when the flood events exceed the interim condition for Napa River.

- (1) On the right bank upstream of Lincoln Avenue (in the River Pointe area between the Lake Park Levee and Lincoln Avenue): Under Post-Bypass conditions, flow begins to reach the overbank at about the 1/6 Annual Chance Exceedance (ACE) event, but is isolated in the River Pointe area until approximately at the 1/10 ACE event.
- (2) On the left bank within the Oxbow, near Taylor Street: Under Post-Bypass conditions, flow begins to leave the channel at between the 1/10 and 1/15 ACE events, but stays pretty localized until flow reaches the 1/25 to 1/50 ACE events.

Figure 6-6 shows the breakout locations for Napa Creek when the flood events exceed the 1/100 ACE event.



- (1) Flow overtops the north bank approximately 800 ft upstream of Jefferson Street and south of Cedar Avenue for the 3,700 cfs For Napa Creek. The 3,700 cfs flow is between 1/25 and 1/50 ACE events.
- (2) Flow overtops the channel banks near Behrens Street Bridge for the 1/200 event of 4,600 cfs.
- (3) Inundation is localized adjacent to the banks up to the 1/200 ACE event.

Flood conditions may cause additional unanticipated breakout points and the entire system should be monitored during floods (see SECTION 8, SECTION 9, and SECTION 10 for additional information on flood response activities including monitoring).

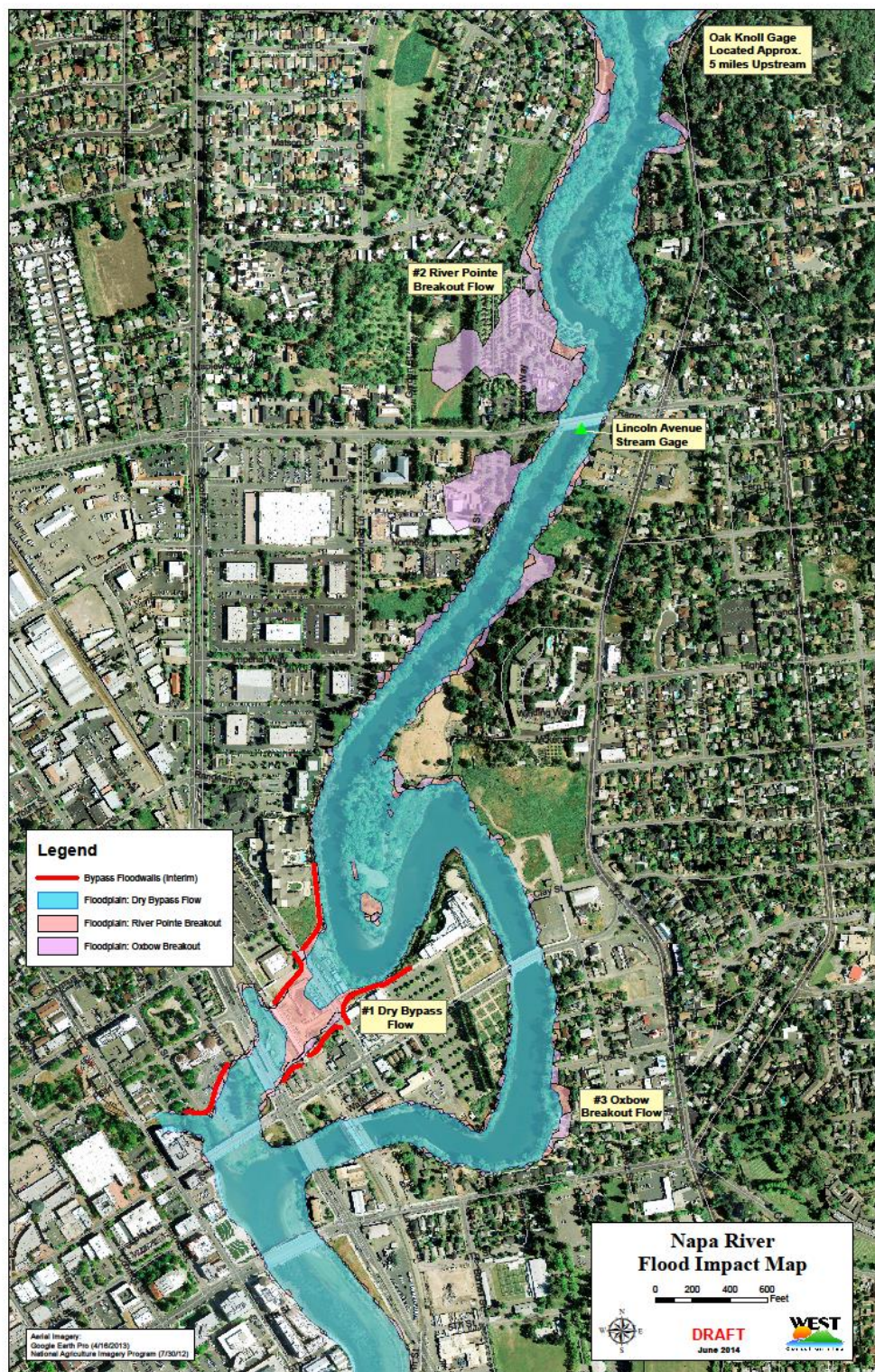


Figure 6-5: Anticipated Breakout Points when the Flood Events Exceed the Interim Condition for Napa River



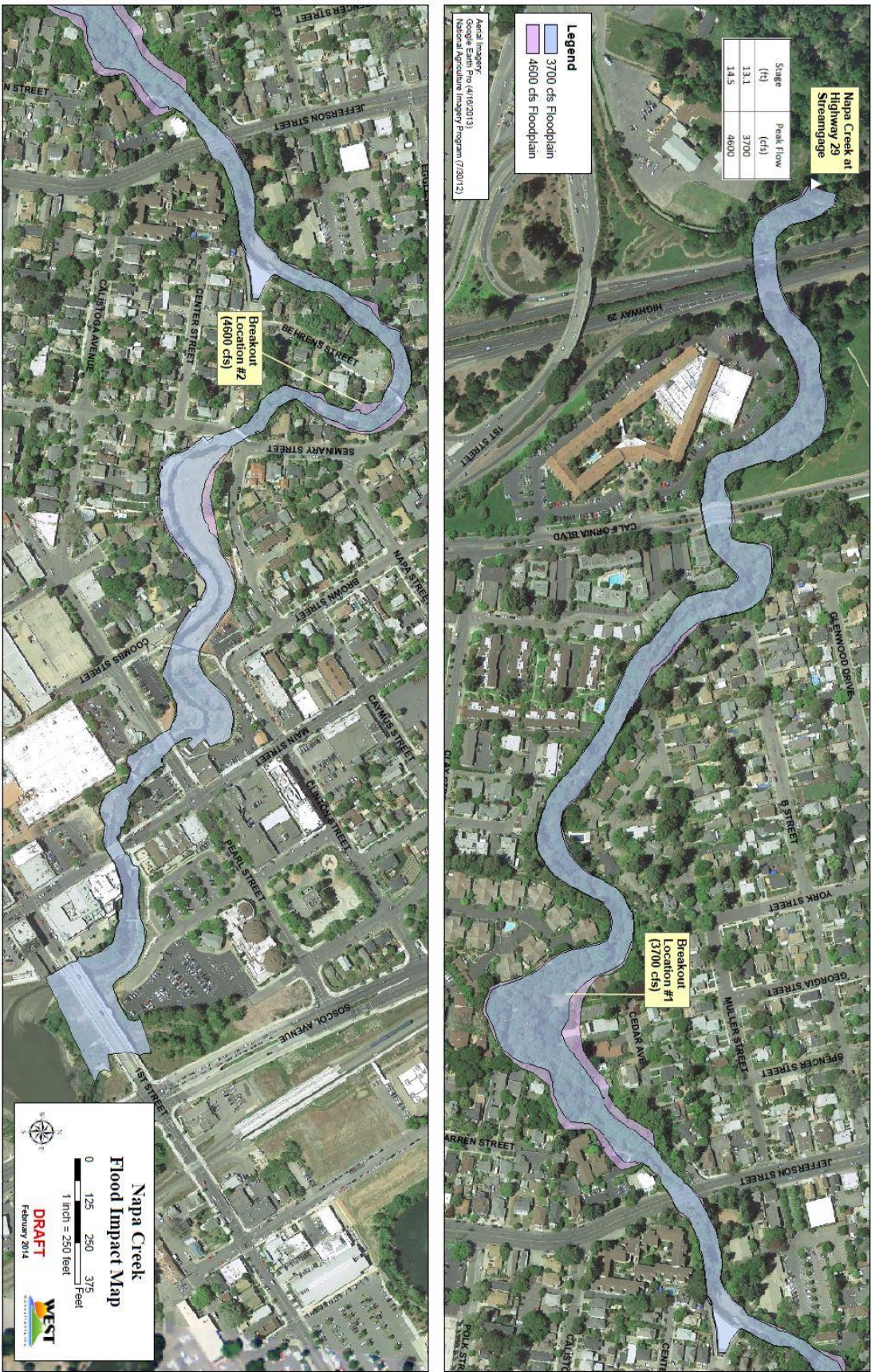


Figure 6-6: Anticipated Breakout Points when the Flood Events Exceed the 1/100 ACE Event for Napa Creek



## **6.4 FLOOD RISK REDUCTION BENEFITS**

### **6.4.1 Features Downstream of Imola Ave**

The features constructed in Contract 1A and Contract 1B, south/downstream of Imola Ave do not provide flood protection to adjacent lands because the reconstructed dikes were set at the same elevation as existing dikes. However, this work does provide increased flood management for the heavily developed portion of the project upstream of Imola Avenue by allowing additional flood conveyance through the constructed marshplain and floodplain terraces. This reduces flood risk damages by reducing the water surface through upstream portions of the Napa River

#### **6.4.1.1 West Bank: Site 1A – Highway 29 to Newport Marina**

Between Highway 29 and Newport Marina the marsh plain terrace excavation and lowering of dikes restored historically functioning floodplains adjacent to Napa River on approximately 910 acres of floodplain lands. The lowered dikes will still prevent most tides from encroaching into low areas which exist behind the dikes. The Vineyard Dike does not provide additional flood damage risk reduction benefits as it was constructed at the same elevation as existing dikes.

#### **6.4.1.2 East Bank: Site 1B – Kennedy Park to Old Tulocay Creek**

On the east bank of Napa River, a marshplain terrace approximately 100 to 150 feet wide was excavated for approximately 450 feet along Napa River. In addition, east of the marsh plain terrace, high ground was excavated and a floodplain terrace approximately 500 feet wide by 500 feet long was constructed to increase the size of the floodplain. The training dike, set at the same elevation as the pre-Project dike, is located along the eastern boundary of the floodplain terrace. The Training Dike is not a flood protection feature and will over top before the design event is reached. On the water side of the Training Dike there is a Planting Berm which does not adversely impact the project performance.

### **6.4.2 Features North of Imola Ave to Soscol Avenue**

#### **6.4.2.1 Old Tulocay Creek to New Tulocay Creek**

The marshplain and floodplain excavation increases conveyance through the Imola Avenue bridge crossing and the NAP5 & NAP6 levees, shown in Figure 6-7, were constructed for the design flood event. Levee slope erosion control has been provided with the planting of native grasses. As indicated in Section 4.9, a portion of NAP5 which parallels Imola Avenue is missing a gravity drainage structure. Installation of this may improve future benefits from possible interior drainage issues.

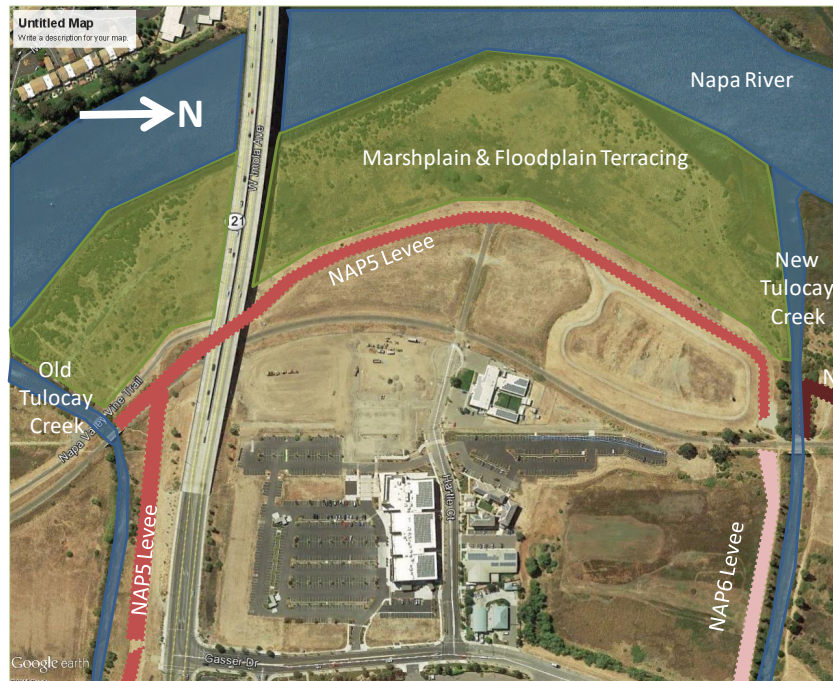


Figure 6-7: Old Tulocay Creek to New Tulocay Creek FRM Features

#### 6.4.2.2 New Tulocay Creek to Soscol Avenue

This reach encompasses the remainder of Contract 2E and features marshplain and floodplain terraces, see Figure 6-8. The excavated marshplain terrace begins on the east bank of the northern bank line of the New Tulocay Creek with NAP7 levee and ends just downstream of the Soscol Bridge. The marshplain and floodplain terracing provide increased channel conveyance which reduces flood damage risk. The NAP 7 levee and the freeboard berm provide flood damage risk reduction. The stone protection reduces risk of erosion failure of the levee, decreasing flood damage risk.

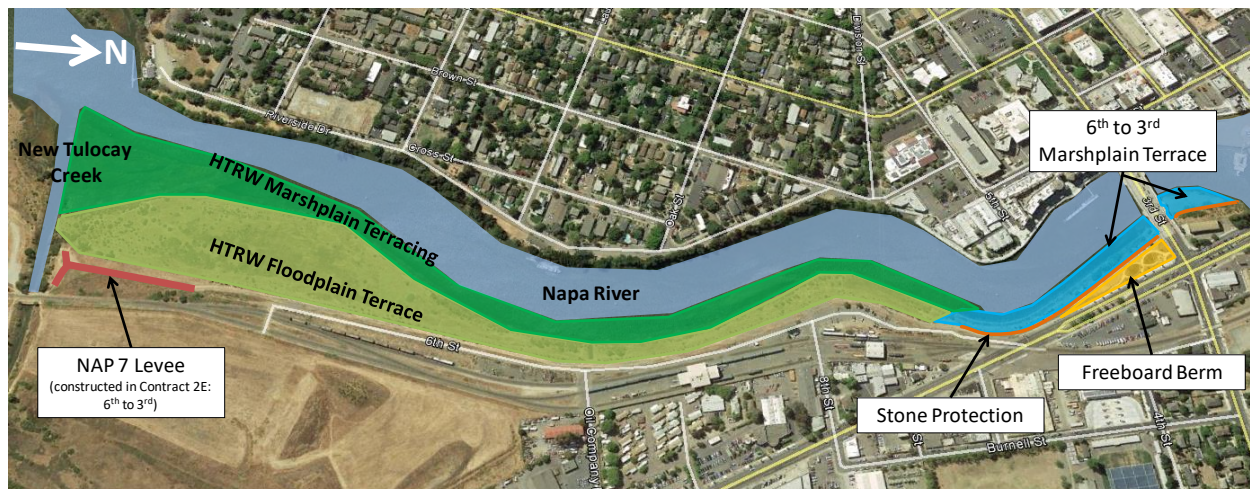
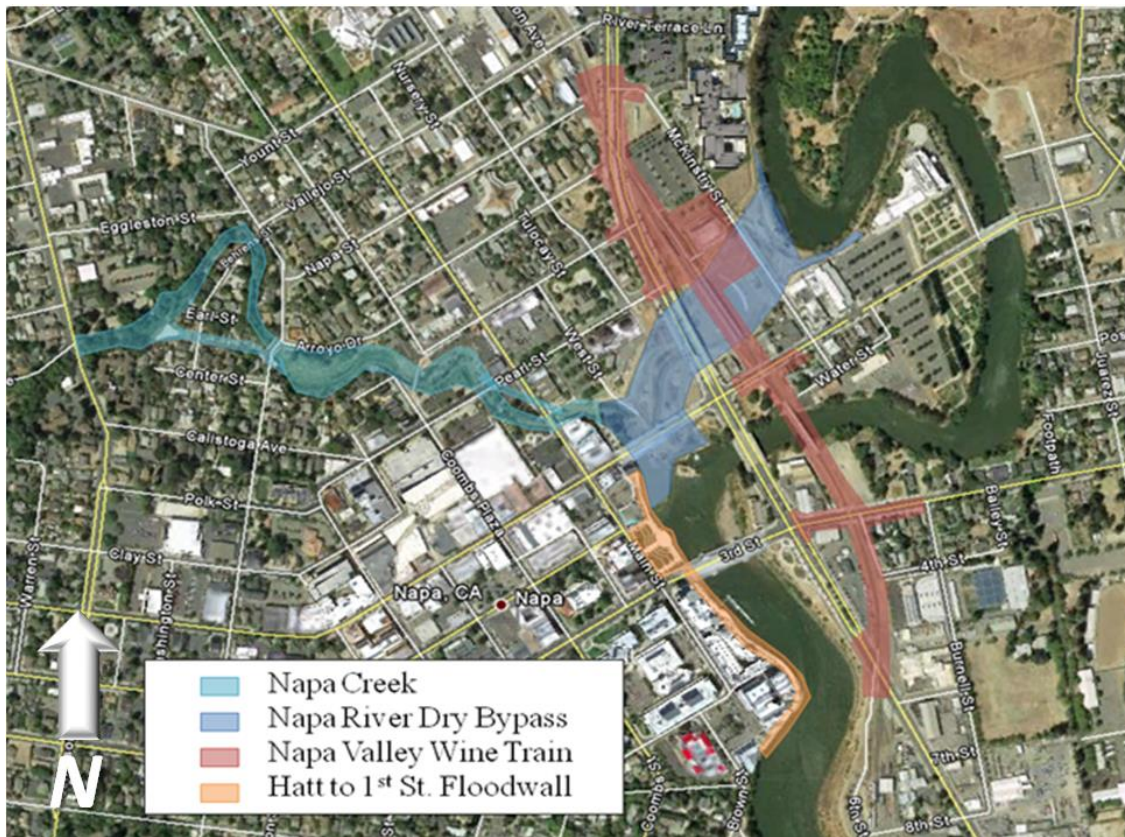


Figure 6-8: New Tulocay Creek to Soscol Avenue FRM Features



### 6.4.3 Downtown Napa FRM Features



**Figure 6-9: Downtown Napa FRM Features**

#### 6.4.3.1 Napa Creek

The Napa Creek's conveyance capacity has been increased to meet the demands of the design event by slope modifications, addition of two bypass culverts and pedestrian bridge removal or replacements, see Figure 6-9. Root wads and slope vegetation is present along the length of this reach to provide slope stability during high water events. The slope stability features reduces erosion of the banks. This reduces downstream sedimentation. In addition, it decreases flood damage risk to adjacent properties by reducing the likelihood that property will be eroded and lost during a flood event.

#### 6.4.3.2 NVWT Railroad Bridges

The existing NVWT Bridge was replaced with the new Napa River Railroad Bridge which gives more than 3 feet of freeboard to the design flood event. The minimum soffit elevation is 21.74 feet NAVD 88. The Dry Bypass Bridge soffit elevation is 23.0 feet NAVD 88 and provides 2.6 feet of freeboard to the design flood event. The new bridges are more efficient hydraulically and help reduce flood damage risk by reducing the bridges impact to conveyance.

#### 6.4.3.3 Napa Dry Bypass

The Dry Bypass is designed to remain dry under non-precipitation conditions. With a severe storm event, the Napa River will begin to flow through the channel when the River reaches elevation 13 feet NAVD 88 and above. The bypass flood conveyance minimizes the flows through the Napa River Oxbow and provides



a direct path of travel for flood flows. The Bypass channel protects the surrounding businesses from flooding by floodwalls along the north and south side of the channel and floodwall closure structures where McKinstry Street crosses the bypass. The dry bypass allows flood flows to move downstream more efficiently, reducing the water surface elevation. This results in reduced flood damage risk along Napa River.

#### 6.4.3.4 Hatt Building to 1<sup>st</sup> Street Floodwall

The Hatt Building to 1<sup>st</sup> Street segment for the project provides FRM with the construction of a floodwall NAP2 set at elevation 19.9' NAVD88 (17.5' NGVD29). This wall begins at Hatt Street and continues north past 3<sup>rd</sup> Street for approximately 260 ft. The floodwall protects nearby areas from flooding.

#### 6.4.4 Upstream of Oxbow to Trancas Street

In the current interim condition, the project reach between the Oxbow and Trancas Street is the most prone to Napa River overtopping its banks causing flooding to occur within the city of Napa. Additional features will need to be constructed for this portion of the project to reach the project performance of the completed project.

### 6.5 MINIMIZATION MEASURES AND BENEFITS OF OTHER PROJECT FUNCTIONS

#### 6.5.1 Cultural Resources

Several cultural resources were impacted by the Napa River project. Project impacts and minimization measures are summarized in Table 6-2.

**Table 6-2: Cultural Resources Impact Summary for the Napa River Project**

	<b>Cultural Resources Impact</b>	<b>Minimization Measures</b>
Contract 4: Napa Creek	<i>Seminary Street Bridge.</i> Impacted by construction activities.	-Bridge abutments will be protected during construction to prevent damage. No permanent alteration will be made.
	<i>CA-NAP-261, the prehistoric River Glen Site.</i> Destroyed by the preferred alternative.	-A Memorandum of Agreement was made between the Corps and the SHPO regarding treatment of the site. Treatment included data recovery excavation, the creation of an excavation report, and monitoring during construction.
	<i>CA-NAP-744H, the Chinatown Site.</i> Destroyed by the preferred alternative.	-Test excavations were performed. It was determined that the site lacked sufficient integrity for National Register eligibility.
-Site 2W: Hatt to 1 <sup>st</sup> -Site 3: Dry Bypass & NVWT -Site 4: Napa Creek	<i>Downtown Napa.</i> The preferred alternative would alter the fabric of the area.	-\$2,400 was allocated for a photographic and videographic recordation of affected buildings, bridges, and streetscapes.
	<i>Other Historical Buildings.</i> Not affected by the preferred alternative.	A number of other historic structures exist in the vicinity of the project. Many, but not all, are National Register eligible. The project has been designed so as to not pose any threat to these structures. They include, but are not limited to: The Hatt Building, The Napa Opera House, the Kyser-Williams Block, and others.

### 6.5.2 Habitat

The Napa River/Napa Creek Project was subject to environmental commitments and regulatory requests and mandates during the construction phase. (Refer to the ‘Conservation Measures’ sections in the NMFS and USFWS BO’s, Appendix E:2 and Appendix E:3). Environmental features were included in the project design to increase and improve habitat for both terrestrial and aquatic species of special concern. The acreages of habitat types were delineated by the USFWS (1999) BA; a summary of environmental restoration and revegetation features is shown in Table 6-3. OMRR&R requirements for the environmental feature areas are included in the 2001 MMP (Appendix E:8) and referenced by habitat type and contract in Table 6-4. The title of the 2001 MMP should not have originally contained any references to mitigation. This was an oversight by the contractor who prepared the document. Plantings and other habitat modifications were included as environmentally sustainable design features to minimize any adverse effects.

**Table 6-3: Environmental Onsite Summary for the Napa River Project**

<b>Project Impacts</b>	<b>Environmental Feature</b>	<b>Location</b>
Loss of riparian forest habitat (5.44 acres)	Revegetate (17.68 acres)	Between Kennedy Park and Lake Park
Loss of riparian scrub shrub habitat (1.80 acres)	Revegetate (10.68 acres)	Between Kennedy Park and Lake Park
Loss of SRA habitat cover (0.19 acre)	Revegetate (2.57 acres)	Between Kennedy Park and Lake Park
Loss of low-value woodlands (11.24 acres)	No features proposed (not a native habitat)	N/A
Loss of high-value woodlands (0.99 acre)	Revegetate (121.97 acres)	South Wetland Opportunity Area and Kennedy Park to Lake Park
Loss of brackish emergent marsh (7.32 acres)	Restoration/revegetate (160.72 acres)	South Wetland Opportunity Area and Site 2E/2W terraces
Loss of seasonal wetlands (44.18 acres)	Restoration/revegetate (56.20 acres)	South Wetland Opportunity Area and Sites 1A/1B/2E
Loss of tidal mudflats (0.61 acre)	Restoration/excavation (2.50 acres)	South Wetland Opportunity Area and Sites 1A/1B/2E

**Table 6-4: Monitoring Plan Habitat Type and Contract Reference Chart**

<b>Habitat</b>	<b>M&amp;M Plan Page references</b>	<b>Site 1 A</b>	<b>Site 1B</b>	<b>Site 2E</b>	<b>Napa Creek</b>	<b>Napa Dry Bypass</b>	<b>Gasser E-7</b>
Riparian Forest and Scrub Shrub	5-1 to 5-9	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
High Value Oak Woodland	5-9 to 5-12		<b>X</b>	<b>X</b>			
Shaded Riverine Aquatic	5-13 to 5-16		<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
Brackish Emergent Marsh/Tidal	5-17 to 5-23	<b>X</b>	<b>X</b>	<b>X</b>		<b>X</b>	

Habitat	M&M Plan Page references	Site 1 A	Site 1B	Site 2E	Napa Creek	Napa Dry Bypass	Gasser E-7
Seasonal and Emergent Wetlands	5-25 to 5- 28			X			
Tidal Mudflat	5-28 to 5- 31	X	X	X		X	X
Grassland	5-31 to 5- 34	X	X	X	X	X	

### 6.5.3 Recreation

The Project Cooperation Agreement (PCA) for Recreation Development outlines the approved recreation elements that are cost-shared between USACE and FCD. The approved recreation elements are summarized in Table 6-5. Recreational elements are categorized and authorized as project opportunities via the Flood Control Act of 1944, The Federal Water Project Recreation Act of 1965, and NEPA. Recreation provides National Economic Development benefits that were quantified for the Napa project in the Supplemental GDM and the 2012 LRR.

**Table 6-5: Napa River/Napa Creek Project Recreation Elements**

Recreation Element	Location
River walk trails	Kennedy Park to Oxbow and Dry Bypass
Trees	Site 1B Training Dike on berm, Napa Creek, Hatt to 1 <sup>st</sup> Promenade, Dry Bypass
Shrubs	Site 1B Training Dike on berm, Napa Creek, Hatt to 1 <sup>st</sup> Promenade, Dry Bypass
Irrigation	Hatt to 1 <sup>st</sup> , Dry Bypass
Signage	Training Dike, Hatt to 1 <sup>st</sup>
Veterans Park	Hatt to 1 <sup>st</sup>
Benches	Training Dike, Hatt to 1 <sup>st</sup>
Trash receptacles	Hatt to 1 <sup>st</sup>
Stairway access	Hatt to 1 <sup>st</sup>
Security lighting	Hatt to 1 <sup>st</sup> , Dry Bypass
Pedestrian bridges	Old Tulocay Creek (Site 1B)

**SECTION 7 – PROJECT COOPERATION AGREEMENT**

The FCD and the Department of the Army have entered into a Project Cooperation Agreement (PCA) for this project on February 1, 2000 as required by Public Law 99-662. A copy of the duly executed PCA is included as Appendix B: of this manual.

Authorizing legislation by the State of California has designated the FCD as the agency to fulfill local interest responsibilities for the Project. The FCD has entered into agreements with USACE (SPK) to fulfill these responsibilities.

Responsibility for operating and maintaining completed Project works will be officially transferred to the FCD. Paragraph 208.10(a)(10) of the Flood Control Regulations (CFR Title 33) provides that the Department of the Army will furnish local interests with a manual for each completed Project, or separate useful part thereof, to assist them in carrying out their obligations. Copies of all Transfer Letters for these projects are included in Appendix C:.

After USACE (SPK), acting as the agent for the Federal Government's Department of the Army, transfers the completed project, or functional portion thereof, to the FCD and provides the FCD with a copy of the Operation and Maintenance Manual, the FCD must operate, maintain, repair, replace, and rehabilitate (OMRR&R) the completed project, or functional portion thereof, in accordance with regulations or directions prescribed by the Federal Government. The PCA includes the FCD's specific responsibilities for operating and maintaining the flood control facilities.

## **SECTION 8 – OPERATION**

### **8.1 INTRODUCTION**

In accordance with ER 1110-2-401, this section details the operations that are necessary for the safe and efficient functioning of the Project to produce the benefits set forth in the project authorization. The operational requirements for non-reservoir projects are presented as operation plans covering essentially the who, what, when and how of various project operations.

### **8.2 PROJECT OPERATIONS**

The Project must be operated and maintained in a manner that will propagate as-built conditions defined in the record drawings, design studies and the requirements set in 33 CFR 208.10 (Appendix H:1). Project operations include management of flood control, recreational, and environmental facilities.

1. Inspect and evaluate the integrity of structural features (levees, drainage structures, etc.)
2. Visually monitor bank stability, deposition and/or erosion of marshes and floodplains and vegetative cover by using aerial photographs.
3. Monitor vegetation establishment through visual inspection.
4. Ensure project flood protection features remain in a sound condition so that they will function as designed.

### **8.3 RESPONSIBLE LOCAL AGENCY**

In accordance with 33 CFR Ch. II Section 208.10, the NCFWCWD shall appoint a “superintendent” who shall be responsible for the development and maintenance of, and directly in charge of an organization responsible for efficient operations and maintenance of all structures and facilities during flood periods and for continuous inspection and maintenance of the project works during period of low water.

In addition to the duties listed in 33 CFR Ch. II Section 208.10, the “superintendent” shall remain knowledgeable and be kept up to date on:

- Reviewing all safety codes and hazards of prescribed operation activities. Watchmen or patrols employed during flood periods need to consist of teams of not less than two people.
- The FCD and superintendent needs to have available the names, addresses, and telephone numbers of all key workers and a reasonable number of substitutes, including an assistant to act for and in the absence of the superintendent.
- Ensuring access to a reserve supply of materials which may be necessary during a flood.

### **8.4 GENERAL OPERATIONS**

#### **8.4.1 Inspection Frequency**

The superintendent/FCD staff and City of Napa must conduct inspections and prepare reports as described Section 10.4 and Section 10.5, respectively, to verify that the Federal Regulations are being adhered to and ensure the project will operate as intended.

### **8.5 PROJECT FEATURE OPERATION**



### **8.5.1 Marshplain and Floodplain Terrace**

Marshplain and floodplain vegetation goal is to achieve a natural protective cover for the ground surface, to stabilize slopes against erosion using environmentally friendly methods and to provide wildlife habitat in an aesthetically pleasing way. Vegetation growing on and near levees and dikes must be maintained in accordance with Section 10.7.3 of this Manual.

### **8.5.2 Veteran's Park Stoplog Operation**

A stoplog closure gate on the north side of the park provides flood protection along the upper part of the Americans with Disabilities Act route access point to the park. A storage locker has been incorporated in the adjacent planter for stoplog storage when not in use. The stoplog needs to be installed and removed annually in the fall to ensure knowledgeable staff, check stoplog and storage condition and the proper operation of this stoplog structure.

### **8.5.3 McKinstry Street Floodwall Closure Gates**

The Dry Bypass McKinstry Street floodwall closure gates are recessed into an alcove within the floodwall to minimize exposure to the public and present an aesthetically pleasing gate face. Yearly, the closure gates will be manually closed and locked to the adjustable support post to ensure knowledgeable staff and proper function of the floodgate. A storage locker has been incorporated at the east end of the southern gate in order to house the temporary steel bars that the gates seal against which are anchored to the road. The storage locker stores these bars when not in use. The steel bars needs to be installed and removed annually in the fall to ensure knowledgeable staff understand its installation and proper operation. Once the annual dry-run of installing the bars and testing the closure of the gate is complete, return the floodgate to its recessed position.

### **8.5.4 Low Flow Channel and Gabion Wall**

The Dry Bypass low flow channel is design to convey the existing storm drain runoff water from the area west and north of the project site south to the Bypass Outlet to the Napa River. The low flow channel collects storm water at the gabion wall between Soscol Avenue and NVWT Dry Bridge. The channel terminates at the outfall of the Dry Bypass into Napa River. This storm drain run off will be maintained at its current location until the future storm drainage pump station is constructed.

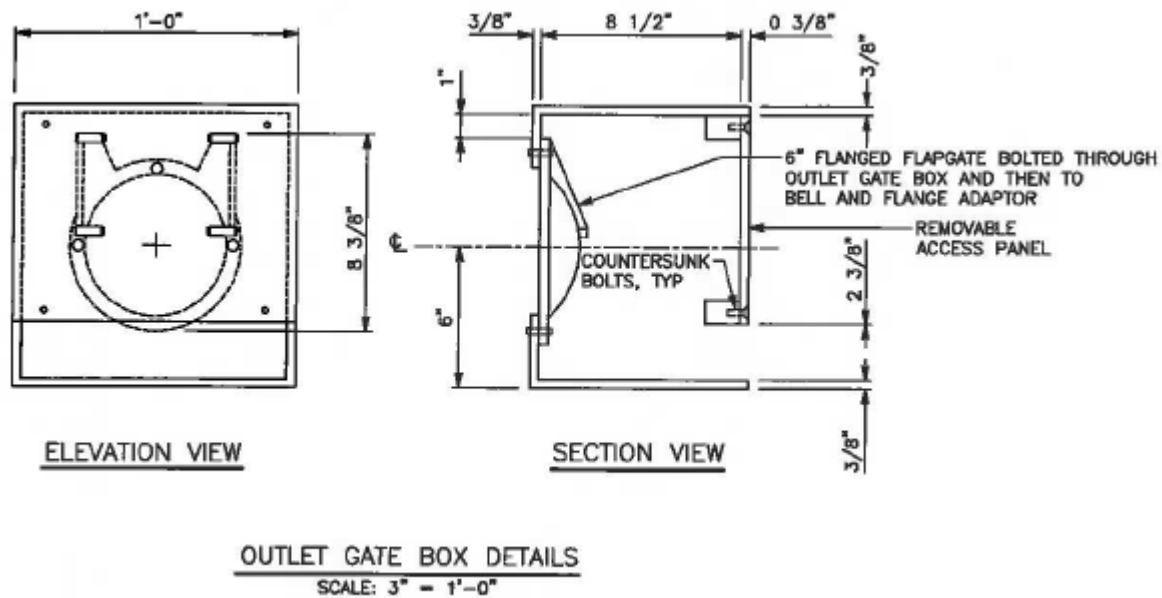
### **8.5.5 Napa Creek Bypass Culverts**

Box culverts are used in two locations to divert high water flows from Napa Creek. The most upstream bypass passes under the alley from approximately 125 feet north of Center Street and re-enters Napa Creek just east of Seminary Street. The second bypass consists of two side-by-side box culverts to divert high water flows from Napa Creek in a bypass that passes under the Napa City Parking Lot associated with the Fire Fighter's Museum and under Pearl Street and the parking lot on the south side of Pearl.

### **8.5.6 Retaining Wall Drains**

Concrete retaining walls have been placed at strategic locations along the side slopes of Napa Creek and Napa River to provide channel stability and increased floodway capacity, and prevent bank erosion. The walls utilize a sub-drain system comprised of solid and perforated piping and granular backfill. This drain system discharges through retaining walls through Outlet Gate Boxes, details shown in Figure 8-1. These sub-drain systems are necessary for relief and drainage of subsurface water that flows towards the creek

and river and may be blocked by debris. Blockage of the drains could compromise the performance of the retaining wall and contribute to wall failure and reduced project benefits.



**Figure 8-1: Outlet Gate Box Detail**

### 8.5.7 Levees, Dikes & Berms

Dikes and levees will have water above the landside toe elevation during floods. Freeboard berms will only have water higher than the landside toe elevation during events larger than the Project design flood as described in Section 4.8. During floods of Napa River, a breach would result in extensive flooding of the protected area, leading to significant loss of property and endangering residents. Continuous long term inspection and maintenance will ensure long-term structural integrity and the ability to contain design flood flows. Dikes, levees, and freeboard/Planting Berms must be inspected in accordance with inspection frequency defined in Section 10.4.

### 8.5.8 Drainage Systems

Proper operation of outlets and flap gates is critical because failure or clogging could flood areas. Failure of flap gates in the open position will allow floodwater to infiltrate into the opposite side of the floodwall, dike or levee potentially causing flooding. Inspection prior to the beginning of flood season on gates shall alert the FCD as to action that may need to be taken to replace or repair. If necessary, the FCD shall coordinate with the city of Napa to manage the operation activities necessary to insure that storm drainage systems operate properly prior to the beginning of flood season.

### 8.5.9 Erosion and Sediment Control

Napa River and Napa Creek carries a large amount of sediment and deposition in the project reach of concern. Sediment in Napa River, downstream of 3<sup>rd</sup> street is part of the Napa River Navigation Project and navigation depths are maintained through channel dredging by USACE, San Francisco District (SPN). The project is designed assuming that the navigation channel section will continue to be maintained.

Stream bank and terrace slopes below levees and floodwalls cannot be allowed to erode and threaten these important lines of protection. Erosion protection measures, such as vegetation and riprap, have been installed in those areas where potential erosion would threaten flood features. The sponsor shall be responsible to maintain and repair/replace of the following materials or engineered features if damaged to the degree that it doesn't function or is a safety hazard.

#### **8.5.9.1 HPTRM**

Anchored HPTRM consists of a high strength woven, three-dimensional mat of polypropylene yarns anchored to the underlying soil with locked cable strand anchors used at the Dry Bypass channel invert and along the levees for site 1B. An anchored HPTRM, combined with a grass vegetative cover, anchors the soil in place to prevent erosion under flood water conditions. The HPTRM allows the bypass channel to pass a portion of the normally high water in the oxbow area and reduce overall flooding potential to the community with lower risk of erosion to the features its protecting including floodwalls, levees, and recreational features. By protecting the levees (i.e. Site 1B) with HPTRM the flooding potential is reduced.

#### **8.5.9.2 Rock Weirs**

Two pairs of Rock weirs located at Napa Creek stations (measured in feet) 10+68 and 21+42 redirect stream flow to the center of the stream channel and disrupt the velocity gradient in the near-bank region reducing the amount of erosion. By reducing erosion, the Rock weirs provide flood damage risk reduction by reducing likelihood of erosion that could cause property damage and loss of life. Rock sizes will vary between 0.5 to 2-ton boulders placed across the channel and keyed into channel banks. The key is vegetated with pole cuttings placed around the edges of the rock and the voids filled with a stream bed material and soil mix. The rock weirs utilize a low weir section pointed upstream to force water flowing over the weir into a hydraulic jump and include a low flow notch for fish passage. Weir boulders are placed in the creek channel and smaller gravel and cobble material is added in the voids between rocks to help seal the structure.

#### **8.5.9.3 Rock Riffle**

Rock riffles are included in Napa Creek at locations where channel incision would threaten bypass structures or existing infrastructure. The riffles are designed in groups of 2 or 3 such that the crest of the lower riffle provides backwater to submerge the toe of the upper riffle. This helps to lower the hydraulic grade line in smaller steps, reduces the need for additional rock between structures, and ensures sufficient tailwater for the upstream structure to promote fish passage. As a consequence, upstream velocities will be lower and potential bank erosion will be reduced, which could lead to bank failure, or failure of conduits/bypasses which could contribute to more flooding.

#### **8.5.9.4 Vegetated Reinforced Soil Slopes (VRSS)**

5-layer and 2 layer VRSS are installed in Napa Creek banks to prevent erosion and promote vegetation. This treatment is typically used where velocities are expected to be moderately high (6 to 9 feet per second) and where room for bank grading alone is not feasible. The fabric used to wrap each soil lift is permeable but provides additional structural support to the bank to resist sloughing and shear stresses from the flow. The VRSS treatments include horizontal brush layers planted between lifts and vertical willow poles planted on top of lifts to provide cover and structure. The top VRSS layer provides a 3-foot floodplain bench and is densely covered with container plantings. The VRSS provides secure, cost-effective erosion control on the river banks and river channel to prevent channel erosion that could lead to bank failure.

#### **8.5.9.5 In stream Woody Material and Rock/Rootwad Revetment**

In-stream woody structures help to direct the flow away from channel banks and promote hydraulic diversity in the channel. Under moderate flood conditions, the barbs can encourage the local trapping and sorting of gravels to improve fish spawning habitat in the creek. The woody material also provides refugia (hiding and resting places) for juvenile fish from predators.

#### **8.5.9.6 Anchored Rock**

In-stream rock structures are a well graded mass with minimum percentage of voids so that during fast moving flood waters the rock won't displace (note in the Quick Reference Maintenance Guide that the joint planted rock has been planted with vegetation). Final rock placement involves rearranging individual pieces by mechanical equipment or by hand as necessary to obtain a minimum percentage of voids. Anchored rock is located at the Newport Marina (nearest Newport Dr., along the west bank of the river), along the southern edge of the 2W floodwall along the west bank of the river, along the eastern bank of the river from 3<sup>rd</sup> Street to approximately 250 to 300 yards south of the 3<sup>rd</sup> Street Bridge, at the inlet of the Napa Creek bypass downstream of Jefferson St, at the inlet of the downstream bypasses for the Napa Creek project, along the eastern bank at the outlet of the Napa Creek project, at the inlet and outlet to the Napa Dry Bypass, the Low Flow Channel of the Dry Bypass, and along the walking trail of the Dry Bypass leading up to the northwest corner of Soscol Avenue and 1<sup>st</sup> street.

#### **8.5.9.7 Willow Brush Mattress/Vegetated Matting**

Vegetated matts are similar to rolls of turf grass sod, as they are pre-grown, soilless, and delivered in rolls. Vegetated matts are grown from custom seed mixes or native grasses. Vegetated matts are initially staked into the soil for support until plant establishment occurs. Brush mattresses are a single row of cuttings, placed side-by-side to form a single layer of plants. The cuttings are either stocks or branches and are taken from live growing material and stripped of all lateral branches to form a single pole. Cuttings can be any tree or shrub species designated as such, but generally are species that sprout easily at nodes when placed in direct contact with the soil. Brush layer cuttings shall be 6 to 8-feet in length with a caliper ranging from ½ to 1 ½ inches. These features are found in the Napa Creek project. The vegetated matting is planted on the north bank of Napa Creek from approximate Sta. 20+25 to 21+25 and from 18+25 to 19+00. The vegetated matting is planted on the south bank of Napa Creek from approximate Sta. 18+60 to 20+85. The willow brush mattress is placed along the south bank of Napa Creek from approximately 21+25 to 22+00. For vegetated mattress locations notes above reference the map of project features provided with this manual.

#### **8.5.10 Domestic/Fire/Irrigation Water Systems**

Irrigation systems are the responsibility of the City of Napa for operation and maintenance. The temporary irrigation systems are intended to be disconnected and abandoned following completion of construction and salvageable equipment shall be removed and returned to the City of Napa Department of Utilities. The construction contractor awarded the post construction plant maintenance contract is responsible for plant maintenance for the 3-year warranty period.

The project has supplied the City of Napa with irrigation water systems for:

- Site 4, Napa Creek (see Appendix J: for water meter details)
- Site 2W, Hatt to 1<sup>st</sup> Street
- Site 2E Revegetation
- Dry Bypass (see Appendix J: for water meter details)

The 5<sup>th</sup> Street Plaza provides water for areas south of the 3<sup>rd</sup> Street Bridge and the Veteran's Park south planter provides water for areas north of the 3<sup>rd</sup> Street Bridge. The City of Napa provides water to areas above and below the 3<sup>rd</sup> Street Bridge. The above ground appurtenances need to be inspected for damage on an annual basis.

### 8.5.11 Lighting

Public Lighting and Electrical systems described herein are the responsibility of the City of Napa for operation and maintenance.

In the Hatt to 1<sup>st</sup> reach, there are two electrical systems installed for this project in order for foot traffic to be able to walk the promenade at night and for purposes of recreation. South of the 3<sup>rd</sup> Street Bridge is an electrical system supporting site lighting and irrigation controllers. The meter and panel for this system is located at the south side of the 5<sup>th</sup> Street plaza. The second electrical system is located in the planter south of Veteran's Park, and north of the 3<sup>rd</sup> Street Bridge. This system controls the lighting, irrigation and future power to the bandstand area.

The electrical system supporting the bypass lighting is located in the northeast corner of McKinstry Street and the flood gate. Lighting is provided along the flood wall of the bypass and at either end of McKinstry Street so that sufficient illumination is provided for vehicular traffic at the closure gates regardless of whether the gates are open or closed, and in order to monitor flooding for nighttime hours.

### 8.5.12 Additional Key Flood Protection Project Features

The Napa project incorporates many features to attenuate flooding in addition to the items listed above. The table below provides for some of the key features and their location with respect to key features to assist with flooding. For further information, reference as-built drawings with respect to their locations.

**Table 8-1: Flooding Attenuation Features, Location of Features, and Benefits of the Features for the Napa Flood Control Project, Napa, California**

<b>Feature</b>	<b>Location</b>	<b>Benefits</b>
Removal of Levees, Construction of Ring Levee (Vineyard Dike).	Site 1A	Provides increased conveyance on the river. Provided marshplain terracing. Protection of vineyard after removal of levees (Vineyard Dike project).
Removal of Levees and Reconstruction of Levees Further Inland	Site 1B	Provides Increased conveyance on the river. Provided marshplain terracing.
Turf Reinforced Mat (HPTRM)	Sites 1B, Dry Bypass	Allows normal vegetative growth, yet anchors the soil to prevent erosion and failure of levee
Vegetated Reinforced Soil Slope (VRSS)	Napa Creek, Dry Bypass	Multiple coir fabric wraps with vegetation planted between wraps prevent bank erosion and

Feature	Location	Benefits
		property damage from flooding @ upper portion of bank
Root Wad Revetment	Napa Creek	Bolt anchored tree trunk roots along lower portions of banks to prevent bank erosion/loss of property
Bank Log Pocket*	Napa Creek	Minimal erosion protection, maximizes habitat value at river/creek lower portion of bank
Low Flow Channel (LFC)	Dry Bypass	Reinforced channel within TRM channel for additional overland flow drainage and to prevent damage to landscape features outside of LFC
Vegetated Coir Matting	Napa Creek	Vegetation planted within coconut coir matting to provide additional soil strength prior to mature establishment
Concrete Bypass Channels	Napa Creek	Provides additional flow capacity to channel system at specific water surface elevation
Energy Dissipator	Dry Bypass	Reduces energy of flow entering the dry bypass to prevent erosion d/s of dissipator
Flood Gates	Dry Bypass	Allows traffic along McKinstry Street. When closed prevents flooding beyond floodwalls
Stop Logs	2W – Veteran’s Park	Prevents high water from entering downtown through a low area in Park when installed
Levees, Floodwalls	1A, 1B, 2E, 2W, Dry Bypass	Containment of rising WSE
Rock Weirs	Napa Creek	Provides grade control, bed stabilization and undermining of root wad structures
Rock Riffles	Napa Creek	Provides bed stabilization

\* - subject to the adaptive management plan for Napa due to its construction along the banks of Napa Creek which can be subjected to fast moving water and damage due to scour.



### **8.6 OPERATION RECORDS**

Operation records will be maintained by the project superintendent and made available for inspection upon request.

- Annual report entitled “Status of Project Operation and Maintenance”
  - indicates the degree of proficiency attained by each obligated local agency in providing required maintenance.
  - This report shall include all records of inspection and maintenance as required by SECTION 10 and SECTION 11.
  - FCD will provide copies of the report to USACE (SPN) and the City of Napa.
  - Operation records (installation of stop logs, any opening or closing of gates, etc) shall be provided.

## **SECTION 9 – OPERATIONS**

### **9.1 INTRODUCTION**

This section addresses flood emergency operation plans and responsibilities, including preparations for and responses to project emergency conditions. This section provides an outline of emergency operation records and covers:

- Chain of responsibility.
- Emergency communications network including redundancies (internal and external).
- Local emergency response assistance such as fire, police, medical, and Red Cross.
- State and Federal emergency response agencies.
- Flood fight or other plans that may have been part of design documentation.

The emergency operations defined in this section represents an initial project guideline and will require adaptation and modification as determined and defined following evaluation of the success of emergency operations following a flood event. Post event evaluation and operations modification are considered to be an integral part of adaptive management necessary for successful continuing operation of this project and are the responsibility of the FCD.

### **9.2 EMERGENCY OPERATION RESPONSIBILITIES**

#### **9.2.1 Lead Agency**

FCD is the lead agency in charge of operation of the flood project features. The City of Napa is responsible for emergency response and evacuations. During periods of flood danger, the FCD is responsible for the Project areas and maintaining contact with secondary agencies.

#### **9.2.2 Secondary Agencies**

The following secondary agencies are involved in emergency operations. See Section 9.5 for Emergency Contact List.

- Napa County Office of Emergency Services (Public Works, Police, and Fire Departments)
- City of Napa (Public Works, Police, and Fire Departments)
- California Department of Water Resources (DWR), State Flood Operations Center
- Pacific Gas and Electric (PG&E)
- California Office of Emergency Services
- Federal Emergency Management Agency
- California Department of Transportation
- California Highway Patrol
- USACE San Francisco District

#### **9.2.3 U.S. Army Corps of Engineers (USACE)**

USACE has authority under PL 84-99, Flood Control and Coastal Emergencies (FCCE) (33 U.S.C. 701n) (69 Stat. 186) for emergency management activities. Under PL 84-99, the Chief of Engineers, acting for the Secretary of the Army, is authorized to undertake activities including disaster preparedness, Advance Measures, emergency operations (Flood Response and Post Flood Response), rehabilitation of flood control works threatened or destroyed by flood, protection or repair of federally

authorized shore protective works threatened or damaged by coastal storm, and provisions of emergency water due to drought or contaminated source.

- **Preparedness:** The Flood Control and Coastal Emergency Act establishes an emergency fund for preparedness for emergency response to natural disasters; for flood fighting and rescue operations; for rehabilitation of flood control and hurricane protection structures. Funding for USACE emergency response under this authority is provided by Congress through the annual Energy and Water Development Appropriation Act. Disaster preparedness activities include coordination, planning, training and conduct of response exercises with local, state and federal agencies.
- **Response Activities:** PL 84-99 allows the Corps of Engineers to supplement State and local entities in flood fighting urban and other non-agricultural areas under certain conditions (Engineering Regulation 500-1-1 provides specific details). All flood fight efforts require a Project Cooperation Agreement (PCA) signed by the Public Sponsor and a requirement for the Sponsor to remove all flood fight material after the flood has receded. PL 84-99 also authorizes emergency water support and drought assistance in certain situations and allows for “advance measures” assistance to prevent or reduce flood damage conditions of imminent threat of unusual flooding.
- **Rehabilitation:** Under the authority of PL 84-99, an eligible flood protection system can be rehabilitated if damaged by a flood event. The flood system would be restored to its pre-disaster status at no cost to the Federal system owner, and at 20% cost to the eligible non-Federal system owner. All systems considered eligible for PL 84-99 rehabilitation assistance have to be in the Rehabilitation and Inspection Program (RIP) prior to the flood event. Acceptable operation and maintenance by the public levee sponsor are verified by levee inspections conducted by the Corps on a regular basis. The Corps has the responsibility to coordinate levee repair issues with interested Federal, State, and local agencies following natural disaster events where flood control works are damaged.

### **9.3 EMERGENCY OPERATION PROCEDURES**

#### **9.3.1 General**

In accordance with ER 1110-2-401, flood emergency is addressed with respect to operations, procedures and responsibilities. Napa County has an emergency action plan and flood fighting procedures in place. This manual doesn’t supersede the county’s existing plans.

As it pertains to the operation of the federally-constructed project, NCFCWCD is the lead agency in charge of the Emergency Operations. As the lead agency, NCFCWCD will coordinate operations of the federal flood control project during flood emergencies and will be on alert status from November 1 through May 1 of each year.

#### **9.3.2 Preliminary Activities**

Within the county of Napa, an incident command system will be used for flood emergencies and all other emergency incidents. Prior to each flood season, the project superintendent should review the following emergency plans:

- Establish an incident command in accordance with FEMA National Incident Management System standards
- Size up the incident, determine the objectives and resource requirements
- Determine the organizational elements required to mitigate the incident if necessary

- Request additional resources necessary to mitigate the incident if necessary
- Delegate authority within the organizational structure
- Develop an Incident Action Plan (IAP), incorporating objectives and strategies

### **9.3.3 Pre-Flood Activities Checklist**

The superintendent will notify the appropriate agencies and labor crews of the impending flood emergency and should assign individuals to defined sections of the Project to perform the following tasks:

- Verify telephone numbers of all emergency team members and communication equipment.
- Know the location of equipment and material stockpiles (such as sacks, sandbags, brush, lumber, lights, emergency generators, fuel, etc.).
- Perform an assessment of levees, dikes, freeboard berms, riverbanks, floodwalls, drainage swales, and access roads.
- Verify that flood fighting personnel have keys to stoplogs, floodwall closure gates, electrical boxes, bollards and other access points necessary for flood fighting, project access and utility shutdown.
  - Napa Creek Bypass Culverts
- Closure of recreation areas and evacuation of pedestrians.
  - Veterans Park
  - Napa Dry Bypass
  - Recreation trail over Training Dike
  - Lower Promenade Trail
- Ensure that all flap gates on culverts are operable, seated properly and closed.
- Understand locations of access roads and ramps in the project vicinity.
- Reserve supplies of filled sacks and rolls of polyethylene sheeting or canvas should be available for immediate use.
- Follow operation procedures described in Section 8.5

### **9.3.4 General Inspections and Ongoing Activities**

After the initial inspection has been made and the location and availability of labor crews, vehicles, heavy equipment, and materials has been ascertained, the following actions need to be taken, time permitting:

- ❑ Removal of accumulation of debris at bridge foundations and overflow weirs.
- ❑ Once Napa Creek flows splits into the bypass culverts, periodic inspections of the bypass inlet trash racks shall be initiated for obstructions. (Equipment capable of safely removing debris from the trashracks shall be stationed at the two bypass inlets in order to be activated should debris wash up and affect the flow split.)
- ❑ Monitor condition of marsh plain terrace, floodwalls, design profile distances (freeboard), and any recent repairs.
- ❑ Monitor condition of the culverts and flap gates of the levee/dike/floodwall drainage structures.
- ❑ Monitor condition of the levees/dikes/floodwall and any recent repairs.
- ❑ Levees and floodwalls more than 5 feet tall with floodwaters at least one-fourth of the way up the structure or higher (from landside toe), must be inspected once every hour. Levees and floodwalls more than 5 feet tall with floodwater above the landside levee/floodwall toe, but with floodwaters less than one-fourth of the way up the structure (landside toe), must be inspected once every 24 hours.

- ❑ Monitor condition of access roads to the levees/dikes/floodwalls, crest roads on the levees/dikes, and the roads on the landside of the floodwalls.

### **9.3.5 Site Specific Operational Flood Activities**

The levees, floodwalls, floodways, improved channels, promenades, drainage structures and terraces must be patrolled during periods of high water. Appropriate measures must be taken to prevent obstructions due to debris, especially at channel constrictions (e.g., bridge crossings) and floodwall protrusions into the river channel once floodwaters have receded. Large objects (greater than 1 cubic yard) that become lodged against the banks, walls or bridge piers must be removed after floodwater have receded.

#### **9.3.5.1 Kennedy Park to Imola Avenue**

- Training and Vineyard Dike inspections should occur *before flood events only*. Since these structures will be overtopped relatively easily, they need to be closed to all people during a flood event. All the accesses to the Training Dike shall be closed to pedestrians before any anticipated flood events. The Vineyard Dike accesses shall either be closed, or the owner of the property should be notified to close the area to pedestrians or workers before any anticipated flood events.
- Includes monitoring and removal of debris build-up at the Imola Avenue Bridge and the pedestrian bridge over Old Tulocay Creek following a flood event.

#### **9.3.5.2 Imola Avenue to 3<sup>rd</sup> Street**

- Inspect the levees before and during a flood event.
- Removal of any debris build-up at the 3<sup>rd</sup> Street Bridge following a flood event.

#### **9.3.5.3 3<sup>rd</sup> Street to Trancas Avenue**

- Close McKinstry Street floodwall gates and remove the low flow culvert hand rails.
- Install Veterans Park stoplogs. See Plate 1.7 for manufacturer's stoplog fabrication and Plate 1.6 for stoplog as built drawing.
- Close the stoplog on the Dry Bypass floodwall left bank behind the Oxbow market.
- Monitor and remove any debris build-up at the three oxbow bypass channel bridges (1<sup>st</sup> Street, Soscol Avenue and NVWT) and at the three other bridge crossings of Napa River (1<sup>st</sup> Street, Lincoln Avenue and Trancas Street).
- Shut off the domestic, irrigation and fire water systems at Veteran's Park water meter near Main and 3<sup>rd</sup> Streets to prevent floodwall damage caused by piping due to a main break during high water and to avoid water contamination.
- Shut off the electrical service to the streetlights and walkway lights within the promenade and Veteran's Park during a high-water event to avoid short circuiting or damaging of the system. Electrical Service shut-offs located at the 5<sup>th</sup> Street Promenade and at the electric meter panel near the northeast corner of 3<sup>rd</sup> and Main Street. The 5<sup>th</sup> Street electrical system is expected to remain above flooding and shutdown will likely not be required for flood events. However, the area should be monitored for unexpected flooding and the electricity turned off.

#### **9.3.5.4 Napa Creek**

- Remove any debris build-up at Main, Pearl, Seminary Street and pedestrian bridges and at the entrance of both culvert bypass entrances following a flood event.

#### **9.3.6 Site Specific Activities Following Flood Event**

Debris removal shall be made within 1-week following a flood event. Assessments for damage shall be made within 2-weeks of a flood event triggering the below actions. Repairs shall be made within 2 months after the assessment is complete which noted that repairs are needed unless dictated otherwise by P.L. 84-99 actions. Clean-up and repairs shall be made prior to opening public areas.

##### **9.3.6.1 Kennedy Park to Imola Avenue**

- The condition of the training dikes, biotechnical bank stabilization features, plant cover and recreation trail/maintenance roads should be assessed and repaired.

##### **9.3.6.2 Imola Avenue to 3<sup>rd</sup> Street**

- Inspect the condition of the levees, floodwalls, tidal rock, biotechnical bank stabilization measures and recreation trail/maintenance roads should be assessed and repaired as needed. Any repairs needed shall be made prior to opening the recreation trail/maintenance roads.

##### **9.3.6.3 3<sup>rd</sup> Street to Trancas Avenue**

- The condition of the levees, floodwalls, tidal rock, biotechnical bank stabilization measures and recreation trail/maintenance roads should be assessed and repaired.
- Before re-pressurizing the domestic water system the valve boxes need to be cleared of water and debris.
- The electrical receptacles need to be inspected for debris and standing water prior to re-energizing.

##### **9.3.6.4 Napa Creek**

- The condition of the floodplain terrace and bank stabilization plant cover should be assessed and repaired as needed.
- Inspection of bypass culverts for accumulated debris.
- The creek slopes should be inspected for any damage.

#### **9.3.7 Emergency Operating Procedure Checklist**

During a flood emergency, the following 4 steps are to be taken by the NCFCWCD or designee:

##### **STEP 1: Monitoring and Advisory (Flood Watch)**

GENERAL: Data on predicted rainfall and river stages from the USGS maintained Napa River Near Napa gage (located at Oak Knoll Avenue Bridge) will be utilized to substantiate potential flood conditions in the flood control project area. The National Weather Service (NWS) California-Nevada River Forecast Center provides stage forecast regularly during periods of flooding. This data will govern the determination to operate flood control infrastructure and mobilize response forces. The Lincoln Ave



Napa River gage and the Napa Creek Hwy 29 gage will also be used as additional data, however NWS only provides predictions for Oak Knoll. Elevations listed in these Steps are based upon gage datum for the individual gage. The Oak Knoll gage datum is 24.74 feet NGVD 29 (27.13 feet NAVD 88) and the Lincoln Ave gage datum is 0.0 feet NGVD 29 (2.39 feet NAVD 88). Note that Napa Creek will generally rise to flood stage sooner than Napa River.

- ❑ NCFCWCD will monitor levees, stream and channel levels. Time, stage and rainfall amounts are recorded by the Napa Valley Regional Rainfall and Stream Monitoring System accessible at <http://napa.onerain.com>.
- ❑ NCFCWCD will coordinate with the City and County Emergency Operation Centers (EOCs) on water levels and flow activities.
- ❑ NCFCWCD will monitor the NWS predictions for rainfall and river stage at Oak Knoll. If the river stage at the Oak Knoll gage is not predicted to rise above 20.0 feet, then the only action necessary is to continue monitoring the appropriate gages on Napa River and Napa Creek.

#### **STEP 2: Flood Warning (River Stage predicted to rise above 20.0 feet @ Oak Knoll River Gage)**

If the river stage is forecast to be greater than 20.0 feet at the Oak Knoll gage, then the following actions shall be completed at least 3 hours before the stage at Oak Knoll is predicted to reach 20.0 feet.

- Evacuate all pedestrians from within the Napa River Dry Bypass
- Post 'No Parking' and flood evacuation signage on McKinstry Street.
- Coordinate with City Parks staff to barricade, or place Do Not Cross Emergency Tape, at all pedestrian walkways or entrances leading into the bypass, Veteran's Park, and the Hatt to First lower walkway.
- Place emergency response contractors on standby.
- Notify the City of Napa Public Works and Police Department, the Department of Water Resources, and USACE, San Francisco District that the bypass has been closed to foot traffic and shall remain closed until the threat of flooding, or actual flood has passed. Notification to the above departments shall include the current water surface elevation, the predicted maximum water surface elevation, and the projected time necessary to complete remaining emergency preparation procedures.

At least 1 hour before the stage at Oak Knoll is predicted to rise above 20.0 feet the following actions shall be completed.

- Request towing of any remaining parked cars on McKinstry Street.
- Remove the low flow channel pedestrian crossing railings and store offsite.
- Install McKinstry Street closure signage
- Close North and South floodgates on McKinstry Street.
- Install stop log structures at Veteran's Park and the River Bypass floodwall near the Oxbow Market.
- Notify the City of Napa Public Works and Napa County Roads divisions to be prepared for possible sandbagging and flood fighting response.
- Stage flood fighting equipment at an accessible location outside known flooding areas.

## **Napa Creek**

At 7.5 feet on the Napa Creek Hwy 29 gage, flow will begin to enter the Napa Creek bypass culverts.. Personnel shall visually assess the culverts and terrace areas to verify if evacuation of pedestrians is necessary. Once flow begins to enter the bypass culverts, NCFCWCD staff will deploy equipment to clear the trash racks at the inlets as needed.

### **STEP 3: Flood Fighting (River Stage 22.0 feet or greater @ Oak Knoll River Gage)**

GENERAL: At this stage, the Napa River Bypass channel begins to flow over McKinstry Street. The Superintendant shall initiate the following activities.

- Notify the City of Napa Public Works and Napa County Roads divisions to be prepared for possible sandbagging and flood fighting response.
- Begin patrol of levees and floodwalls. Monitor for signs of erosion, boils, cracking, or other signs of distress.

### **STEP 4: Flood Evacuations (River Stage above 22.0 feet or greater and predicted to exceed 26.0 feet @ Oak Knoll River Gage)**

GENERAL: Notification shall be made to the City of Napa Public Works and Police Departments, the Department of Water Resources and the USACOE, Sacramento District. Notification shall include the water surface elevation, the rate at which the water is rising and the projected time to initiate Notification of Evacuation of businesses and residences adjacent to Napa Creek

- At 26.0 feet on the Oak Knoll gage, flow is expected to leave the channel at River Pointe near Lincoln Avenue.
  - At 27.0 feet on the Oak Knoll gage, flow is expected to leave the channel at the South Coombs area north of Imola Avenue.
  - At 28.0 feet on the Oak Knoll gage, significant flooding is expected to break out at Lincoln Avenue. Flow is also expected to leave the Napa River Oxbow near Taylor Street.
  - At 29.0 feet on the Oak Knoll gage, major flow is expected down the Soscol Avenue corridor between Lincoln Avenue and the River Bypass.
- ❑ The City of Napa Public Works Department will be notified and directed to execute emergency notification and evacuation procedures for each identified location.
- ❑ NCFCWCD will continue monitoring, record the time, stage and rainfall amount for Napa River at the 3<sup>rd</sup> Street Bridge staff gauge.

## **9.4 FLOOD FIGHTING METHODS**

The following flood fighting tactics may be needed. The following methods pertain to earth channel and natural river portions of the Project. The project superintendent may consult the DWR, State Flood Operations Center, and the USACE SPN District Engineer, for further guidance. The methods listed below and in Appendix F:1, Appendix F:2 and Appendix F:3 have proven effective during many years of flood fighting by Federal, State, and local agencies.

### **9.4.1 Scour and Erosion**

Scour and erosion may occur near places where trees, pipes, sewers, or other structures penetrate the riverbank or levee. All scour and erosion should be carefully observed to determine the necessity and adequacy of repairs to be accomplished. Observed scour and erosion should be repaired as quickly as possible. Areas of scour and erosion with the highest risk of compromising the function of the project shall be repaired first.

#### **9.4.2 Bank Caving**

In an emergency, rock riprap or rock-filled cribs, if properly placed, are very effective as protection against active bank caving. Riprap should consist of broken stone material and should be free of segregation, seams, cracks, or other defects that would impede its resistance to weathering. Neither the breadth nor the thickness of any piece of riprap should be less than one-third of its length. Riprap material should be in shapes that will form a stable protective structure. Rounded boulders or cobbles should not be used. As a general guideline, California Department of Transportation Class III riprap (10-24 inches in diameter) can be used for emergency operations. However, larger rock may be necessary at times if this gradation provides insufficient protection.

#### **9.4.3 Debris Accumulation**

During a major flood, the bridge foundations (piers/walls) and the three inlets to bypass culverts have the potential to become partially obstructed by large, floatable debris. Debris could accumulate on weirs, divider walls, bridge piers, and behind the numerous grade control structures in the river. In addition, vegetation planted along the riverbanks could trap floodwater debris that floats down the river. The weirs, inlet structures, bridge piers, and grade control structures should be checked for debris accumulation, and debris should be removed as quickly as possible to return the river to its pre-flood condition.

#### **9.4.4 Emergency Topping Methods**

The as-constructed line of protection, whether from the natural riverbanks or a structural flood control feature (i.e., gabions, downstream levees, floodwalls, or stone protection) must maintain the original design grades (elevations) for the life of the project. If any reaches or localized areas show signs of degradation below design grades, emergency grade raising should be conducted at once to restore the necessary grade and protect adjacent landowners. Emergency grade raising or control of overtopping includes sandbag topping, temporary levee, and lumber and sack topping as described in Appendix F:1.

#### **9.4.5 Site Security and Access**

It is critical that site security be maintained during and immediately following an emergency. Immediate surveillance of project features will ensure that public access to potentially hazardous conditions is restricted. Site security shall be maintained until the danger to the public has been removed.

#### **9.4.6 Flood Fight Documentation**

- Prepare a report documenting damages and proposed repairs.
- Prepare an After Action Report to include lessons learned and proposed changes to current procedures.

**9.5 TELEPHONE CONTACT LIST**

Department of Water Resources Floodplain Management

- (916) 574-1474

CA Department of Water Resources Flood Operations Center

- (916) 574-2619

U.S. Army Corps of Engineers Emergency Management

- San Francisco District Office: (415) 289-3079
- Sacramento District Office (916) 557-6884
- South Pacific Division office: (415) 503-6610

Napa County, City of Napa (Public Works, Police, and Fire Departments)

- Public Works Department: (707) 257-9520
- Police Department: (707) 257-9223 (24-hour non-emergency)
- Fire Department: (707) 257-9593

California Department of Water Resources (DWR), State Flood Operations Center

- (800) 952-5530
- (<http://www.water.ca.gov/about/contacts.cfm>)

California Emergency Management Agency

- (916) 845-8506

Federal Emergency Management Agency

- (202) 646-2500

California Department of Transportation

- (916) 654-2852

California Highway Patrol, Napa

- (707) 253-4906

Environmental Emergency Contact for Emergency in-water works

- (800) 424-8802

National Weather Service, Monterey Office

- (831) 656-1725

Pacific Gas & Electric

- (707) 257-5906

**SECTION 10 – MAINTENANCE & INSPECTION****10.1 INTRODUCTION**

This section details the inspection and maintenance required for proper care of the project elements. Completed projects must be adequately maintained if they are to function as intended. The FCD shall maintain and inspect project elements in accordance with local, state, and federal standards and requirements. The FCD is responsible for preserving maintenance and inspection records and making them available for Government inspection. Government inspections will be performed in consultation with the FCD. The SPN District Engineer may update this Manual for changed conditions and, if warranted, to correct conditions discovered during inspections. Such updates will be performed in consultation with the FCD and other regulatory agencies, as required. Alterations to original project features by the FCD shall be approved by the SPN District Engineer since alterations shall not be considered maintenance.

**10.2 SAFETY REQUIREMENTS**

FCD should be aware of, and adhere to, all federal, State, and local regulations that are applicable to this project. USACE Safety and Health Requirements Manual, EM 385-1-1, the Occupational Safety and Health Act (OSHA) Standards for Construction (29 CFR Part 1926), and Cal/OSHA are applicable to this project.

Scheduled maintenance work should not be performed within the Project limits during periods of high water flow and caution should be exercised during the potential high water season of October 1<sup>st</sup> through March 31<sup>st</sup>.

**10.3 APPROVALS REQUIRED PRIOR TO MAINTENANCE****10.3.1 Routine Maintenance**

- The sponsor shall maintain and obtain the necessary permits and authorizations to implement repairs below the high tide line or in- water work which involves rip-rap or placement of fill to correct scour and erosion.
- San Francisco District Dredge Management and Maintenance Office (DMMO) at telephone 415-503-6808 can guide the FCD if channel maintenance is required to re-align cross-sections by sediment removal. Sediment removed from discharge structures can be disposed of in an approved land fill, without authorization, if access can be gained from land owner.
- Any in-water work, except USACE-approved emergency work, will be conducted within the June 1 to October 15 work window (NMFS BO; USFWS BO; RWQCB Waste Discharge Requirement [WDR] General Finding #26).

In-water work is prohibited October 15 to June 1, unless specifically authorized by Federal and State regulatory agencies, i.e., USFWS, NMFS, RWQCB, and CDFW, to work outside of these dates. All relevant agency approvals can be found in Appendix E.

**10.3.2 Emergency Maintenance**

Any emergency maintenance measures or repairs which the superintendent deems necessary must be promptly taken or made and documented in the flood fight documentation. Other maintenance activities will be described in the “Status of Project Maintenance” annual report and must be approved, in writing, by the RWQCB Executive Officer prior to the work starting, as described in Finding 45 of the attached

RWQCB Order #99-074. This must also be coordinated with other national resource agencies (i.e., USFWS, NMFS, and CDFW) as their permits/approvals require (see Appendix E:4).

### **10.3.3 Project Alterations**

Project alteration current policy Section 14 of the Rivers and Harbors Act of 1899 and codified in 33 USC 408 (commonly referred to as “Section 408”) authorizes the Secretary of the Army, on the recommendation of the Chief of Engineers of the US Army Corps of Engineers (USACE), to grant permission for the alteration or occupation or use of a USACE civil works project if the Secretary determines that the activity will not be injurious to the public interest and will not impair the usefulness of the project. On July 31, 2014 USACE issued Engineer Circular (EC) 1165-2-216, *Policy and Procedural Guidance for Processing Requests to Alter U.S. Army Corps of Engineers Civil Works Projects Pursuant to 33 USC 408*. The purpose of this policy is to improve consistency in processing requests both geographically and across Civil Works project types, outline a process that is scalable to be commensurate with the anticipated impacts of an alteration, and provide those seeking alteration a clear understanding of information required by them in seeking alteration to a USACE project. The EC provides the policies and procedural guidance for an overall review process that can be tailored to the scope, scale, and complexity of individual proposed alternations, and provides infrastructure specific considerations for dams, levees, floodwalls, flood risk management channels, and navigation projects.



**10.4 INSPECTION SCHEDULE**

Table 10-1 gives the inspection schedule for specific items. All other items which are not included in this table shall be inspected on a schedule set by the superintendent, but a minimum of once per year.

**Table 10-1: Inspection Schedule**

	Section	Pre Flood Season (Fall, no later than October)	Immediately prior to every high water event	Following High Water Events	Every 90 Days During Flood Season	Following Flood Season (Spring/Summer)	Post Earthquake
<b>NAPA RIVER / CREEK</b>							
Improved Channels/Floodway	10.7.1	X		X	X		X**
Marshplain & Floodplain Terrace	10.9.1	X	X	X	X		
Levee & Freeboard Berm	10.7.3	X*	X	X	X	X*	X
Dikes & Planting Berm	10.7.3	X*	X	X	X		X
Floodwall and Retaining Walls	10.7.4	X		X			X
McKinstry Floodwall Gates	10.7.5	X		X	X	X	X
McKinstry St (integrity)				X			X
Bridges	10.10	X					X
Bypass Culverts/Trash Racks	10.7.7	X	X	X			X
Riprap and Planted Rock Protection	10.7.8	X		X		X	
Napa Creek Restoration	10.9.4	X				X	
<b>Drain System/Utilities</b>							
Drainage Channel & Gabion Wall	10.8.1	X		X			X
Flap Gates	10.8.2	X					
Drainage Through Dikes & Levees	10.8.3	Once every five years.	X				X
Positive Closure Structure	10.8.4	X					X
<b>Other</b>							
Flowage Easement Area	10.9.3	X		X		X	
Invasive Plant Control Survey	10.6.3					X	
Biotechnical Bank Stabilization	10.9.7	X		X		X	
Dredge Disposal Area							X

\* Inspections to occur within 1 week after mowing.

\*\*Napa Creek and Dry Bypass channels only

## **10.5 INSPECTION DOCUMENTS & REPORTS**

A joint meeting will be undertaken by the superintendent, USACE, and other invited agencies such as local utilities and the City of Napa to review and discuss the inspection report.

### **10.5.1 Semi-Annual Report**

#### **10.5.1.1 Inspection, Maintenance & Operation Semi-Annual Report**

Under 33 CFR Chapter II Paragraph 208.10(a)(6), a semi-annual report must be submitted within a 10-day period prior to June 1 and December 1 of each year to the USACE (SPN) District Engineer covering inspection, maintenance, and operation of the project features included in Table 10-1. The report shall include inspection performed during the month of October (before flood season) and the month of June (after flood season).

### **10.5.2 Annual Reports**

#### **10.5.2.1 RWQCB Report**

The FCD will submit an annual report of planned maintenance activities for written approval by the Executive Officer of the California Regional Water Quality Control Board, San Francisco Bay Region as required by Order #99-074. (Refer to Appendix E:4a, finding 45e) Monitoring and reporting will be conducted until performance criteria is satisfied or ultimately until performance criteria have been satisfied with the completion of the project as outlined in Section 4.8 and Section 6.3.

#### **10.5.2.2 NMFS Report**

An annual report will also be submitted to NMFS by April 15 of each year which summarizes the previous year's flood reduction, bank stabilization, and revegetation activities conducted pursuant to the Napa Project and will include planned activities for the following year. The report will include an estimate of all incidental take of steelhead resulting from disturbance, relocation, or incidental mortality.

#### **10.5.2.3 Inspection, Maintenance & Damage Reports**

- FCD semi-annual content and inspection checklist, see Appendix D:0
- Bridge Inspection Checklist, see Appendix D:2
  - See Section 10.10
- Annual Dike Inspection Checklist, See Appendix D:3
  - Use to inspect the Training Dike and Vineyard Dike on a yearly basis.
  - Levee Inspection Checklist, See Appendix D:4
    - NAP5, NAP6, and NAP7
  - Floodwall Inspection Checklist, see Appendix D:5
    - NAP2 and Dry Bypass Floodwalls
  - Channel/Floodway Inspection Checklist, see Appendix D:6
    - Napa Creek, Dry Bypass, Site 2 and Site 1.
  - Drainage System Checklist, see Appendix D:7
  - Dredge Disposal Inspection Report, see Appendix D:8
  - Deficiencies and Repairs, see Appendix D:9
  - Flood Damage Reduction/Segment/System Inspection Report - Appendix D:1

- Information Only for Sponsor. This Inspection Form will be used by USACE, SPN to perform the National Levee Database required yearly inspection for continued PL84-99 eligibility.
- The FCD must keep written records of all maintenance tasks performed and submit them with the annual report.

### **10.5.3 Vegetation & Environmental Reports**

#### **10.5.3.1 Annual Vegetation Report**

A vegetation report done every year for each project site (to be included in the annual report) will document the following information:

- Health of existing brackish emergent plants.
- Natural recruited native species present.
- Damage to the plants from acts of nature or other reasons.
- Document the removal of exotic trees from the Napa Creek Riparian Corridor.
- Deposition or removal of soil from planting area (~5.8- 6.6 feet NAVD 88) since previous year.
- Number of plants to be installed.
- Invasive weeds present and method of removal.
- Additional plant species installed at the site.
- Photographs taken at the time of inspection.
- Document volunteer native herbaceous plants, trees, and woody shrubs growing in the Project area to include: increase or decrease in volunteers, environmental changes, competing plant species, impacts (natural or manmade), and recommendations.

#### **10.5.3.2 Annual Revegetation Report**

The local sponsor must prepare an annual report (per calendar year) for all the revegetation sites for submittal to the USACE (SPN) District Engineer and/or his/her designated representative(s) by e-mail or conventional mail. Copies of the report must be provided to the resource agencies, at their request.

The annual report shall include:

- Address all significant events that took place during the previous 12 months.
- The checklists for all inspections. (FCD shall create their own checklist form to be used)
- A photographic record of overall conditions and specific significant damage.
- A summary statement of the general vegetation conditions for the reporting period.

The FCD will submit an annual report of planned maintenance activities for written approval by the Executive Officer of the California Regional Water Quality Control Board, San Francisco Bay Region as required by Order #99-074. (Refer to Appendix E:4a, finding 45e) The annual report for year ten shall include a Report of Waste Discharge for long-term maintenance activities necessary in all reaches of the Project after the initial ten years.

#### **10.5.3.3 Annual Conservation Measure report**

See Section 10.6.2.

#### **10.5.3.4 Comprehensive Vegetation Monitoring Report**

See Section 10.9.3.1.

### **10.6 MAINTENANCE & INSPECTION - ENVIRONMENTAL**

Most activities associated with maintenance of flood control projects are exempt from the statutory requirement for a USACE permit, or may be covered by a general permit. Some maintenance activities such as channel dredging or recontouring of project features would require specific Army Corps Regulatory Division authorization. Further information can be found on the USACE (SPN) Regulatory Division website (USACE, 2010b).

The project was also issued several environmental permits or approvals from various Federal and State resource agencies, as described in Section 2.2. The summary below provides an update and description of the most pertinent OMRR&R conditions from these permits or approvals.

Pursuant to USFWS BO File #1-1-99-F-0041 and subsequent BO re-initiations (see Appendix E:3); the FCD in conjunction with the Corps will reinitiate formal consultation with the USFWS for proposed work exceeding the BO limits in the 1999 BO or any of its subsequent re-initiations (see Appendix E:3). Special attention must be made to the May 21, 2012, BO amendment allowing limited work in the Salt Marsh Harvest Mouse (SMHM) habitat in Site 1A and 1B areas.

#### **10.6.1 Pickleweed and Saltmarsh Harvest Mouse (SMHM)**

The SMHM is a federal endangered species found primarily in pickleweed saltmarsh habitat. Figure 10-1 delineates pickleweed SMHM habitat that must be maintained under the maintenance requirements for Contract 1 dike and riprap areas, summarized below for SMHM from the May 21, 2012 Biological Opinion (BO). Appendix E:3 lists all environmental compliances that must be met prior to inspection and maintenance activities.

- All maintenance and repair activities including mowing, must be monitored in areas near SMHM habitat, by a biologist approved by the USFWS. (See the May 21, 2012, BO no. 6 for additional direction)
- Required maintenance and repairs must not operate during periods of extreme high tides. (See May 21, 2012 BO no. 1 for additional information)
- A field assessment of pickleweed must be performed by a USFWS approved biologist prior to any repairs or maintenance activity. (See May 21, 2012 BO no. 2 for additional information)
- Ensure that all staff involved with maintenance and repair activities attend SMHM awareness training. (See May 21, 2012 BO no. 4 for additional information)
- Removal of pickleweed for any OMRRR activities must be conducted by hand, without machinery. (See May 21, 2012 BO no. 5 for additional information)
- For major structural repairs of dikes or culverts. (see May 21, 2012 BO no. 7 for requirements)
- All earthmoving equipment will be cleaned of soil, seeds, and plant materials prior to arriving on site (and between sites). Implementation of the current Invasive Plant Control Plan to minimize the spread of non-native perennial pepperweed and other invasive weeds that threaten the upland refugia and tidal marsh habitat for the SMHM.

#### **10.6.2 Annual Report**

An Annual Report shall be prepared that documents repairs and maintenance activities. (Refer to the USFWS May 21, 2012 BO no. 3 for additional information). The annual maintenance report shall record the current calendar year activities, and will be submitted to USFWS by March 30 of the following year. This report shall include:

- Types and date of work of all maintenance activities in that calendar year
- Extent of work by all actions (including annual mowing), shown by both quantity (work area, lineal feet of dike or path) and by mapped location
- Pickleweed quantity (area) removed
- Saltmarsh Harvest Mouse (SMHM) sightings
- Photographs immediately before and after maintenance
- Copy of annual report for the herbicide eradication program



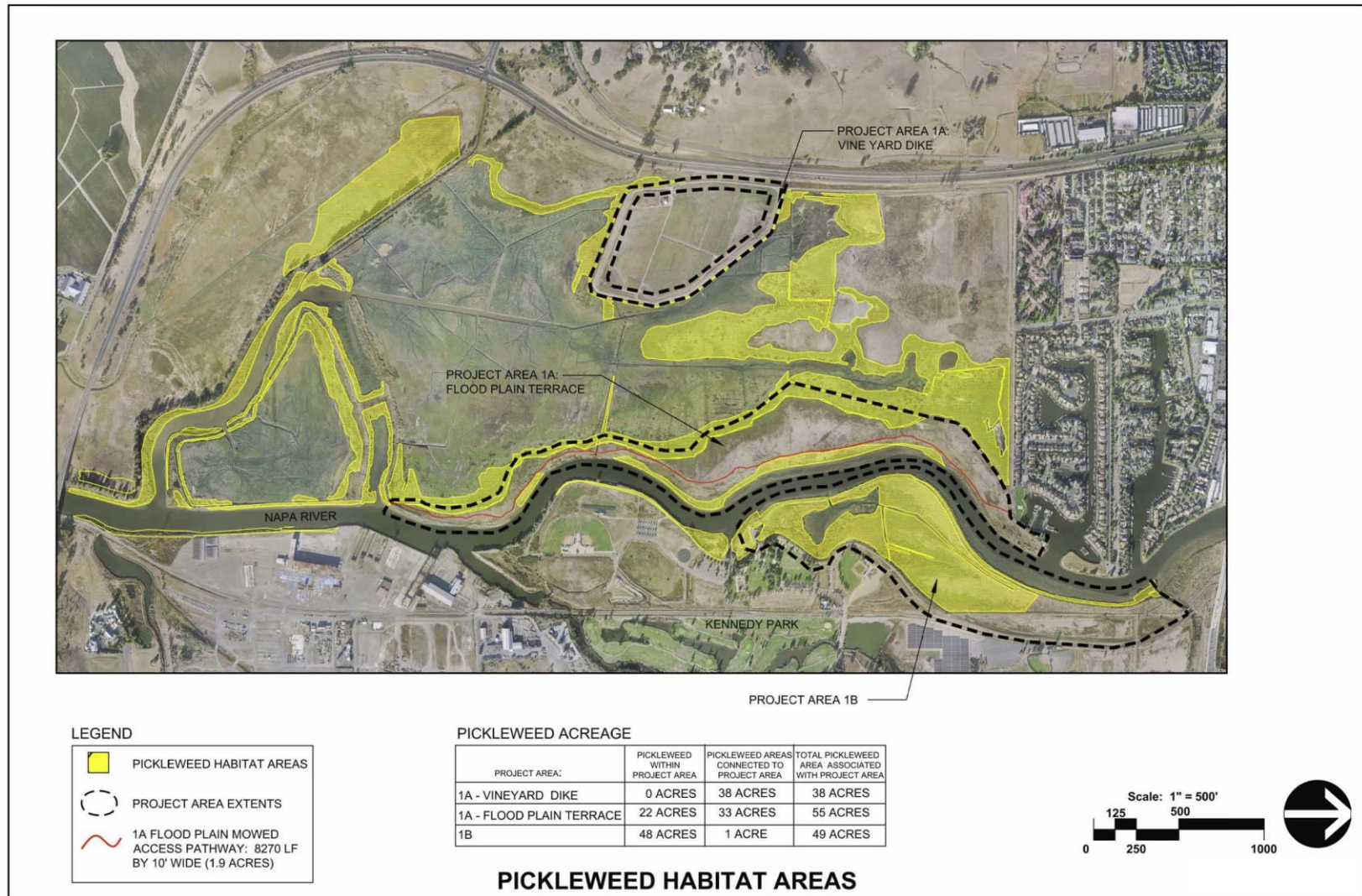


Figure 10-1: Pickleweed Habitat Areas

### 10.6.3 Invasive Plant Control Plan (IPCP)

The FCD has developed an IPCP that includes a schedule for annual spring identification and mapping surveys. The plan includes prioritization of treatment areas by species, specific species recommended control options (both mechanical and herbicidal), and post treatment re-vegetation guidance with adaptive management strategies and annual reporting requirements. The IPCP is consistent with the invasive plant inventory and control methods, as outlined by the California Invasive Plant Council (CIPC, 2010). Table 10-2 shows a priority ranking of the most invasive plant species that have been observed at Site 1A and Site 1B areas, and are currently the target species to be managed and eradicated. Additional species may be added to the list as needed.

The RWQCB Section 401 Certification discusses the importance of invasive plant control and the responsibilities of the Corps and FCD for this project. A list of invasive plant species relevant to the project is listed in Appendix E:9.

**Table 10-2: Priority Ranking for Invasive Plant Species Control and Monitoring**

Scientific Name	Common Name	Habitat Type				
		Woodland	Grassland	Wetland/ Riparian	Brackish Marsh	Mudflat
<i>Lepidium latifolium</i>	Pepperweed	Low	High	High	High	Low
<i>Centaurea solstitialis</i>	Yellow star-thistle	High	High	N/C	N/C	N/C
<i>Foeniculum vulgare</i>	Fennel	High	High	Medium	Medium	N/C
<i>Arundo donax</i>	Giant reed	N/C	N/C	Medium	N/C	N/C

N/C = No known occurrence

### Napa Projects IPCP

The FCD has developed as list of “A-rated pest plant species” that requires immediate control and will be limited to monotypic concentrations of no more than 100 square feet consisting of no more than 1% cover throughout the authorized project area and the SWOA will be limited to the following species:

giant reed (*Arundo donax*)  
 pepperweed (*Lepidium latifolium*)  
 purple loosestrife (*Lythrum salicaria*)

tree of heaven (*Ailanthus altissima*)  
 smooth cordgrass (*Spartina alterniflora*)  
 fennel (*Foeniculum vulgare*)

Manage the remaining invasive species, considered as B-rated pest plant species and listed as “high, moderate, or limited” in the current California Invasive Plant Inventory (Appendix E:9) so that they do not exceed 5% cover of the authorized project area and South Wetlands Opportunity Area (SWOA). The FCD current participatory efforts with “Team Arundo del Norte” and management control methods are beneficial and should be continued.

Consistent with standard Integrated Pest Management techniques practiced by the local sponsor, use of herbicides must be minimized. Mechanical and cultural weed controls must be used when feasible in lieu of herbicide application. Any herbicide use or other invasive plant control method must target only plants selected for removal. The FCD will ensure that weed growth is controlled on the firebreaks, if any, at each site.

### **10.6.3.1 Herbicide Eradication Program**

The herbicide eradication program report is required to be submitted with the Annual Report to the USFWS by March 30 of the following year (See Section 10.6.2).

- **Weed Survey:** Include a list of invasive species, include where each invasive species is growing, specify what habitat zone/area of the project the invasive is growing, and specify how much damage the invasive is doing prevent establishment of native plants.
- **Weed Eradication Program:** Include details of all mowing, general weeding (other than mowing), and herbicide applications including the chemical used, quantity, and total area sprayed per application.

## **10.7 FLOOD REDUCTION FEATURE MAINTENANCE & INSPECTION**

The following inspections shall be performed to ensure adequate operability of each project feature.

### **10.7.1 Improved Channels and Floodways**

Superintendent shall make the following inspection and prescribe required maintenance based on inspection findings.

#### **Inspection**

- Channel or floodway vegetation is acceptable as long as it meets the following requirements:
  - Does not reduce hydraulic capacity
  - Is located more than 15 feet from the waterside levee toe. Is located 15 feet from the face of the floodwall, or 8 feet from the floodwall foundation, whichever is less, with exceptions (exception: 10.7.3 – Vegetation Removal).
- The channel of floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments.
- Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred.
- Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

#### **Maintenance**

As prescribed by Superintendent.

#### **Location**

Any improved Napa River and Napa Creek shoreline.

### **10.7.2 Sedimentation Dredging**

The reach downstream of 3<sup>rd</sup> Street is part of the Napa River Navigation Project and navigation depths are maintained by periodic channel dredging by USACE (SPN). The Napa Project's design assumes that the navigation channel section will continue to be maintained. Observations should be made to note if sediment deposition is occurring in the Napa River just downstream of the bypass inlet. If sufficient deposition occurs in the river it could equate to more flow being diverted into the bypass than the bypass was designed to accommodate.

Maintenance of the Napa River channel and floodway will be based on results of the Performance Based Maintenance Surveillance Results as described in SECTION 11.

### 10.7.3 Levee, Dike and Freeboard Berm Inspection

Prior to performing maintenance and inspection on levees and berms, Section 10.6 shall be reviewed for important environmental features, specifically the BO exception granted for maintenance to Site 1 dikes. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion and other forces unless otherwise noted. Vineyard Dike, Training Dike, Planting Berm and Dredge Disposal Dike shall follow the requirements described below except if it conflicts with the Special Instruction given in Section 10.7.3.1, 10.7.3.2, and 10.7.3.3, respectively.

#### Location



**Figure 10-2: (left) Freeboard Berm Location, (right) Levee Location**

#### Maintenance

Maintenance activities shall follow the requirements of the CFR 208.10 (b) for Levees (Appendix H:1) which has been summarized below with additional site specific instructions:

- The water side levee slope and adjacent marsh and floodplain terraces shall not be tread upon by equipment (excluding mowing equipment).
- Fill up holes or washes in the levee crest and slopes. Where new construction has been completed during the year and vegetation has not had time to become established, rain washes and deep gullies may have developed.
- Repair gaps where the levee is below grade. Borrow material normally needs to come from off-site commercial sources. However, onsite borrow material can be used, provided the borrow material is excavated at least 50 feet from any project feature. All borrow material, whether off-site or onsite, must meet the following conditions:
  - Borrow material meets specifications for levee fill material given in the third bullet under Slope Stability below.
  - Borrow material is clean and free of any contaminants.
  - No other environmental impacts to cultural resources sites, threatened and endangered species, water quality, or other resources occur when obtaining the material.

*Vegetation – mowing:*

- Grass cover on the dike slopes will be kept below 12 inches at any time during the year.
- A minimum of once a year, prior to the October inspection before flood season, the crests and slopes must be mowed to no more than 2 inches in height to allow for a thorough inspection.
- All mowing shall occur between March 1 and November 30 and be timed to interrupt weed seed production.

*Vegetation – removal:*

- New growth of woody vegetation (trees and shrubs) must be removed from the dike and levee sideslopes, the landside toe easement area, and within 15 feet of the waterside toe. For a floodwall the waterside and landside toe vegetation clearance should be 15-feet from the face of the floodwall or 8-feet from the floodwall foundation, whichever is less, before vegetation has time to become well established. Removal of woody vegetation shall include removal of all roots greater than larger than half an inch in diameter. After removal of woody vegetation, including roots, the voids shall be filled by placement of levee fill material in 6 inch lifts and compacted. There is an exception to the 15-ft landside and waterside easement area as the Napa project in general uses biotechnical bank features. The planting berm within the contract 1B limits was specifically constructed as a berm with vegetation where the vegetation can be maintained. The planting berm isn't considered a flood control levee but rather a berm to support vegetation in order to keep it out of the floodplain terrace area. The area beside and east of the 2W floodwall which was planted with Tules, the planting berm for the 2E levee, the planting berm/training dike in 1B, and the incomplete Imola levee which runs parallel to Imola Avenue are exceptions to the landside easement requirement. Other smaller area that are exceptions are provided in the Quick Reference Maintenance Guide table. Levee fill material is defined in the Slope Stability section below.
- Native upland grasses on the levee slopes and the landside and waterside toe easement areas must, when dry, be mowed to a height of 3 to 6 inches at any time the grass reaches a height of 12 inches. A minimum of once a year, shortly prior to the October inspection before flood season and coordinated with the USACE (SPN) Inspection of Completed Works (ICW) Program Manager, the dike/levee/berm slopes and toe easement areas must be mowed to no less than two inches in height to allow for a thorough inspection. A good grass cover on the dike/levee/berm slopes will minimize erosion of the slopes during rain and flood events.

*Erosion Protection:*

- Service/patrol roads along or on the dikes and levees need to be maintained in a usable condition during all weather conditions, especially during periods of precipitation, to allow vehicular patrols and monitoring of embankment performance. All holes, soft areas, or cracks need to be filled and compacted with aggregate similar to the type used in the roadway base. Tire ruts on the crest must be repaired by blading of the aggregate course or by adding additional compacted aggregate course. If rutting routinely occurs at times when the dikes, levees, and berms are not saturated by rainfall, then the speed of vehicles driving along the crest road needs to be reduced.
- No action will be taken that will compromise erosion protection of the earth structure. An example of an inappropriate action would include burning grass or weeds along the embankment or toe areas just prior to the normal rainy season.
- Any barren embankment side slopes that have been disturbed by maintenance and repair activities or other reasons must be reseeded before the rainy season (November 15), if at all possible. Preventative measures such as employing straw rolls and straw mulch need to be considered as measures to prevent erosion, such as gullies and rills on levee slopes, especially if the barren areas are seeded later than October 15 of a given year. Some of the most important conditions that need to be considered when planting native grasses for erosion control are: the importance of the grass to grow quickly and the overall amount of moisture in the soil during the year. A quick cover native seed mix (*Vulpia microstachys* and *Trifolium willdenovii* species), a seed mix with species



tolerant to dry conditions, and a native seed mix with species adaptable to moist conditions would satisfy the requirements/conditions listed above. The end product must be a continuous stand of grass chosen for a given site.

- Embankment side slopes must be kept clear of debris and trash. It is common for woody debris and trash to be deposited on the waterside slope during flood events. These items must be removed from the slopes as soon as possible after they are observed. Woody debris and trash hinder grass mowing and inspection activities, and woody debris may encourage burrowing animals.
- Unauthorized vehicles are not allowed on the dikes, levees, and berms; however, pedestrians and bicyclists are allowed on the dike/levee/berm crests, but not the sideslopes. This is provided that such activities do not adversely impact the ability of the maintaining agency to inspect, maintain, and flood fight the embankments. No encroachments or modifications will be made to the dikes/levees/berms or the landside/waterside toe easement areas without prior approval from the USACE (SPN) District Engineer.

*Slope Stability:*

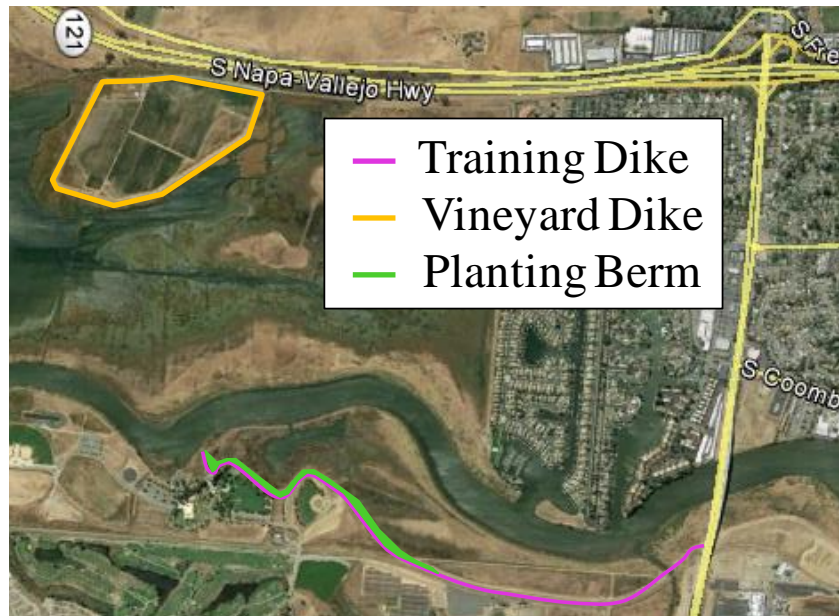
- The slope of the dike/levee/berm crest needs to be maintained to allow surface runoff to drain readily and prevent ponding on the crest.
- The dike/levee/freeboard berm cross section needs to be maintained at its original design elevation and geometry. See Section 11.2.2 for Levee/Dike Surveillance.
- Dike, levee, and berm slopes need to be kept free of surface erosion rills or gullies using preventative measures or repairs. Any missing portion of the original embankment cross section due to erosion or other causes needs to be replaced. Rills and gullies in need of repair must be filled with levee fill material. Levee fill material is soil that meets the following physical property requirements:
  - Maximum particle size of 2 inches,
  - Minimum of 20 percent by weight passing the number 200 Standard Sieve,
  - Liquid Limit below 45,
  - Plasticity Index between 7 and 25, and
  - Be free of organic material.
- Levee fill material also must be able to support grass growth in any areas where grass cover is required for erosion protection. In these areas levee fill material must have adequate nutrients for plant growth or must be amended with fertilizers to sustain adequate native grass growth and must not contain substances toxic to plants (such as salts). Where grass cover is required, levee fill material must fall into one of the following agricultural soil classifications: loam, clay loam, sandy clay loam, silty clay loam, or loamy clay. A minimum of 6 inches must be excavated around the eroded area prior to placing fill. The excavated material may be re-used during the repair. Fill needs to be placed in loose layers not exceeding 6 inches in thickness and compacted to a density equal to that of the original embankment.

*Rodent Abatement:*

- A rodent abatement program needs to be employed as soon as evidence of burrowing activity is found on the dike/levee/berm embankment or toe. Burrows and dens may be filled in with either a low-pressure grout or over-excavation and backfill with compacted levee fill material assuming the SMHM is not present. If it is determined that SMHM is present, grout and backfill to correct levee deficiencies will not be possible to undertake. For circumstances on abatement in areas that are SMHM habitat see Section 10.6.1.
-



- Construction/installation of raptor perches within the Project area is not acceptable. This encourages raptor populations in SMHM habitat which is contrary to encouraging the SMHM species.



**Figure 10-3: Location Map of Dikes and Planting Berm**

#### **10.7.3.1 Vineyard Dike Special Instruction**

Do not mow the emergent marsh grasses planted at the waterside toe of the Vineyard Dike; only dike landside slopes, and crest should be mowed. The marsh grasses on the water side toe have shallow, fibrous root systems similar to upland native grasses and pose no additional hazard to the dike. All woody vegetation shall be removed from the dike's landside and waterside slopes as soon as detected so it does not become established. Refer to the Quick Reference Maintenance Guide for special instructions for the maintenance of the Vineyard Dike.

#### **10.7.3.2 Training Dike Special Instruction**

Do not mow the wetlands at the waterside toe of the Training Dike contained in site 1B. Retain woody vegetation on the waterside Planting Berm. Refer to the Quick Reference Maintenance Guide for special instructions for the maintenance of the Training Dike.

#### **10.7.3.3 Planting Berm Special Instruction**

Retain woody vegetation on the Planting Berm on the waterside of the Training Dike, but remove volunteer trees/shrubs that start to grow within 3 feet of the edge of the crest road pavement, and existing woody vegetation that is diseased or dead. Do not remove existing mature trees near the landside toe of the Training Dike at Kennedy Park unless they become diseased and die. Removal of woody vegetation includes the tree/shrub branches and trunk and all roots larger than half an inch in diameter. After removal of woody vegetation, including roots, the voids shall be filled by placement of levee fill material in 6 inch lifts and compacting. Conduct woody vegetation removal only by hand methods on or near the Site I dikes

during the low tide cycle. Hand methods include use of hand-held mechanical weed whippers. Refer to the Quick Reference Maintenance Guide for special instructions for the maintenance of the Planting Berm.

#### **10.7.3.4 Dredge Disposal Dike Special Instruction**

There are no specific vegetation management requirements for the dredge disposal dike as it is located on the landside of the project flood risk management levees. The FCD can use their own judgment for the management of vegetation on this dike. The FCD should consider their ability to inspect, maintain, and repair the interior and exterior dike slopes as well as the future ability for dredge tailings disposal when deciding whether or not to remove living woody vegetation; dead or dying woody vegetation must be removed from the dike slopes. Excessive woody vegetation on the interior and exterior dike slopes may make inspection and routine maintenance (such as mowing and repair of cracking) more difficult, and excessive woody vegetation on the interior dike slope may interfere with the future placement of dredge spoils within the disposal cell.

The discharge pipe through the dike is not required to be videoinspected every 5 years. The purpose of the discharge pipe is to drain water from future disposal of dredge tailings to the exterior of the cell. The FCD will perform a visual inspection of the discharge pipe yearly looking for visible damage and/or obstructions. This inspection includes shining a high-powered flashlight into both ends of the pipe. Erosion, “sinkholes”, and cracking of the slope directly over the pipe may be an indication of pipe damage which must be investigated and repaired. The discharge pipe must be videoinspected prior to the disposal of dredge spoils within the disposal cell to assure that the pipe is undamaged and will function as intended. Any damage to the discharge pipe revealed in the videoinspection must be repaired prior to disposal of dredge spoils within the disposal cell.

#### **10.7.4 Floodwalls and Retaining Walls**

##### **Maintenance & Inspection**

Floodwalls and retaining walls should be inspected for unusual vertical or horizontal movement, cracking or spalling. Should cracking appear, a structural engineer with at least 10 years of structural experience shall observe the cracking and recommend a monitoring plan or determine the level of repair necessary for the floodwall or retaining wall. When the recommendation is made the plan shall be sent to USACE San Francisco District for approval prior to initiating the recommended fix.

Maintenance shall not include the removal of tules along the waterside of the 2W floodwall. The 2W floodwall was specifically designed with this vegetation. In addition, along the downstream bypass retaining wall for the Napa Creek project (closest to the Chop House), vegetation whose roots will not impact the retaining wall have been planted in this area and maintenance activities shall not remove this vegetation.

Proper drainage is important to ensure proper stability of retaining and floodwalls. The terraced walkway between the Hatt Building and 3<sup>rd</sup> Street on the west bank will require inspection after each flood event. Repair and/or replacement of the asphaltic concrete and recreational features shall be performed as needed throughout the life of the project. See Section 10.8 for inspection requirements for drainage features.

##### **Location**

See Table 10-5 for location of Floodwalls and Retaining Walls.

#### **10.7.5 McKinstry Street Floodwall Closure Gates**

**Location**

The floodwall closure gates are integral components of Floodwall 352 and Floodwall 362 located along the Dry Bypass boundaries of McKinstry Street.

**Inspection and Maintenance**

The following inspection and maintenance is to be performed as required by Table 10-1 and in accordance with evaluation, inspection, and repairs as provided in EM 110-2-6054.:

- Check for debris that has accumulated on the gates and removable gate post pockets
- Clean hinges (Oiling of hinges is not required) and internal structural components and refinishing wood surfaces as needed.
- Check to verify that no damage to the structural portions of the gates including hinges, anchoring post, structural members, gate seals or other related structural components has occurred.
- Check for vandalism
- Annually by October 1st:
  - Check gate locking mechanism
  - Unlock and exercise each closure gate
  - Check and operate the gate center post lift mechanism
  - Check and operate the hand wheel and bevel drive assembly. Maintain per manufacturer's recommendations.

**10.7.6 Stoplog Structures**

Stoplogs are stored at Veteran's park within 10-feet from the intended installation, and approximately 500-feet from the intended installation for the Dry Bypass. Each stoplog weighs approximately 20 pounds. They are 14-feet long and approximately 6-inches wide and made of aluminum. The following inspection and maintenance is to be performed for the stoplog structure and should be followed in accordance with EM 110-2-6054.

**Location**

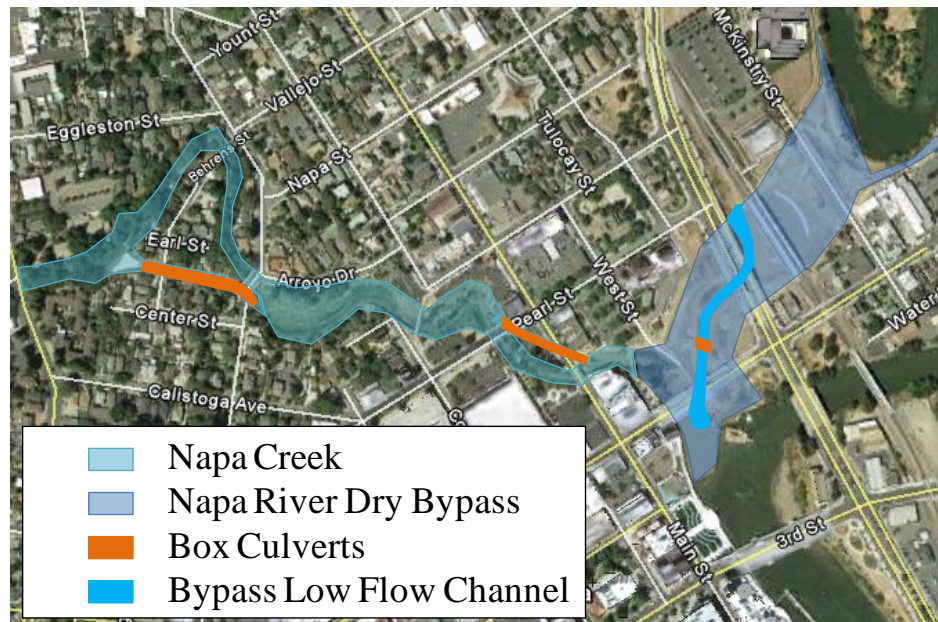
- Veterans Park
- Stoplogs on the Dry Bypass floodwall left bank behind the Oxbow market.

**Inspection & Maintenance**

- Remove any debris that may have accumulated within stoplog guide embedments.
- Check neoprene seals for wear and damage. Repair or replace as necessary.
- Ensure nonslip coating on sill plate is performing as required.
- Install stoplog guides yearly and check for damage or leaks.
- Check for any signs of corrosion. Repair as necessary.
- Clean as necessary.

**10.7.7 Napa Creek Bypass Culvert and Dry Bypass Box Culvert****Location**

There are two underground dual box culvert bypasses along Napa Creek. The downstream box culvert bypass is located between Main Street and Pearl Street and the upstream box culvert bypass is located between Seminary Street and Behrens Street. The dry bypass box culvert forms a "bridge" over the low flow channel in the dry bypass along a recreation trail. The box culvert locations are shown on Figure 10-4.



**Figure 10-4: Box Culvert Location Map**

### **Inspection and Maintenance**

- The Napa Creek bypass culverts may be inspected by walking through the culverts. The Dry Bypass box culverts may be inspected by shining a high-powered flashlight into the interior of the culvert from both ends.
- It is recommended that photographs be taken of the box culverts during inspections.
- Spalling, cracking, tilting, leaking, settlement, and joint displacement of the concrete shall be evaluated by a structural engineer with at least 10 years of structural experience. The engineer will develop monitoring or repair recommendations based on the cause and severity of the anomaly.
- Debris must be removed from inlet of box culverts
- Culvert interiors shall be cleaned of debris and sediment or anything that may impede the hydraulic capacity.

### **Special Inspection for Napa Creek Box Culvert**

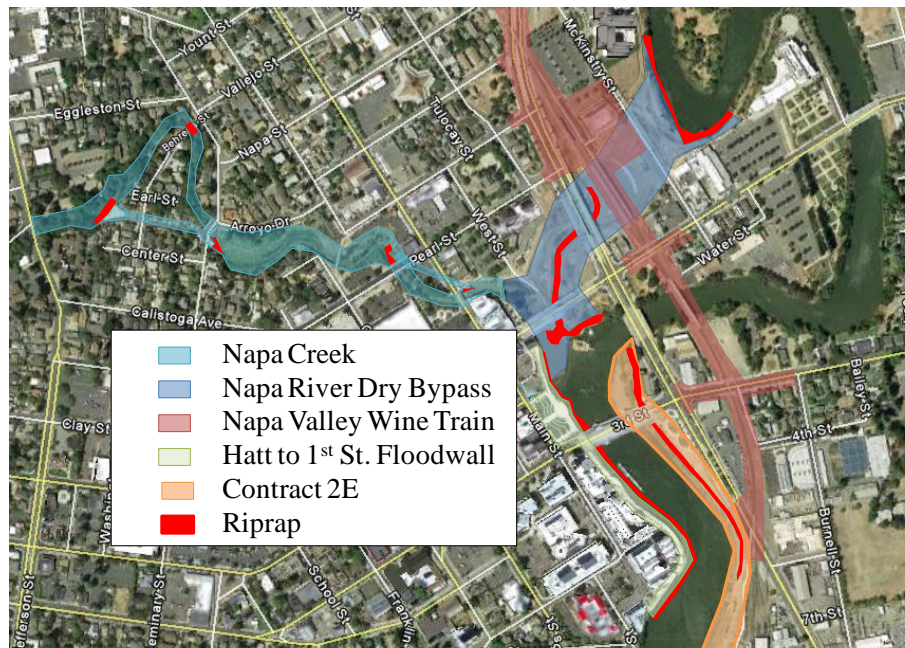
Inspection and maintenance shall include the concrete apron at the inlet for any cracks, removal of debris from the trash racks at the inlets of the bypass box culverts, inspection of the interior box culvert for the presence of cracks, sediment and debris, inspection of barrier railing atop inlet and outlet walls, verify operation of access control gates and fences at the bypass culvert inlets and outlets. Sometimes large voids can form above the culverts that are not visible on the ground until a “sink hole” develops. Inspections should check for this. Tapping the sides of the culvert could help locate hidden voids that could point to piping issues. Check for piping around the culvert, check for settlement, cracking, and discoloration of the box culvert that can lead to loss of water in the box culvert and contribute to piping of the surrounding soil and structural failure of the box culvert.

### **10.7.8 Riprap and Planted Rock Protection**

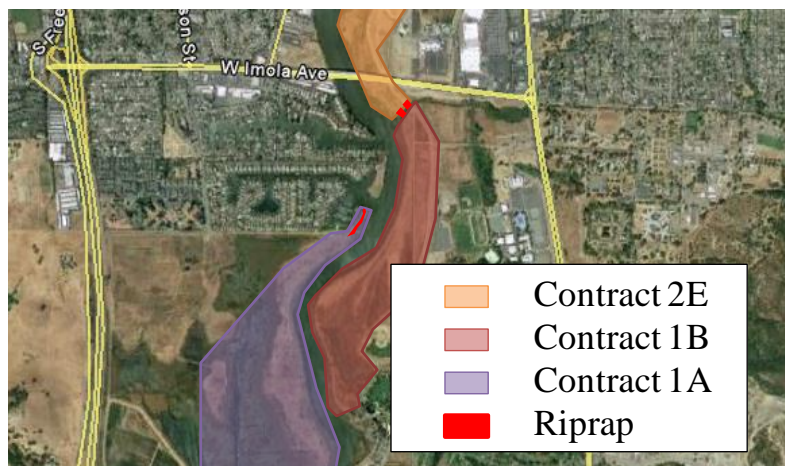
During floods the Napa Creek and Napa River experiences high velocity flow which can cause erosion of slopes. Riprap deterioration could result in instability and erosion of the protected slopes endangering



nearby structures and adding sedimentation issues downstream causing premature maintenance activities. See Table 10-6 to reference locations of riprap on the project site.



**Figure 10-5: Location of Riprap around Downtown Napa**



**Figure 10-6: Location of Riprap in Southern Project Reach**

### Potential Challenges

- *Slumping or other rock displacement.* A riprap slope may become unstable similar to an earthen embankment, resulting in rock possibly sliding down the slope. Individual stones may also become displaced due to flood flows or human activity. Rock displacement results in a reduced riprap thickness at some locations, resulting in a reduction in the erosion protection provided.
- *Stone deterioration.* Over time individual stones may slake or break apart. Riprap is sized based in part on the expected flow velocity. Smaller sized rock may be washed away or displaced during floods, resulting in a significant reduction in erosion protection for the impacted slopes.

- *Vegetation growth.* Over time vegetation will grow up through the riprap, which can cause problems with visual inspections and it may increase the rate of riprap deterioration. The vegetation needs to be suppressed except where riprap has been covered with soil and planted as part of the project construction (i.e., 2W floodwall marshplain terrace, the 2E remediation site from 6<sup>th</sup> to 3<sup>rd</sup> Streets for bank protection, and the inlet and outlet of the Napa dry bypass channel (there are other exceptions not mentioned which can be referred to in the project map and the Quick Reference Maintenance Guide in order to locate these areas)). Vegetation is also allowed to grow at those locations where it was planted during construction.
- *Debris accumulation.* Debris, including trash and wood, will tend to be deposited on the riprap during flood events. Debris interferes with inspections. Impacts with heavy debris may cause rock displacement.
- *Displacement by people.* Fishing platforms, windbreaks, etc.

**Maintenance**

- Riprap must be maintained as a smooth slope to the original size, design elevation, thickness, and geometry. Rock displacement must be repaired by moving stones back into position on the slope or adding additional stones of the appropriate size to maintain the design thickness.
- If significant deterioration of individual stones occurs, additional riprap needs to be placed on the slope. The new riprap needs to be keyed at the toe of the slope in the same manner as the original riprap. In no case shall the underlying geotextile or aggregate bedding material be exposed. If the geotextile or bedding material becomes damaged, it must be removed and replaced as well in accordance with manufacturer criteria.
- Debris needs to be removed from the riprap slopes.
- Soil covering and native planting should be inspected and replaced as required.

**10.8 DRAINAGE SYSTEM/OUTFALL MAINTENANCE & INSPECTION**

Structures need to be inspected by an individual familiar with or having inspection experience with drainage facilities. Inspections performed in SMHM habitat need to follow requirements of Section 10.6.1.

Interior drainage systems collect local surface runoff collected behind project dikes, levees, floodwalls and retaining walls. The surface water is discharged into the channels through pipes. Surface drains and inlets provide collection points from promenades, walkways, ramps and platforms and discharge collected water via storm drain piping and wall penetrations. Routine inspection and maintenance of outlets and flap gates is critical because failure or clogging could cause flooding of areas behind the dikes, levees and floodwalls.

**10.8.1 Drainage Channels & Gabion Wall****Location**

- Drainage channels were constructed in Site 1B at Napa River Station 647+00 and the Site 2E area in the vicinity of Imola Bridge.
- Dry Bypass:
  - The open channel north of the Soscol Avenue Bridge will be retained and will discharge into the new low flow channel. This channel extends south to discharge into Napa River.
  - The gabion wall is located at the most upstream location of the Bypass Low Flow Channel shown in Figure 10-4.

**Potential Challenges**

- Vegetation growth (large trees, cushy vegetation) within the channel, thereby reducing its hydraulic capacity.



- Excessive accumulation of sediment and debris within the channel.
- Bank erosion and sediment deposition.
- Check for signs of erosion around gabion baskets.
- Remove debris that has accumulated behind gabion wall.
- Verify that no rocks have been displaced, washed out or removed.
- Check wire casing of gabion basket for damage from debris, vandalism, or general deterioration. Repair to manufacturer specifications, including replacing any rock that may be missing.

**Maintenance**

- Perform maintenance as required to keep channel and gabion wall in normal working order or as required by the superintendent. Annual inspection of the gabion wall wire basket for cut, damaged or weakened basket wire. Repair per manufacturer's recommendations or recommended repair for gabion baskets.

**10.8.2 Flap Gates****Location**

See Table 10-9 for locations of flap gates.

**Inspection**

- Note any soil erosion and vegetation growth near the structures that may inhibit stability and performance. Also note any cracking spalling, tilting of the headwalls, and settlement of the headwalls or concrete pads and whether damage is cosmetic or structural.
- Prop flap gate open and shine a high-powered flashlight through the conduits from both the inlet and the outlet, when possible. Note any visible debris, sedimentation, misalignment, and damage to the conduit. Video tape on a periodic basis if visual inspection is inconclusive.
- Remove any debris, sediment, and vegetation from the inlets and outlets and within the conduit pipes.
- Repair any erosion adjacent to inlets and outlets that threatens the stability and performance of the structures. Place riprap protection in eroded areas to prevent further erosion.
- Check the gate for alignment and seating.
- Examine and trial-operate flap gate as part of the routine maintenance program.
- Assembly bolts and pivot lugs need to be free of corrosion and shearing.
- Growth of "slime" on the metal flap gates and concrete portions of drainage structures. The FCD will determine the need for cleaning individual structures based on the yearly inspection.
- Make sure flap gate is seating properly.

Note: Flap gates that are mounted to the face of Site 2W: Hatt to 1<sup>st</sup> Street lower floodwall (Wall no. 1) will require special equipment for maintenance and inspection, either through the use of an articulating boom from above or via access from the riverside below.

**Maintenance**

- All flap gates must be lubricated and tested for smooth operation annually in the fall.
- Adjustable pivot points need to be free of any stiff or binding action. Do not damage studs or jam gates in an open position.
- The structures must be cleaned with water only (no bleach, detergents, etc.) using a wire brush or a power washer. All rinseate must be contained in buckets or small basins. The material shall be disposed of off-site as non-hazardous waste.

- All problems found during the inspection need to be corrected immediately. If damage is significant or if the same damage occurs repeatedly, an engineer needs to evaluate the structures to determine the cause of the problem and develop a corrective action to eliminate the problem.

### **10.8.3 Drainage through Levees, Dikes and Floodwalls (Excludes Flapgates)**

Follow inspection requirements included in Section 10.8.2 and special inspection requirements below.

#### **Location**

- Dry Bypass
  - Storm drain that passes through floodwall
  - Gravity sewer under the Dry Bypass
- Site 2W – Hatt to 1<sup>st</sup> Street
  - 3<sup>rd</sup> Street Bridge drainage through floodwall
- Site 2E
  - Two sanitary sewer lines that cross Site 2E levees. One crosses the Imola levee near the Caltrans drainage structure and the other crosses the NAP5 levee just north of the Imola Bridge.
- Site 1A – Vineyard Dike drainage
  - North and south Interior drainage structures comprised of a 24-inch inside diameter reinforced concrete pipe and their outlets are located at the dike encompassing the vineyard.

#### **Maintenance & Inspection**

Once every 5 years, conduits shall be inspected using video and/or sonar, depending on conditions. Video is preferred when the pipe is completely dry. Due to endangered species and Clean Water Act issues, dewatering of the conduits for inspection is not practical. The video/sonar inspection must be performed at low tide to minimize the amount of standing water in the conduit inverts. The portion of the conduits above water will be video inspected, and the portion of the conduit below water will be sonar inspected. The inspection must be done without cleaning the conduits if possible. If the conduits must be cleaned to be adequately inspected, effluent water must be vacuumed into a storage truck. The effluent water within the truck will be tested for turbidity and pH. If those values are within the Numeric Action Levels (NALs) (pH between 6.5 and 8.5, and maximum turbidity of 250 Nephelometric Turbidity Units (NTU)), the water can be discharged on the waterside of the dike, levee or floodwall, at a location/rate that prevents erosion. If the water exceeds the limits, it can be sprayed onto the crest or access road for dust control. The video inspection must be conducted by personnel certified by National Association of Sewer Service Companies Pipeline Assessment Certification Program (NASSCO PACP). Provide a copy of the video and the video/sonar inspection report to USACE (SPN) with the next regularly submitted inspection report.

### **10.8.4 Positive Closure Structures**

Positive closure gates are installed on the storm drain outlets that pass through floodwalls and levees to allow discharge of storm water and prevent water from flowing back into the drainage system during flood events.

#### **Location**

- Imola Levee – Cal Trans Slough Gate
- Dry Bypass
  - The West Street system drains under Floodwall 352 and will have a concrete box installed on the dry side of the floodwall next to the existing drop inlet (water collection system). Within

the concrete box a positive control valve gate is installed per the USACE requirements. This gate allows the flow into the piping system to be closed if there is a problem with the pipe crossing under the floodwall.

### **10.8.5 Storm Drain – Trench Drain & Wall Drain Outlets**

#### **Location**

Trench drains and outlet gate boxes are located at various locations throughout the Site 2W area (see Figure 8-1). See Table 10-7, Table 10-8, and Table 10-9 for location of storm drains, trench drains and wall drain outlets throughout the project.

#### **Potential Challenges**

- Blockage of trench drains, drainage inlets and area drains due to vegetation, trash, siltation, and debris.
- Damage to outlet gate boxes and outlet pipes by impact of floating debris inhibiting internal flap operation.
- Accumulation of debris in safety grates.
- Erosion adjacent to drainage structures that endangers water tightness or stability of outlet pipes.

#### **Inspection & Maintenance**

- The outlet gate box covers need to be removed for these periodic inspections and to verify operation of the interior flaps.
- Trench drain covers need to be removed annually in the fall, and the trench drains flushed with water to remove debris and sediment.
- Washing of trench drains following removal of grates allows maintenance staff to verify discharge flow during maintenance activities.

### **10.8.6 Dry Bypass Gravity Sanitary Sewer System**

#### **Location**

An existing 48-inch-diameter gravity sanitary sewer main crosses the bypass channel on a diagonal alignment just downstream from McKinstry Street. Final grading provides for approximately 1 foot of soil cover over a 12-inch-thick concrete pipe cap. The top of the 48-inch sewer line is approximately 2 feet below the top of the concrete cap.

The 48-inch sewer crosses the floodwall in two locations within the project limits. One crossing is under Floodwall 352 near the Wine Train Station. The second crossing is under the Floodwall 362 closure gate on McKinstry Street. Both crossings are located under the structural elements of the floodwalls and are encased in a Controlled Low Strength Material (CLSM) concrete. The crossing details are illustrated in Appendix A:20 on sheet S-118 for the crossing under the closure gate and sheet S-231 for the crossing under the wall.

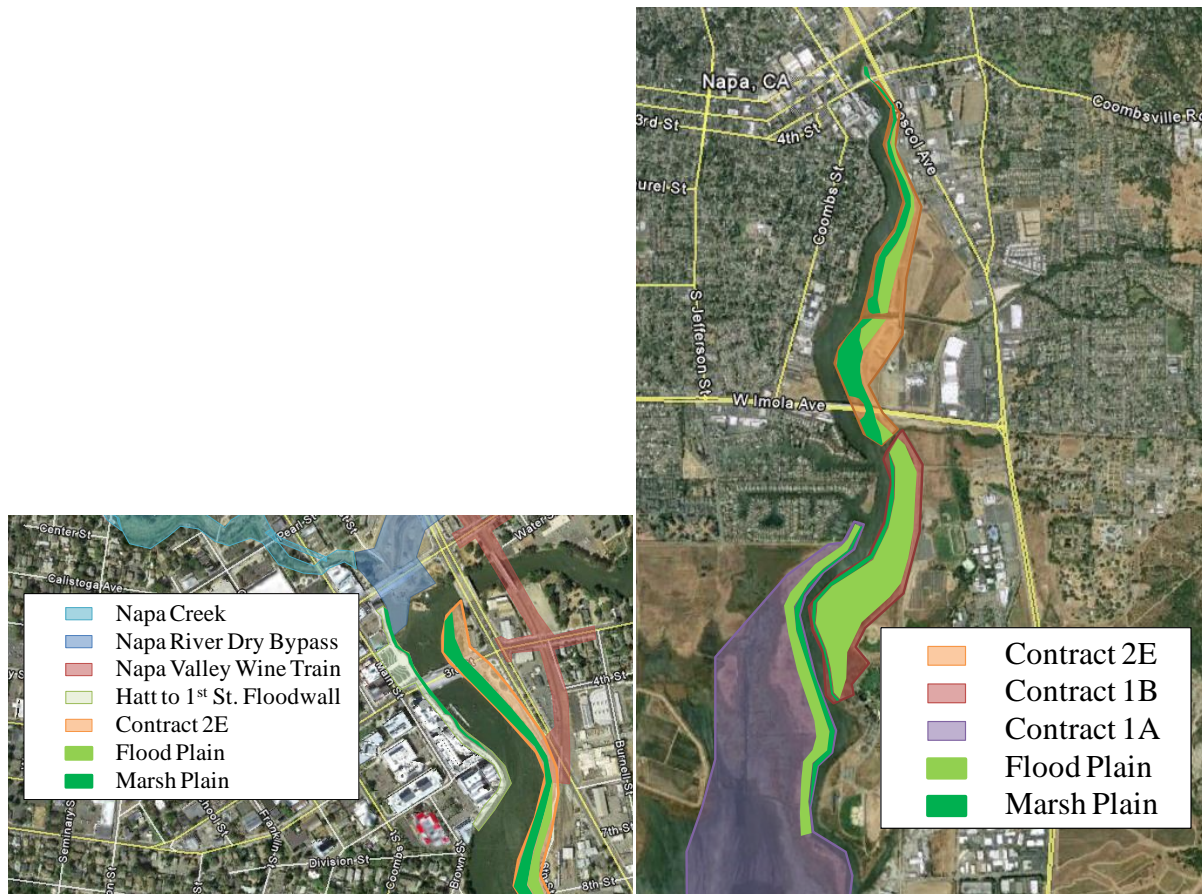
#### **Inspection**

These crossings shall be inspected semi-annually and before/after flood events to monitor for any movement in the walls or settlement along the pipe crossings.

## 10.9 PLANT CARE MAINTENANCE & INSPECTION

### 10.9.1 Marshplain and Floodplain Terrace

A larger variety of vegetation will attempt to establish on the floodplain terrace and on the slope from the marsh plain terrace to the floodplain terrace. Vegetation must be closely controlled on this terrace or flow conveyance could be significantly reduced.



**Figure 10-7: Location of Marshplain and Floodplain Terrace**

#### 10.9.1.1 Floodplain Terrace Vegetation

##### Inspection

Vegetation on the floodplain terrace itself outside the riparian strip is restricted to native grasses/shrubs (ie. coyote brush) with occasional trees with the exception of allowing native shrubs and trees to develop on the slope of the interface of the marsh plain terrace and the floodplain terrace (from the toe of the floodplain terrace) a distance of 30 perpendicular feet inland. Do not exceed more than ten trees per acre, spaced no closer than 50 feet apart. The vegetation density doesn't apply to the interface of the marshplain and floodplain terrace area. When a tree reaches a height of fifteen feet, any limbs below the design water elevation shall be removed. Another heavily vegetated strip will be allowed at the edge of the floodplain terrace where it transitions to natural ground. This strip will most likely take on the characteristics of an Oak Upland.

**Maintenance**

- FCD must include noxious weed control and thinning of non-native species, debris removal, repair of fences and gates, and maintenance of firebreaks.
- 1A Floodplain Terrace: An access path is mowed along the entire length of the 1A Floodplain Terrace to allow for maintenance access. This mowed path shall provide a buffer from areas supporting pickleweed by staying 75-100 feet from pickleweed areas.

**10.9.1.2 Marshplain Terrace Vegetation****Inspection**

Monitor and record the vegetation conditions along the Project reach and compare these conditions with assumed design vegetation conditions outlined in the SGDM Record losses of plant quantities and species installed in the various project sites. See Appendix A: for as-builts. Inspect water emergent plants after storm events that bring the river stage elevation to 12 feet NAVD 88 or greater, and inspect once during March.

**Potential Challenges**

Sporadic storm events are expected to be the main cause of mortality of marshplain terrace plants. High water events can kill plants in the following ways: high velocity currents scouring the finish grade, which washes out plants, silt deposition that buries plants, and by standing water in depressions that suffocate the roots of plants in poor drainage conditions. Browsing of domesticated geese can cause extensive damage to emergent plants. Excessive vegetation can reduce flood conveyance and increase flood damage risk.

**Maintenance**

- Plants shall be protected from predation or other damage caused by domesticated animals and wildlife.
- Monitoring will determine whether additional plantings are needed. If the goals are not being met, the FCD will determine the cause of plant mortality and propose measures to reestablish the required vegetation cover in affected areas. The findings and corrective action plan will be included in the semi-annual report.
- If replacement plants are required, they must be installed between April and July to develop a healthy root system that anchors within the soil.
- Site 2W Floodwall: The 2W floodwall was constructed with tules along the waterside. The FCD will make accommodations to be able to fully inspect the floodwall along the entire length of the floodwall along this deposition area. The intent is to be able to inspect without damaging/harming the Tules.
- Remove vegetation impeding the design flood conveyance.

**10.9.1.3 Preservation of Woody Vegetation**

Ropes, cables or guy wires must not be fastened or attached to any existing trees for anchorage. Where emergency use is necessary, wrap trunks and limbs with a sufficient thickness of burlap, temporary boards, or other appropriate material that will adequately protect the bark.

Native shrubs and trees can develop on the interface from the marsh plain terrace and the floodplain terrace (from the toe of the floodplain terrace) to a distance of 30 perpendicular feet inland. Because of flood conveyance concerns, vegetation on the floodplain terrace outside the riparian strip must be restricted to native grasses with shrubs and occasional trees. If the existing planting densities in specific locations are



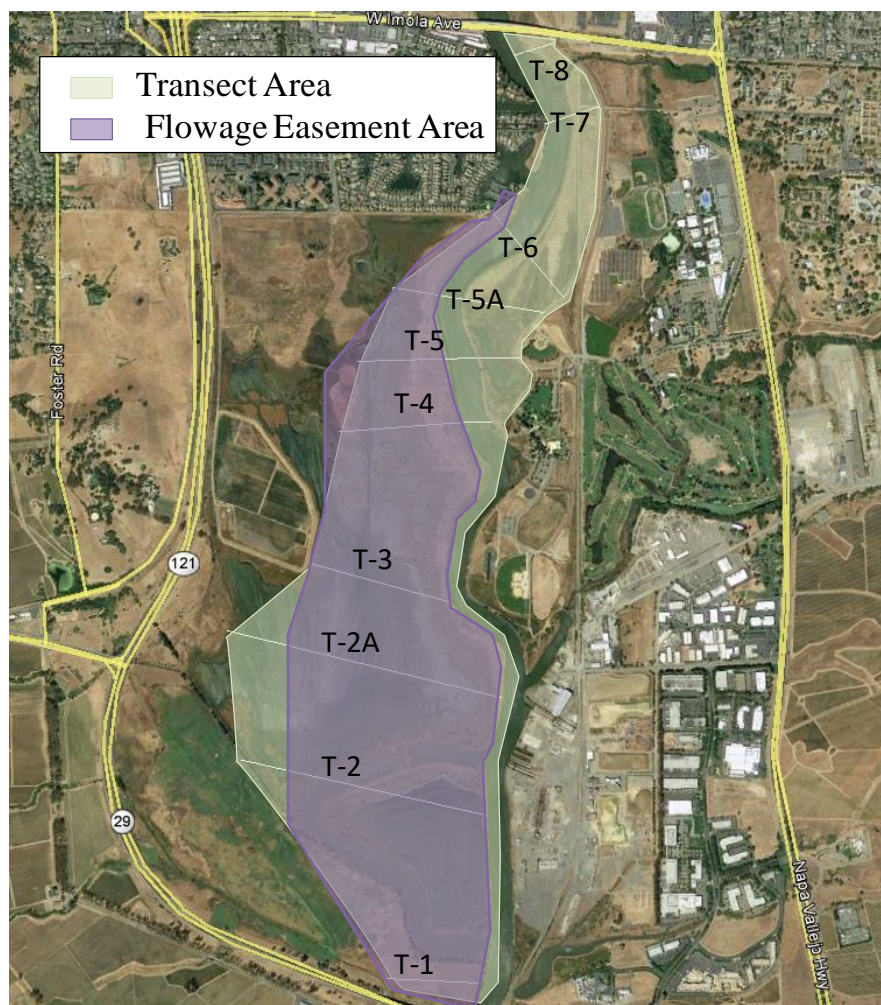
found to be out of compliance, the local sponsor must either remove the vegetation or ask USACE (SPN) to re-evaluate the risk of keeping the vegetation. The vegetation density doesn't apply to the interface of the marshplain and floodplain terrace area.

### 10.9.2 Woody Debris and Felled Trees

Downed trees and branches, dead limbs, and dead trees provide habitat for numerous wildlife species. Therefore, clearing and pruning must not occur unless such materials restrict site access, prove to be detrimental to the integrity of the bank protection structure, or present a risk to public safety, or impede conveyance of the design flood. Woody debris can be left on the marshplain and floodplain terraces, but must be removed from the dike/levee/berm slopes and the toe easement areas as this may encourage burrowing animals.

### 10.9.3 Flowage Easement Area (FEA)

The FEA is frequently flooded during large storm events and it is important to monitor the vegetation in this area. The monitoring will be completed by comparing results of on-site vegetation studies, which occur every 5 years, with previous studies through the 40<sup>th</sup> year following Project completion. See Section 10.9.3.1 for details.





**Figure 10-8: Location of Flowage Easement Area****Potential Challenges**

- Excessive woody vegetation growth
- Unauthorized planting of row crops
- Excessive accumulation of sediment and debris
- Bank erosion, especially at the confluences with Horseshoe Bend.

**Maintenance**

- Erosion of the slough banks may occur during the rainy season and after high flood flow each year, particularly at the confluences with Horseshoe Bend where pre-project riverbank levees were breached. Repair banks and replace gravel and lost soil with proper compaction to allow regular access.
- Remove excessive accumulation of sediment along and at the upper end of the channel. The local sponsor will be responsible for complying with all laws and regulations, and for all necessary documentation and/or permits to comply with all Federal, State, and local laws and regulations, if dredging becomes necessary.
- Remove non-native vegetation and debris that impedes flow and/or obscures inspection and routine maintenance.

**10.9.3.1 Comprehensive Vegetation Monitoring Report**

Conduct the remaining comprehensive vegetation monitoring studies every 5 years beginning with the next comprehensive study in spring 2018. Studies should follow the format and procedures of the last USACE study and must include any interested agencies that wish to compare the condition of the sites with the goals stated in the March 1999 FRP FSEIS-EIR and other subsequent project documents. Inspections must be conducted in the spring between March and May when leaves emerge from buds, facilitating plant identification and evaluation of general plant health and mortality. Transect information is located in Appendix G of the report and transects can also be located on the project maps in Appendix K. The first 7 cross sections have been surveyed with monuments (Appendix G, Back Up Info, NAPASurveyMarkPlotsWithConnections.kmz) and the remaining transects will be surveyed upon project completion, or as the project progresses with construction. For locations of each transect point surveyed see Appendix G, the G-2 SPK Installed Transect Survey Data, Description Cards file.

- Presence/absence surveys and management of invasive plant species: relative frequency, as measured in quadrants along permanent transects, to document presence/absence of both native and non-native species and manage invasive plants.
- Vegetative cover: relative abundance, as measured in quadrants along permanent transects, to document percentage of ground surface covered by vertical projection of native vegetation canopy.
- Woody species: relative percent cover of woody plants, as measured by a qualitative estimate along permanent transects.
- Natural recruitment: visual count of seedlings or vegetative reproduction, as measured in quadrants along permanent transects, to determine if communities are self sustaining.
- Water salinity: measured in parts per million at or near permanent quadrants along transects.

**10.9.4 Napa Creek Revegetation**

The Maintenance efforts at Napa Creek shall be focused on the health of the plantings, the condition of the willows growing in the VRSS, the willows and alders adjacent to the channel, the upland trees and shrubs,

and the Native grasses growing throughout the site. Willow pole cuttings eventually help stabilize the lower bank and provide SRA; and may be installed to fill in gaps along the creek. The sponsor should inspect the willows growing in the VRSS, to make sure they still are actively growing. Additionally, the VRSS at the lower reach of the creek may need to have the salt from the brackish water tide leached, in order to keep plants growing. The sponsor should keep the irrigation system in working order. The native grasses and herbaceous cover should be kept at least 70% growth, and invading weeds should be eliminated. A Vegetation Report (see Section 10.5.3.1) shall be completed on a yearly basis for each Corp project that had a vegetation establishment requirement.

### **Inspection**

Napa Creek must be inspected at least twice a year by a specialist of stream restoration, with an understanding of the biotechnical applications. When temporary irrigation is turned off, monitor these plants for health twice a week after the site is turned over, and after the irrigation is discontinued until it is certain that the plants no longer need irrigation.

The inspection of the vegetation health and vigor per plant species per zone as shown in the original site drawings is as follows:

- Health and Vigor: For each zone, document the health of the plant species per zone
- Have the plants used for biotechnical applications (esp. VRSS) grown enough to provide protection for the following storm events: 2 year, 10 year, or 30 year storm events?
- Significant insect browse or other damage done by wildlife
- Make note if there are particular plant species in poor health by zone
- Are there specific maintenance practices that could help the growth of some plants? For instance, thinning of trees could be warranted if such thinning does not affect the function of a biotechnical application
- Vandalism: Have plants been affected by trespass, trash, or other unauthorized man-made activities?
- Do some of the plants need additional irrigation?
- Has there been erosion damage to the plants?

### **10.9.5 Volunteer Growth**

Volunteer native herbaceous plants, trees, and woody shrub saplings found growing in the riparian zone and on the Planting Berm must be protected whenever possible from maintenance practices, such as mowing and herbicide application events. The local sponsor must protect volunteers in other areas within the densities described in the SGDM.

An exception of the “do not disturb the native volunteers” would be if a large number of volunteers crowded each other and the vegetation nearby causing severely stunted growth and declining health of the vegetation. Thinning should be prescribed and supervised by a horticulturist with a restoration background or similar experience. Volunteer growth may need to be removed to restore flood conveyance so that the flood damage risk reduction benefits of the project can be realized.

### **10.9.6 Dry Bypass Inlet-Outlet Inspection and Volunteer Growth**

The inlet of the dry bypass was constructed with a rock depression for the width of the inlet from the top of the inlet to elevation 5.0' (at the hinge point just before the rock transitions to a steeper grade). The bottom of the depression is layered with coir matting and planting soil is placed on top of the coir matting. The coir matting is anchored to the top of the soil in order to keep it in place. The local sponsor shall conduct a bi-yearly inspection of the plants planted into this depression and replace the plants bi-annually in order

to insure the soil is held in place as practically as possible. Both the inlet and outlet may experience volunteer growth at the water's edge which is acceptable.

The outlet of the bypass was originally designed with rock over soil and at the request of the CRWQCB and CA Fish and Game the Corps allowed for soil to be placed over rock which would allow plant growth. The stipulation that the Corps mandated was that if the soil ever washed into the Napa River that neither the Corps nor NCFCWCD wouldn't be mandated to return and replace/replant the soil over the rock at the bypass outlet. The CRWCB and Fish and Game agreed.

The top of the inlet of the bypass has been planted with willow stakes which has produced immature willow plants that stand approximately 3 to 4-feet in height and that flex easily. The current growth of willow is acceptable so long as a thick stand of willow trees doesn't choke the ability of the inlet to accept flows scheduled at the 2 ½ year storm event from entering the bypass.

### 10.9.7 Biotechnical Bank Stabilization

#### 10.9.7.1 Anchored HPTRM

##### Location

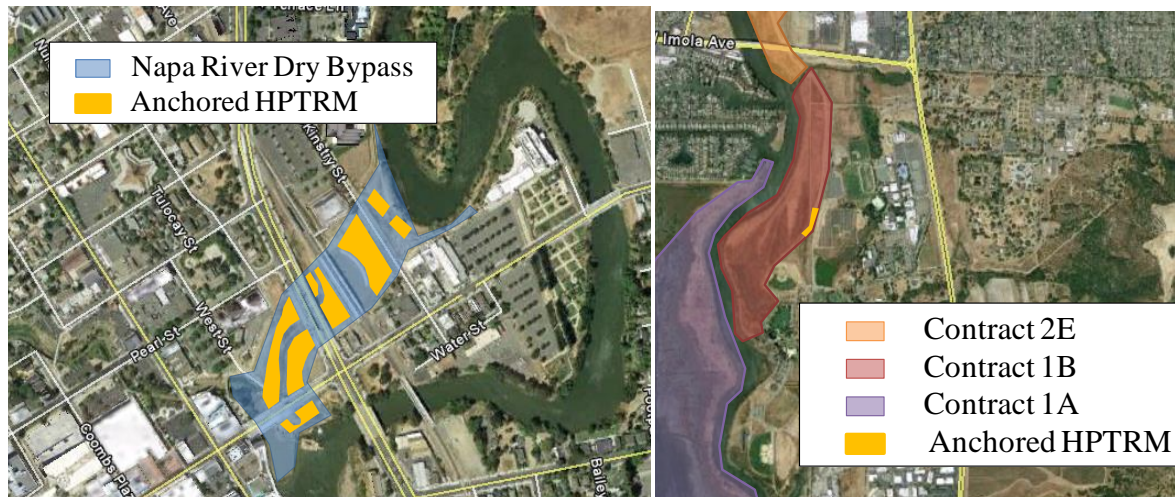


Figure 10-9: Locations of Anchored High Performance Turf Reinforced Matt

##### Potential Challenges

- **Loss of intimate contact with the underlying soil surface.** For the anchored HPTRM to maintain its level of performance, it needs to remain in intimate contact with the underlying soil surface. If intimate contact is lost, the underlying soil is susceptible to erosion during heavy rainfall and overtopping events. The HPTRM itself is also susceptible to tearing damage by routine mowing operations if the intimate contact is lost.
- **Woody vegetation.** The anchored HPTRM is designed to work in combination with a grass cover. The larger diameter and stiffer stems of woody vegetation, including brush, saplings, and trees growing through the mat will cause localized mat damage. During flood events, uprooting of woody vegetation will lift the anchored HPTRM from the slope surface and increase the rate of erosion.
- **Mat Penetrations.** Items penetrating the mat, including but not limited to pipelines, monitoring wells, posts, and survey markers, cause a stress concentration where the mat is attached to the penetration. Movement of the penetration over time due to settlement, equipment impact, or other reasons could result in tears in the mat at the location of the penetration.

- **Mowing Damage.** If mowing of the vegetative cover over the anchored HPTRM is not done carefully, the mowing operation could lift the mat off the slope surface and/or rip the mat.

### Maintenance

All slopes, channels, banks and other transition structures shall be maintained to assure the expected design of life of the reinforced vegetated system. Here are a few tips that should prove helpful as per the Product Data Sheets for HPTRM in Appendix J:1 and J:5.

- **Monitoring.** Should be conducted semi-annually and after major storm events. This should include: observing the condition of the vegetation; testing the irrigation system; checking condition of all permanent erosion systems; observing sediment and debris deposits that need removal.
- **Vegetation.** Repair and maintenance of various types of vegetation shall be consistent with their original design intent, including:
  - **Grass/Turf Areas:** applications shall be maintained for adequate cover and height.
  - **Mowing:** grasses shall be mowed according to normal maintenance schedules as determined by local jurisdictions or maintenance agreements; operations shall not start until vegetation achieves a minimum height of 6 in (150mm); mower blades shall be greater than 6 in (150mm) above the mat.
  - **Unvegetated Area:** shall be re-seeded and soil-filled (if applicable).
- **Sediment and Debris Deposits.** Accumulation of sediment and debris can reduce the hydraulic capacity of channels, clog inlet and outlet structures and can damage existing vegetation. Sediment and debris removal is a vital part of system maintenance.
  - **Removal:** shall be done carefully to avoid damage. When excavation is within 12 in (300mm) minimum of matting, removal shall be done by hand or with a visual “spotter”. If equipment must operate on the mat, make sure it is of the rubber-tired type. No tracked equipment or sharp turns allowed on the mat.
    - **Alternatively,** “steak chasers” or some other form of permanent visual markers can be utilized to provide a visual marker for maintenance activities.
- **Damage Sections.** Missing or damaged sections of the matting should be replaced per the installation guidelines.
  - **Repairing Rips or Holes:** these should be patched with identical matting material. First, carefully cut out the damaged section with a knife. Then replace the compact soil to the elevation of the surrounding subgrade and plant seed. Cut a piece of replacement material a minimum of 12 in (300mm) larger than the rip or tear. Use ties to attach the replacement material to the existing material. At overlaps, the upstream and upslope material should be on the top. Secure the replacement material with a ground anchoring devices spaced every 6 in (150mm) around the circumference of the repair and at the frequency and spacing shown in the Anchor Pattern Guide on page 7 in the HPTRM Product Data Sheets in Appendix J:1. Seed and Soil fill replacement area.

#### 10.9.7.2 VRSS

##### Location

VRSS is located throughout the Napa Creek and with the confluence of Napa Creek and Dry Bypass.

##### Potential Challenges

VRSS is susceptible to undermining from local scour and application of this bank treatment in the project includes a scour apron below the summer water line. Vandalism or debris could damage the face of the VRSS, leading to loss of functionality. Minimally, inspection should occur after each of the first few floods and/or at least twice a year for the first year and once a year thereafter. Repair any undercutting, flanking and scour. Examine the cut branches and rooted plants for survival and growth and absence of disease, insect, or other animal/human damage (e.g., grazing, trampling, digging, eating, and cutting). Repair

damage to the geosynthetic in accordance with manufacturer's recommendations. Repair the vegetation to insure structural stability. VRSS should be repaired prior to flood season.

### **10.9.8 Irrigation**

Maintenance of the irrigation system may include repair and replacement of components and ensuring proper function per design specifications and plans. Maintenance activities may include cleaning and adjusting sprinkler and bubbler nozzles, repairing damaged equipment, servicing valves, controller programming. Irrigation systems shall be test-operated and adjusted annually in early June to verify correct operation in advance of the high-demand summer season.

### **10.9.9 Planter Box Vegetation**

Vegetation which includes vines, flowers, small shrubs and trees, were planted at numerous locations along the floodwall. Vegetation at the floodwall location will be maintained to allow visibility of concrete features for inspection purposes. Maintenance may include Repair of small eroded areas, removal of trash and debris and rake surface soils, removal of accumulated fine sediments, dead leaves and trash, removal of weeds and prune back excess plant growth, removal of sediment and debris accumulation near inlet and outlet structures.

### **10.9.10 Prescribed Burning**

Should the FCD decide to carry out prescribed burns, an approval from USACE (SPN) and the resource agencies (i.e., USFWS, NMFS, RWQCB, CDFW) shall be obtained prior to burning. The FCD is responsible for determining the safety and feasibility of the prescribed burn from the City of Napa Fire Department. The FCD must pinpoint the location of the proposed prescribed burn and consult with the City of Napa Fire Department to determine safety precautions and the feasibility of performing a prescribed burn on the particular site. The FCD must contact the California Department of Forestry and Fire Protection and the Bay Area Air Quality Management District for prescribed fire planning and permit applications.

The FCD must inform USACE no less than 14 calendar days before a prescribed burn as to the location of the intended burn site. The prescribed burn must be done following all State and local codes, and the local sponsor must obtain necessary permits to safely conduct the burn. The burn must be performed by an experienced crew, with a Fire Leader who has at least 5 years experience as part of a prescribed burn fire crew, having been a Fire Leader or Captain on a prescribed burn fire crew for no less than 10 burns. Trees and shrubs must be protected from damage caused from fire getting too close. The FCD will be responsible for damage caused by a prescribed burn. The local sponsor must have a qualified biologist or ornithologist survey the proposed prescribed burn area in accordance with Federal law (i.e., Migratory Bird Treaty Act) and State codes. Prescribed burns must not occur in the grasslands north of the vineyard on the west side of the SWOA, must not burn HPTRM and VRSS, and burns must not occur from February 1 to August 31 to avoid impacting existing and potential burrowing owl habitat, unless specifically approved by all resource agencies. A Fire and Logistics Plan must be completed, and copies of the document must be made available to the resource agencies and USACE 7 calendar days before the scheduled prescribed burn (see Appendix E:6).

### **10.9.11 Grazing**

Impacts to Site 1A and Site 1B from grazing (i.e., livestock traffic soil compaction) may offset benefits by augmenting restoration. The FCD must consult with the University of California Livestock and Natural Resources Advisor assigned to the region and with the USDA, Natural Resources Conservation Service.

The FCD will comply with the following measures for grazing in any area of the Project.

- The FCD must coordinate and receive approval from the USACE (SPN) and all the resource agencies (i.e. USFWS, NMFS, RWQCB, CDFW) before grazing domesticated animals on the Napa River revegetation sites.
- The local sponsor must have a qualified biologist or ornithologist survey the proposed grazing area in accordance with Federal law and State codes prior to any future grazing activities.
- The FCD must have a grazing plan and keep records to document each graze. In the plan, the FCD must document the location within the project to be grazed, the duration of the graze, the number of cattle or sheep to graze, and the location of grazing within the project area. Within the grazing zone, the plan must catalog the number of trees and shrubs before each graze.
- Grazing must be monitored on a regular basis by the FCD for signs of overgrazing and trampling of grass. The FCD must not allow grazing animals to browse on native shrubs and trees. The FCD must 1<sup>st</sup> test the group of grazing animals by observation to see if the animals find native plants (*Grendelia*, *Salicornia* species, etc.), native shrubs, and trees palatable. The length of time to determine the behavior of the grazing must be determined by an expert in the field (Range Management specialist or similar, the owner of the herd of sheep or cattle). If the FCD chooses not to test the preference of plant material, they will be required to protect native herbaceous shrubs (*Grendelia*, *Salicornia*, etc.) and trees with fencing.
- Grazing will be prohibited on levee/dike slopes. Damage from accidental grazing shall be repaired.
- Damage to native plant material, volunteers, trees, shrubs, and the native grass stand, as a direct result from grazing, will be the responsibility of the FCD.
- The FCD must plant additional trees and shrubs for trees or shrubs that have been damaged as a result of grazing. A shrub or tree must be replaced at a 2:1 ratio if 50 percent or more of each individual plant is damaged as a result of grazing. Replacement plants must be irrigated and protected from grazing for a period of 2 years.
- Once excessive rain has caused saturation of the soil, or before excessive trampling has occurred, the FCD must remove grazing animals from the site.
- Before grazing, the cattle must be given feed which is as free of weed as possible for such a time as it takes to go through the animals' digestive system.
- The FCD must take photographs of grazing areas before and after grazing.
- All above records must be made available to USACE, upon request.

The Project is not intended to be maintained to ornamental landscape conditions. Greater habitat value is afforded by those conditions that might be unsightly in an ornamental landscape; for example, downed trees, broken branches, un-mown grass, etc. Removal of vegetation must be consistent with the guidance provided below and must be documented in the FCD's annual maintenance and monitoring report to the USACE (SPN) District Engineer. Additional plantings, if needed, must be grown from plant material that originated from the Napa Watershed.

#### **10.9.12 Damage Repair**

The local sponsor will be responsible for the restoration of sites due to human impacts and environmental damage as indicated below. Discrepancies noted during the annual inspection and reported in the Annual Report will be reviewed by all concerned resource agencies, and required actions relative to repair or replanting will be decided.

- The public's access to the Napa River revegetation sites will be limited to designated walkways or trails. The public's impact on a site may continue to be potentially disruptive to the vegetation. The local sponsor must ensure that recreational activities do not impact the vegetation.



- If it is necessary to work within revegetation sites and natural vegetation stands, the location of adjacent woody vegetation to be retained should be field-marked and protected and preserved in advance to avoid destruction or damage of the vegetation.
- Vandalism is always a potential threat, but generally decreases over time. Most vandalism involves the theft of planting stock while young (usually the 1<sup>st</sup> year after planting). As the plant root systems develop, the plants become hard to remove, and are no longer a desirable target. Cuttings of trees for firewood can be another long-term threat. Vandalism damage to signs, fences, and gates are long-term problems and will be repaired or replaced by the local sponsor in a timely fashion.
- Damage caused by domestic animals will be the responsibility of the local sponsor (see Section 10.9.8, Grazing).
- Damage caused by wildlife (beaver, deer, rabbit, and gopher damage) is an ongoing threat to the vegetation. Beaver damage is the most common. Deer, rabbit and gopher damage are prevalent while the vegetation is young, but have less of an impact over time. Wildlife damage is considered an “act of nature” and will be revisited by all concerned agencies; decisions, relative to replanting, will be made on a case-by-case basis.
- Natural processes are inevitable, and natural environmental damage could occur at any time during the reestablishment of the vegetation. However, over time the damage will likely be less, due to the maturity of the vegetation. Wind throws of trees may increase over time as trees mature and provide beneficial habitat. They do not need to be removed as a measure of routine maintenance unless they are located in the dike/levee slopes or within the toe easement areas.
- Flood and erosion damage could be an annual occurrence and must be documented in each annual report. Damage due to flooding will impact both vegetation and soil erosion.
- Fire and wind damage must be documented in each annual report. Fire is a potential threat from both maintenance practices and public carelessness.

### **10.10 STRUCTURAL MAINTENANCE & INSPECTION**

Structures need to be inspected by either a Licensed Civil Engineer with bridge or similar structures inspection experience or other qualified personnel from FCD. Post-flood inspections need to note any unusual accumulation of debris such as fallen trees, broken concrete, riprap, shopping carts, or other debris greater than 1 cubic foot in size. An inspection checklist is included in Appendix D:2.

#### **10.10.1 NVWT River Bridge**

Per Section 5.4, the NVWT River Bridge is not under the jurisdiction of USACE for maintenance and inspection.

#### **10.10.2 NVWT Dry Bypass Bridge**

The NVWT Dry Bypass railroad bridge shall be inspected annually by a competent inspector to determine whether the structure conforms to its design rating condition. Inspection should include measuring and recording the condition of substructure support at locations subject to erosion from moving water. The drainage system should be inspected for blockages and debris annually. Drain covers should be removed annually in the fall, and the drains flushed with water to remove debris and sediment. See Appendix D:2 for the Bridge Inspection Checklist.

A special bridge inspection should be performed after an occurrence that might have reduced the integrity of the bridge, including a flood, earthquake, derailment or an unusual impact. For more information on this topic, consult the Federal Track Safety Standards, Title 49 Code of Federal Regulations Part 213 in Appendix C:.

The FCD shall provide copies of bridge inspection reports to the track owner, Napa Valley Railroad, and should solicit their participation during the inspection.

### **10.10.3 Old Tulocay Creek Pedestrian Bridge**

Structures need to be inspected by a Licensed Civil Engineer with bridge or similar structures inspection experience, or other FCD qualified personnel. Bridge plans can be found in Appendix A:5, sheet S-1 to sheet S-4. Post-flood inspection needs to note any unusual accumulation of debris (large objects such as fallen trees, broken concrete, riprap, shopping carts, or debris greater in size than 1 cubic foot).

#### **Potential Challenges**

- Hairline cracks in the north and south abutments and bridge deck can be typical. Cracks wider than a hairline need to be monitored.
- Cracks in the welds connecting the steel members.
- Debris collecting on the bridge deck and on the bridge seats.
- Signs of seated structural steel drifting laterally off the elastomeric bearing pads, or impeded movement (binding) in the longitudinal direction.
- Debris and sediment deposits can impede flow capacity of the facility, resulting in structural damage due to debris movement.
- Corrosion on the steel members, bearing anchorage, and on the stay-in-place metal forms.

## **10.11 SITE ACCESS AND SECURITY**

### **10.11.1 Maintenance Roads and Access Ramps**

Maintenance roads provide access for maintaining various project features and for public enjoyment. Inspection and maintenance team should have knowledge of these roads and keys to access gates for inspection and surveillance during flood season.

#### **Potential Challenges**

- Road surface damage such as cracks, potholes, ruts and undulations.
- Erosion of areas adjacent to the road surface.
- Inadequacy of surface drainage.

#### **Maintenance**

Maintenance will be based on actual problems identified during field inspections. Routine maintenance for maintenance roads and access ramps includes the following:

- Any debris on road surfaces needs to be removed to avoid obstruction to traffic and drainage.
- Dirt or sediment on road surfaces need to be removed to avoid a slick or wet surface that poses a hazard to pedestrians or vehicles.
- Vegetation on the dike/levee access roads needs to be removed or sprayed immediately to allow for unimpeded vehicular access at all times and to reduce potential fire danger during the dry summer months. USACE encourages uprooting of small bushes and trees instead of using herbicides or other chemicals to minimize the environmental impact. Also see Section 10.7.3
- All asphalt pavement will deteriorate over time. When pavement damage occurs, then the pavement needs to be repaired or replaced to current local, county, state or federal standards. If pavement is actively repaired quickly it can last longer than waiting until there is widespread damage.

- During flood season, any damage to the access roads or access ramps needs to be repaired immediately. At a minimum, provide temporary repair to re-establish access within 24 hours.

### **10.11.2 Unacceptable Site Uses**

The local sponsor is responsible for stewarding the Project site according to the goals of the project. Any use not defined here with potential to cause significant damage to resources on site must be discussed with all concerned agencies. This includes:

- Camping
- Unauthorized activity or access
- Off-road vehicles
- Off-trail biking
- Mining for minerals, aggregate, oil, and sand
- Disposal and/or spoiling of dredged material.
- Thorough fare for livestock or other grazing animals.
- Other recreational uses.

The local sponsor must patrol the project area to make sure unlawful activities will be promptly reported to the appropriate law enforcement agency, documented, and included in the annual report. Reoccurring unlawful activities at the site are cause for concern and need to be addressed by the local sponsor by either stepping up patrols of the site or further limiting access. Signs listing acceptable and prohibited activities will be posted by the FCD at access points for the public.

## **10.12 RECREATION**

### **10.12.1 Pedestrian Railing**

#### **Location**

The pedestrian railing is installed in the following sites:

- Site 4, Napa Creek – provides a barrier between the public areas above the Coombs Street Retaining wall and the bypass culvert inlet and outlet walls.
- Site 2W, Hatt to 1<sup>st</sup> – provides a barrier between the public areas above the wall and the Napa River or lower promenade below. (This is also a convenient location to remove debris that may have collected on the lower promenade during a period of high water.)
  - A portion of the railing south of the 3<sup>rd</sup> Street Bridge can be removed to accommodate a portable dock access system in the river.
- Dry Bypass Site – on top of flood control walls and pedestrian culvert crossing over low flow channel
  - The culvert crossing railing is designed to be removed and stored during high flow events.

#### **Maintenance**

The anchoring system needs to be inspected yearly for signs of corrosion, loose anchoring points and bent or missing railing. Finish/paint of the metal railing/fences shall be inspected for flaking or corrosion. Inspections should begin 2 years after installation and be conducted yearly thereafter.

### **10.12.2 River Access**

There are two concrete river access areas and pedestrian river access locations within the Dry Bypass.

The first is located Dry Bypass Outlet below China Point Park, north of the salt marsh tidal flat. The second site is located at the easterly side of the Dry Bypass Inlet. Access to the two locations is provided by pedestrian pathway within the project or by river access.

### **Maintenance & Inspection**

- Check for debris that has accumulated on the ramps or access areas.
- Check to verify that no rock adjacent to the ramps has been displaced or removed.
- Check the 2 inch access handrail on the upstream river access to ensure it is still securely anchored to the concrete.
- Check that the glide rails on the upstream river launch for wear and damage.
- Ensure that the 4- by 4- inch pressure treated edge rails are securely anchored.

The program shall include removing any debris, replacement of missing or worn parts, cleaning and removal of accumulated sediment, and repair of the kayak launch rails and glide rails.

### **10.12.3 Lighting**

Maintenance and inspection of lighting features are the responsibility of the project sponsor and City of Napa.

### **10.12.4 After Earthquake Inspection**

Per Chapter 11 of ER 1110-2-1156, USACE recommends a special post-earthquake project inspection be conducted if earthquake ground motions are felt in downtown Napa or in accordance with the following earthquake magnitude and epicentral distance from downtown Napa provided in Table 10-3.

**Table 10-3: Criteria for Post-Earthquake Inspections**

<b>Magnitude</b>	<b>Epicentral Distance from Downtown Napa</b>
<4.5	10
5.0	50
6.0	75
7.0	125
8.0	200

### **10.12.5 After Flood Inspection**

Special post-flood inspections should be conducted for specific project features in accordance with Table 10-4.

**Table 10-4: Post-Flood Inspection Guidance**

<b>Project Feature</b>	<b>Inspect After</b>
Dikes, levees, floodwalls, berms (including appurtenant features)	Water level above the landside toe elevation

<b>Project Feature</b>	<b>Inspect After</b>
Floodplain Terrace (including slopes up to natural ground and down to Marshplain Terrace)	Water more than 1 foot deep on floodplain terrace
Riprap	Water more than 1 foot deep on riprap
Napa Creek (includes box culverts and bank/channel stabilization features)	Water flows through box culvert
Dry Bypass (including NVWT bridge and other appurtenant features)	Water flows through bypass
Hatt Building to First Street floodwall	Water above lower promenade under Third Street bridge

### **10.13 MAINTENANCE/INSPECTION FOR NON-FLOOD CONTROL FEATURES**

For non-flood control features it shall be the responsibility of the NCFCD to assess on a periodic basis and maintain the features for safe and efficient functioning of the project to produce the authorized benefits as detailed in the design documentation. The FCD shall maintain and inspect project elements in accordance with local, state, and federal standards and requirements.

**10.14 LOCATION TABLES****Table 10-5: Retaining Wall/Floodwall Locations**

Station Line	Beginning Station	End Station	Location	Description / Location	Size / Material	Contract / Sheet Number
Napa River	758+50	776+30	West Bank	Wall 1	Reinforced Concrete Retaining Wall	2 West / C-101 - C103
Napa River	765+50	768+18	West Bank	Wall 2	Reinforced Concrete Retaining Wall	2 West / C-101B / C-102
Napa River	768+50	770+50	West Bank	Wall 3	Reinforced Concrete Retaining Wall	2 West / C-102
Napa River	771+42	772+35	West Bank	Wall 4	Reinforced Concrete Retaining Wall	2 West / C-103
Napa River	773+19	774+00	West Bank	Wall 5	Reinforced Concrete Retaining Wall	2 West / C-103
Napa River	774+08	776+00	West Bank	Wall 6	Reinforced Concrete Retaining Wall	2 West / C-103
CRK Line	10+10.27	10+66.54	East Bank	CSRW1	Reinforced Concrete Retaining Wall	Contract 4 / C-111
CRK Line	11+34.85	11+59.11	West Bank	CSRW2	Reinforced Concrete Retaining Wall with CIDH pile	Contract 4 / C-111
CRK Line	17+06.05	20+37.38	Coombs Street	COOMBSRW	Reinforced Concrete Retaining Wall	Contract 4 / C-121 / C-122
CRK Line	8+80	9+25	North Side of Creek	DB1 Wall	Reinforced Concrete Retaining Wall	Contract 4 / C-101
CRK Line	7+39.70	9+25	North Side of Creek	DB2 Wall	Reinforced Concrete Retaining Wall	Contract 4 / C-101
CRK Line	14+63	15+00	East Bank	DB3 Wall	Reinforced Concrete Retaining Wall	Contract 4 / C-102
CRK Line	23+94.49	24+28.64	West Bank	Lopez Wall	Reinforced Concrete Retaining Wall	Contract 4 / C-151
CRK Line	24+00	25+00	West Bank	UB1 Wall	Reinforced Concrete Retaining Wall	Contract 4 / C-151
CRK Line	38+00	39+40	South Bank	UB2 Wall	Reinforced Concrete Retaining Wall	Contract 4 / C-152
CRK Line	38+01	37+35	South Bank	UB3 Wall	Reinforced Concrete Retaining Wall	Contract 4 / C-152
Dry Bypass- Napa River	782+50	790+00	East Bank	Wall 362	Reinforced Concrete Retaining Wall	NapaBypass / CS-102
Dry Bypass- Napa River	778+25	882+75	West Bank	Wall 352	Reinforced Concrete Retaining Wall	NapaBypass / CS-102



**Table 10-6: Rip Rap Locations**

Station Line	Beginning Station	End Station	Location in Channel	Description / Location / Drawing Designation	Size / Material	Contract / Sheet Number
Napa River	677+00	670+00	On Top of West Bank	Top of Bank	Stone Protection	1A / C-20
Pedestrian Bridge Old Tulocay Creek	1+00	1+50	East and West bank of	Bottom Of Pedestrian Bridge	Stone Protection	1B / C-22
Napa River	758+00	775+00	West Bank	Napa River Inn to Veteran Park	Stone Protection	2W / G-004
Napa River	762+00	777+00	East Bank	Above Marsh Plain	Stone Protection	2E / C-1-07 / C-1-08
Napa River	777+50	778+50	South Bank	Under Soscal Ave Bridge	Stone Protection	2E / C-5-23
Napa River	691+75		West Bank	Drainage Swale into Old Tulocay Creek	Stone Protection	2E / C-104
Napa Creek			Under Bridge Both Banks	Behrens Street Pedestrian Bridge	Stone Protection	Napa Creek / C-01
Napa Creek			South Bank	Main Street Road Bridge	Stone Protection	Napa Creek / C-113 / P-111
CRK Line	40+80	41+45	North Bank		Stone Protection	Napa Creek / C-184
CRK Line	39+45	37+15	South Bank	Single out Culvert	Stone Protection	Napa Creek / C-183
CRK Line	24+60	25+40	West Bank	Double in Culvert	Stone Protection	Napa Creek / C-124
CRK Line	13+80	14+85	East Bank	Double out Culvert	Stone Protection	Napa Creek / C-123
CRK Line	9+55	7+40	North Bank	Single in Culvert	Stone Protection	Napa Creek / C-103C / C-103D
Napa River	774+00	783+70		Low Flow Channel	Stone Protection	Napa Bypass / C-102
Napa River	816+75	819+00	South Bank	Beginning of Dry Bypass	Stone Protection	Napa Bypass / C-115
Napa River	776+00	783+30	Bypass	In Dry Bypass	Stone Protection	Napa Bypass / B-101 / B-102

Table 10-7: Storm Drain Location Table 1 of 2

Station Line	Beginning Station	Location	Description / Location / Drawing Designation	Size / Material	Contract / Sheet Number
Napa River	672+55	North West Bank	Existing Storm Drain	24 inch	1-A / C-20
Pedestrian Bridge Old Tulocay Creek Line B	0+82	South East Bank	Weephole Drain Pipe (X2) Tulocay Creek Pedestrian Bridge	4 inch PVC	1B / C-22 / S-3
Pedestrian Bridge Old Tulocay Creek Line B	1+65	North West Bank	Weephole Drain Pipe (X2) Tulocay Creek Pedestrian Bridge	4 inch PVC	1B / C-22 / S-3
New Tulocay Creek Line	9+00	North Side Levee	Existing Storm Drain inlet	High Density Polyethylene	2E / C-127
New Tulocay Creek Line	12+15	North Side Levee	Existing Storm Drain outlet	High Density Polyethylene	2E / C-127
Napa River	758+65	West Bank	Existing Storm Drain	4 inch PVC	2 West / C-104
Napa River	758+75	West Bank	Existing Storm Drain	4 inch PVC	2 West / C-104
CRK Line	10+07.66	Napa Creek West Bank	Into Napa Creek	42 inch Corrugated Metal Pipe	Contract 4 / C-146C
CRK Line	19+00	Brown Street	Into Napa Creek	15 inch Reinforced Concrete Pipe	Contract 4 / C-146D
CRK Line	25+45	UB Culvert	Through Wall UB Culvert	15 inch Reinforced Concrete Pipe	Contract 4 / C-163A
CRK Line	33+77.61	East Bank	Into Napa Creek	12 inch Reinforced Concrete Pipe	Contract 4 / C-172
CRK Line	32+32.03	West Bank	Into Napa Creek	12 inch Reinforced Concrete Pipe	Contract 4 / C-172
CRK Line	32+50	West Bank	Existing Storm Drain Into Napa Creek	12 inch Reinforced Concrete Pipe	Contract 4 / C-173
CRK Line	32+65	East Bank	Existing Storm Drain Into Napa Creek	36 inch Reinforced Concrete Pipe	Contract 4 / C-173
Pedestrian Bridge Old Tulocay Creek Line B	0+82	South East Bank	Old Tulocay Creek Pedestrian Bridge	Geosynthetic Wall Drain	1B / C-22 / S-3
Pedestrian Bridge Old Tulocay Creek Line B	1+65	North West Bank	Old Tulocay Creek Pedestrian Bridge	Geosynthetic Wall Drain	1B / C-22 / S-3
Napa River	763+25	West Bank	Storm Drain Through Wall with Outlet Gate Box from Trench Drain	6 inch SDR35	2 West / C-104B
Napa River	763+35	West Bank	Storm Drain Through Wall with Outlet Gate Box from Tree Well Drain	6 inch SDR35	2 West / C-104B
Napa River	763+81	West Bank	Storm Drain Through Wall with Outlet Gate Box from Tree Well Drain	6 inch SDR35	2 West / C-104B
Napa River	764+29	West Bank	Storm Drain Through Wall with Outlet Gate Box from Tree Well Drain	6 inch SDR35	2 West / C-104B
Napa River	765+25	West Bank	Storm Drain Tree Well Drain through Wall	6 inch PVC	2 West / C - 104B
Napa River	765+50	West Bank	Storm Drain Tree Well Drain through Wall	6 inch PVC	2 West / C - 104B
Napa River	765+75	West Bank	Storm Drain Tree Well Drain through Wall	6 inch PVC	2 West / C - 104B
Napa River	766+00	West Bank	Storm Drain Tree Well Drain through Wall	6 inch PVC	2 West / C - 105
Napa River	766+50	West Bank	Storm Drain Tree Well Drain through Wall	6 inch PVC	2 West / C - 105
Napa River	766+53	West Bank	Storm Drain Through Wall with Outlet Gate Box	6 inch PVC	2 West / C - 105
Napa River	769+25	West Bank	Storm Drain Through Wall with Outlet Gate Box	6 inch PVC	2 West / C - 105
Napa River	769+37	West Bank	Storm Drain Tree Well Drain through Wall	6 inch PVC	2 West / C - 105
Napa River	769+87	West Bank	Storm Drain Tree Well Drain through Wall	6 inch PVC	2 West / C - 105
Napa River	770+37	West Bank	Storm Drain Tree Well Drain through Wall	6 inch PVC	2 West / C - 105
Napa River	771+06	West Bank	Storm Drain Through Wall with Outlet Gate Box	12 inch Reinforce Concrete Pipe	2 West / C - 105
Napa River	773+43	West Bank	Storm Drain Through Wall with Outlet Gate Box from Trench Drain	6 inch PVC	2 West / C - 106
Napa River	774+10	West Bank	Storm Drain Through Wall with Outlet Gate Box from Trench Drain	6 inch PVC	2 West / C - 106
Napa River	774+95	West Bank	Storm Drain Through Wall with Outlet Gate Box from Trench Drain	6 inch PVC	2 West / C - 106
Napa River	759+25	West Bank	Through Wall with Outlet Gate Box	6 inch SDR35	2 West / C-104A
Napa River	775+81	West Bank	Storm Drain Through Wall with Outlet Gate Box from Trench Drain	6 inch PVC	2 West / C - 106

Storm Drain Table Continues on Next Page

Table 10-8: Storm Drain Location Table 2 of 2

Station Line	Beginning Station	Location	Description / Location / Drawing Designation	Size / Material	Contract / Sheet Number
Napa River	760+80	West Bank	Through Wall with Outlet Gate Box	6 inch SDR35	2 West / C-104A
CRK Line	12+60	Pearl street and Main street Bypass	Throught wall into Bypass Culvert	24 inch Reinforced Concrete Pipe	Contract 4 / C-104A
SD Arroyo Drive Line	12+33.36	Arroyo Dr into Napa Creek	Throught wall into Napa Creek	15 inch Reinforced Concrete Pipe	Contract 4 / C-135B
SD Coombs Street Line	10+30.92	Coombs Street Retaining Wall	Throught wall into Napa Creek	15 inch Reinforced Concrete Pipe	Contract 4 / C-135A
CRK Line	17+38.55	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-132
CRK Line	17+68.55	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-133
CRK Line	18+03.55	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-134
CRK Line	18+21.05	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-135
CRK Line	18+46.05	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-136
CRK Line	18+76.05	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-137
CRK Line	19+03.55	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-138
CRK Line	19+29.05	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-139
CRK Line	19+56.05	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-140
CRK Line	19+84.05	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-141
CRK Line	24+16.49	West Bank Napa Creek	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-162
CRK Line	7+54.70	North Bank DB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-102 / S-103
CRK Line	7+77.70	North Bank DB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-102 / S-103
CRK Line	7+99.70	North Bank DB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-102 / S-103
CRK Line	8+22.70	North Bank DB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-102 / S-103
CRK Line	8+44.70	North Bank DB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-102 / S-103
CRK Line	8+66.70	North Bank DB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-102 / S-103
CRK Line	8+99.70	North Bank DB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-102 / S-103
CRK Line	9+05	South Bank DB1 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-102 / S-103
CRK Line	14+80	North Bank DB3 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	0+55	West Bank UB1 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	0+78	West Bank UB1 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	1+02	West Bank UB1 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	5+81.50	South Bank UB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	6+07.50	South Bank UB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	6+27.50	South Bank UB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	6+93.50	South Bank UB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	5+81.50	South Bank UB3 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	6+07.50	South Bank UB3 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	6+27.50	South Bank UB3 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	6+50.50	South Bank UB3 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	6+72.50	South Bank UB3 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	6+97.50	South Bank UB3 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	7+23.50	South Bank UB3 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153

**Table 10-9: Flap Gate Location Table**

Station Line	Station	Location	Description / Location / Drawing Designation	Size / Material	Contract / Sheet Number
Vineyard Dyke Line A	10+80	East Bank Vinyard Dike	Drain Pipe with Flap Gate	24 inch Reinforced Concrete Pipe	1-A / C-5 / C-30
Vineyard Dyke Line A	30+52	North Bank Vineyard Dike	Drain Pipe with Flap Gate	24 inch Reinforced Concrete Pipe	1-A / C-8 / C-30
Vineyard Dyke Line A	55+60	West Bank Vineyard Dike	Drain Pipe with Flap Gate	24 inch Reinforced Concrete Pipe	1-A / C-7 / C-30
Napa River	617+00	West Bank	Exhisting Drainage Structure with Flap Gate	Unknown	1-A / C-17
Napa River	767+15	North Bank	Exhisting Storm Drain with Flap Gate	18 inch or 8 inch Reinforced Concrete Pipe	2E / C-4-26 /C-5-23.1
Napa River	771+05	North Bank	Exhisting Storm Drain with Flap Gate	19 inch or 8 inch Reinforced Concrete Pipe	2E / C-4-26 /C-5-23.1
New Tulocay Creek Line	7+50	North Side Levee	Storm Drain Concrete Headwall with Flap Gate	24 inch High Density Polyethylene	2E /C- 121 / C-449 / C-555
Dredge Disposal Levee Line C	5+50	South Side Levee	Imola Dredge Disposal Drainage Structure with Flap Gate	25 inch High Density Polyethylene	2E / C-123 / C-554
CRK Line	14+87.95	Napa Creek East Bank	Into Napa Creek with Flap Gate	24 inch Reinforced Concrete Pipe	Contract 4 / C-145B
Napa River	773+10	West Bank	Storm Drain Through Wall with Flap Gate	18 inch Reinforce Concrete Pipe	2 West / C - 106
Napa River	775+50	West Bank	Storm Drain Through Wall with Flap Gate	15 inch Reinforce Concrete Pipe	2 West / C - 106

**Table 10-10: Drainage through Levees, Dikes and Floodwalls (Table 1 of 2)**

Station Line	Station	Location	Description / Location / Drawing Designation	Size / Material	Contract / Sheet Number
Vineyard Dyke Line A	10+80	East Bank Vinyard Dike	Drain Pipe with Flap Gate	24 inch Reinforced Concrete Pipe	1-A / C-5 / C-30
Vineyard Dyke Line A	30+52	North Bank Vineyard Dike	Drain Pipe with Flap Gate	24 inch Reinforced Concrete Pipe	1-A / C-8 / C-30
Vineyard Dyke Line A	55+60	West Bank Vineyard Dike	Drain Pipe with Flap Gate	24 inch Reinforced Concrete Pipe	1-A / C-7 / C-30
New Tulocay Creek Line	7+50	North Side Levee	Storm Drain Concrete Headwall with Flap Gate	24 inch High Density Polyethylene	2E / C- 121 / C-449 / C-555
Dredge Disposal Levee Line C	5+50	South Side Levee	Imola Dredge Disposal Drainage Structure with Flap Gate	25 inch High Density Polyethylene	2E / C-123 / C-554
Napa River	763+25	West Bank	Storm Drain Through Wall with Outlet Gate Box from Trench Drain	6 inch SDR35	2 West / C-104B
Napa River	763+35	West Bank	Storm Drain Through Wall with Outlet Gate Box from Tree Well Drain	6 inch SDR35	2 West / C-104B
Napa River	763+81	West Bank	Storm Drain Through Wall with Outlet Gate Box from Tree Well Drain	6 inch SDR35	2 West / C-104B
Napa River	764+29	West Bank	Storm Drain Through Wall with Outlet Gate Box from Tree Well Drain	6 inch SDR35	2 West / C-104B
Napa River	765+25	West Bank	Storm Drain Tree Well Drain through Wall	6 inch PVC	2 West / C - 104B
Napa River	765+50	West Bank	Storm Drain Tree Well Drain through Wall	6 inch PVC	2 West / C - 104B
Napa River	765+75	West Bank	Storm Drain Tree Well Drain through Wall	6 inch PVC	2 West / C - 104B
Napa River	766+00	West Bank	Storm Drain Tree Well Drain through Wall	6 inch PVC	2 West / C - 105
Napa River	766+50	West Bank	Storm Drain Tree Well Drain through Wall	6 inch PVC	2 West / C - 105
Napa River	766+53	West Bank	Storm Drain Through Wall with Outlet Gate Box	6 inch PVC	2 West / C - 105
Napa River	769+25	West Bank	Storm Drain Through Wall with Outlet Gate Box	6 inch PVC	2 West / C - 105
Napa River	769+37	West Bank	Storm Drain Tree Well Drain through Wall	6 inch PVC	2 West / C - 105
Napa River	769+87	West Bank	Storm Drain Tree Well Drain through Wall	6 inch PVC	2 West / C - 105
Napa River	770+37	West Bank	Storm Drain Tree Well Drain through Wall	6 inch PVC	2 West / C - 105
Napa River	771+06	West Bank	Storm Drain Through Wall with Outlet Gate Box	12 inch Reinforce Concrete Pipe	2 West / C - 105
Napa River	773+10	West Bank	Storm Drain Through Wall with Flap Gate	18 inch Reinforce Concrete Pipe	2 West / C - 106
Napa River	773+43	West Bank	Storm Drain Through Wall with Outlet Gate Box from Trench Drain	6 inch PVC	2 West / C - 106
Napa River	774+10	West Bank	Storm Drain Through Wall with Outlet Gate Box from Trench Drain	6 inch PVC	2 West / C - 106
Napa River	774+95	West Bank	Storm Drain Through Wall with Outlet Gate Box from Trench Drain	6 inch PVC	2 West / C - 106
Napa River	775+50	West Bank	Storm Drain Through Wall with Flap Gate	15 inch Reinforce Concrete Pipe	2 West / C - 106
Napa River	759+25	West Bank	Through Wall with Outlet Gate Box	6 inch SDR35	2 West / C-104A
Napa River	775+81	West Bank	Storm Drain Through Wall with Outlet Gate Box from Trench Drain	6 inch PVC	2 West / C - 106
Napa River	760+80	West Bank	Through Wall with Outlet Gate Box	6 inch SDR35	2 West / C-104A
SD Coombs Street Line	10+30.92	Coombs Street Retaining Wall	Throught wall into Napa Creek	15 inch Reinforced Concrete Pipe	Contract 4 / C-135A
CRK Line	17+38.55	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-132
CRK Line	17+68.55	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-133
CRK Line	18+03.55	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-134
CRK Line	18+21.05	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-135
CRK Line	18+46.05	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-136
CRK Line	18+76.05	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-137
CRK Line	19+03.55	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-138
CRK Line	19+29.05	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-139
CRK Line	19+56.05	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-140
CRK Line	19+84.05	Coombs Street	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-131 / S-141
Drainage through Levees, Dikes, Floodwalls					

**Table 10-11: Location of Drainage through Levees, Dikes and Floodwalls (Table 2 of 2)**

Station Line	Station	Location	Description / Location / Drawing Designation	Size / Material	Contract / Sheet Number
CRK Line	24+16.49	West Bank Napa Creek	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-162
CRK Line	7+54.70	North Bank DB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-102 / S-103
CRK Line	7+77.70	North Bank DB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-102 / S-103
CRK Line	7+99.70	North Bank DB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-102 / S-103
CRK Line	8+22.70	North Bank DB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-102 / S-103
CRK Line	8+44.70	North Bank DB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-102 / S-103
CRK Line	8+66.70	North Bank DB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-102 / S-103
CRK Line	8+99.70	North Bank DB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-102 / S-103
CRK Line	9+05	South Bank DB1 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-102 / S-103
CRK Line	14+80	North Bank DB3 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	0+55	West Bank UB1 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	0+78	West Bank UB1 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	1+02	West Bank UB1 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	5+81.50	South Bank UB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	6+07.50	South Bank UB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	6+27.50	South Bank UB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	6+93.50	South Bank UB2 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	5+81.50	South Bank UB3 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	6+07.50	South Bank UB3 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	6+27.50	South Bank UB3 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	6+50.50	South Bank UB3 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	6+72.50	South Bank UB3 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	6+97.50	South Bank UB3 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153
Upper Bypass Culvert UB Line	7+23.50	South Bank UB3 Wall	Storm Drain Through Wall with Outlet Gate Box into Napa Creek	6 inch PVC	Contract 4 / S-153

**Table 10-12: Summary of Reporting Requirements for the Napa Flood Protection Project**

Report	Reporting Frequency	Reference
Status of Project Maintenance	annual	10.5.2.1
Semi-Annual	June 1, December 1	10.5.1
NMFS	annual, by 4/15	10.5.2.2
Inspection, Maintenance & Damage	see reference	10.5.2.3
Vegetation	annual	10.5.3.1
Revegetation	annual	10.5.3.2
Conservation Measure; Maintenance	annual	10.6.2
Comprehensive Vegetation Monitoring	every 5-years	10.9.3.1



<b>Report</b>	<b>Reporting Frequency</b>	<b>Reference</b>
Invasive Plant Control Plan	annual	10.6.3
Herbicide Eradication Program	annual	10.6.3.1
Periodic Inspection	every 5 years	10.8.3
Bridge Inspection	annual or more often if needed	10.10.2, 10.10.13

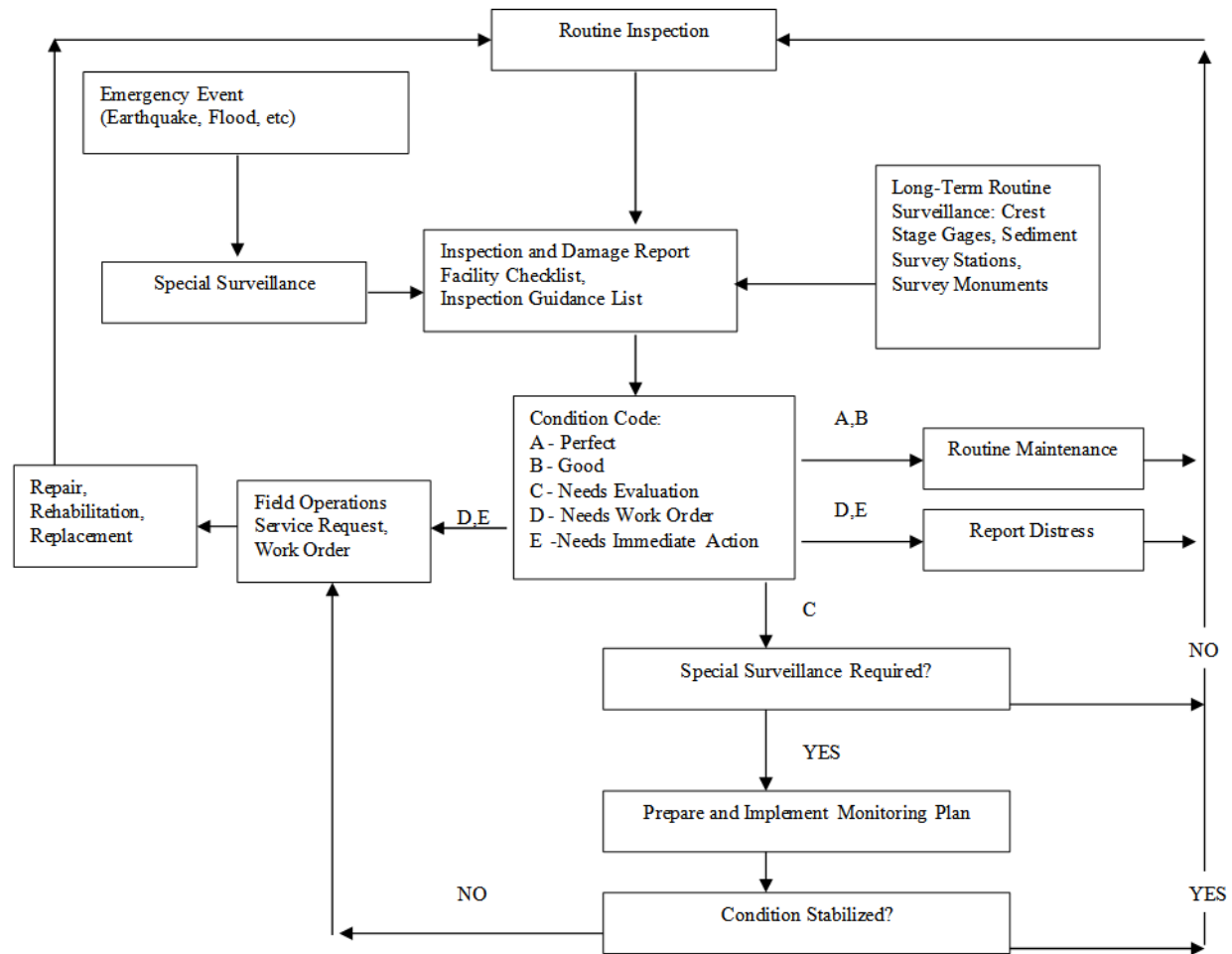
**SECTION 11 – SURVEILLANCE****11.1 INTRODUCTION**

In accordance with ER 1110-2-401, this section discusses the surveillance program for the project. The unique nature of the Napa Project and its associated environmental features require adaptive management and maintenance to achieve project performance. Maintenance of constructed project features ensures that the project operates or performs as intended.

Surveillance includes the use of measurements, observations, and other activities to verify that project benefits are being realized. Results of surveillance activities are evaluated to identify the need for additional maintenance, continued surveillance, or repair, replacement, and rehabilitation activities. The sequences of and relations among the activities involved in surveillance are shown in Figure 11-1.

Surveillance can be classified into three categories:

- Long-term routine surveillance conducted annually.
- Special surveillance specified in Inspection and Damage Reports conducted as needed.
- Special surveillance after emergency events conducted post-flood and post-earthquake.

**Figure 11-1: Work Flow Chart**

## 11.2 LONG –TERM ROUTINE SURVEILLANCE

The long-term surveillance program consists of monitoring, measuring, observing, and gathering/documenting various features of the Project as required by subsequent sections.

### 11.2.1 USACE Levee Safety Program Surveillance

For purposes of the USACE Levee Safety Program, flood damage reduction features, such as levees and floodwalls, are divided into projects, systems, and segments as defined below.

- **Project:** A project is made up of one or more flood damage reduction systems that were constructed under the same authorization.
- **Segment:** A segment is defined as a discrete portion of a flood damage reduction system that is operated and maintained by a single entity. A segment can be made up of one or more features, including levee embankments, floodwalls, channels, pump stations, closure structures, etc.

- **System:** A system is made up of one or more segments that collectively provide flood damage reduction to a defined area. Failure of one segment within a system constitutes failure of the entire system. Failure of one system does not affect another system.

See Sections 10.7.3 and 10.7.4 for constructed project feature inspection requirements.

The Project is currently in the interim condition phase and additional segments will be added to the system as construction is completed and turned over to the Sponsor.

### 11.2.2 Channel Conveyance Monitoring and Maintenance

The objectives of the monitoring and maintenance program are to: 1) assess channel conveyance performance, 2) monitor bank stability performance, and 3) monitor vegetation establishment and roughness. Hydraulic performance will be assessed through monitoring of physical conditions and the use of a hydraulic model. Bank stability will be assessed using repeated cross section surveys, erosion pins, aerial photographs and vegetative cover. Vegetation establishment and roughness will be assessed through visual inspection.

To carry out the monitoring and maintenance program, various physical features that affect performance in the project reach will be monitored to identify changes. These conditions include hydrology, channel geometry, vegetation, and bank stability. Not all changes are considered detrimental. Considerable reconfiguration of physical features may be allowed as long as they do not adversely affect conveyance, bank stability, structural integrity, or habitat quality. Significant evolution of the physical features is expected following construction.

### Hydrology

Table 11-1 shows the computed probability peak flows at river reaches downstream of Trancas Street. Computed probability flows were used in the risk-based analysis of the NED plan's project feature design. Those flows and the associated flood frequency will be used in the hydraulic modeling for channel conveyance monitoring and maintenance. Hydrologic and hydraulic changes will be monitored using gage stations.

**Table 11-1: Computed Probability Flows in Napa River & Tributaries**

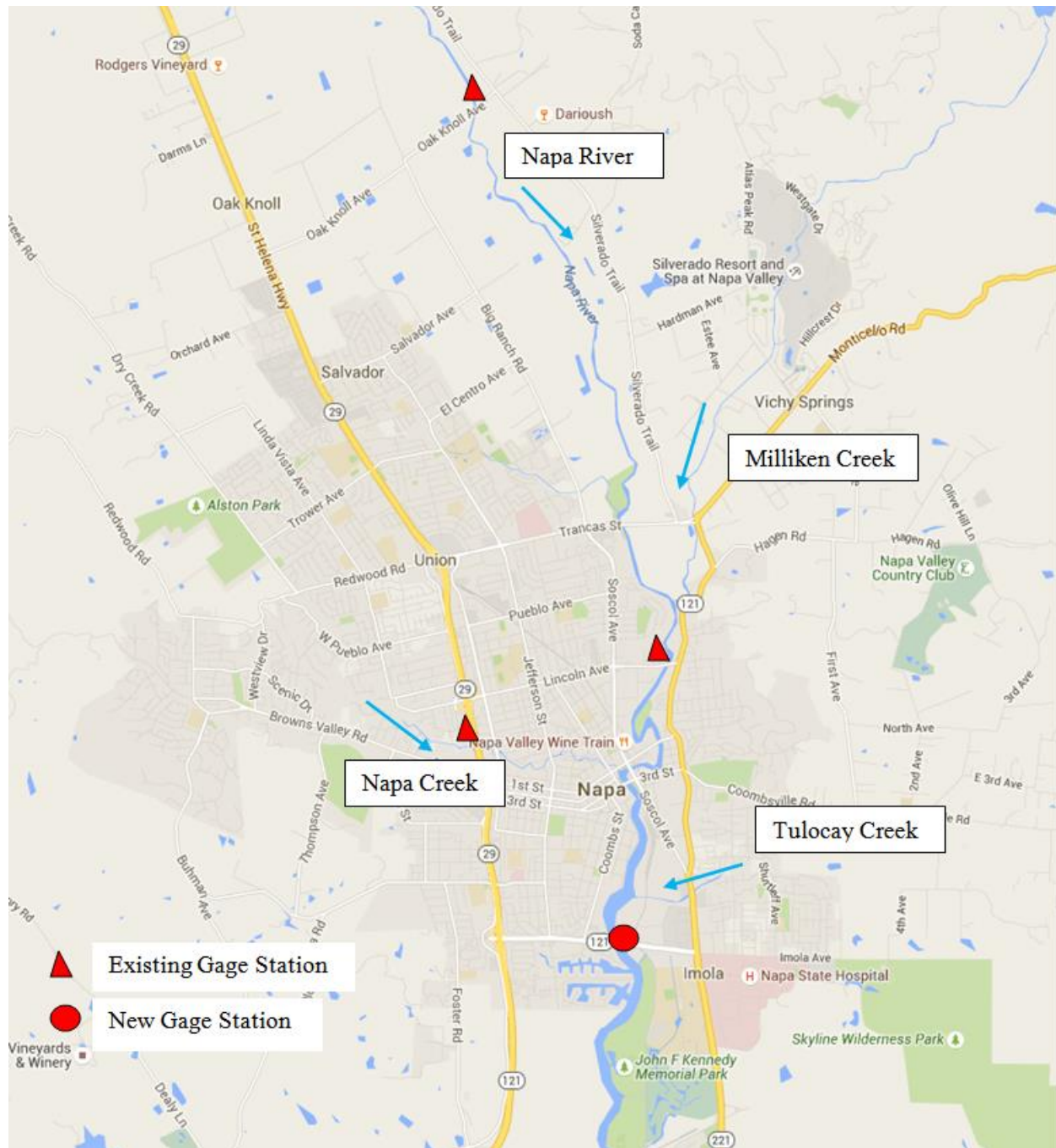
Location	Computed Probability Flows (cfs)							
	50%	20%	10%	2%	1%	0.5%	0.2%	0.1%
Upstream of Milliken Creek (RS 876+00)	10,420	17,640	22,760	33,430	37,470	40,730	44,540	47,160
Downstream of Milliken Creek (RS 876+00)	11,320	18,520	23,810	35,010	39,350	42,850	47,300	50,430
Upstream of Napa Creek (RS 773+00)	11,630	18,810	24,040	35,600	40,100	43,620	48,300	51,810
Downstream of Napa Creek (RS 773+00)	12,940	20,480	25,810	38,010	42,720	46,310	51,260	55,140
Upstream of New Tulocay Creek (RS 724+00)	12,900	20,270	25,850	37,610	42,410	46,110	51,060	54,770
Downstream of New Tulocay Creek to Study Limit (RS 685+00)	13,580	21,170	26,830	39,170	44,370	48,310	53,590	57,550

Stream flow gage stations shall be installed in the Napa River/Napa Creek project area to provide stream-

discharge data base for water resources planning and design, hydrologic analysis, and for operation and maintenance of the project features.

Currently there are 3 gage stations located in the vicinity of the project area. The gage station at Oak Knoll Avenue is owned and operated by USGS. Gage stations located at HW 29 and at Lincoln Avenue are operated by the Napa County Resources and Conservation District (RCD). The vertical datum of both stations is based on NGVD 29. The discharge rating curve at HW 29 gage station has been developed by RCD. RCD does not maintain a discharge rating curve for Lincoln Avenue gage station.

A new gage station shall be installed at Imola Avenue, as shown in Figure 11-2. The stage-discharge data collected at those 4 gage stations can be used to verify current conditions and reconcile differences between the model-predicted baseline and actual conditions. This reconciliation should be performed in the first performance assessment report.



**Figure 11-2: Existing and Proposed Gage Stations**

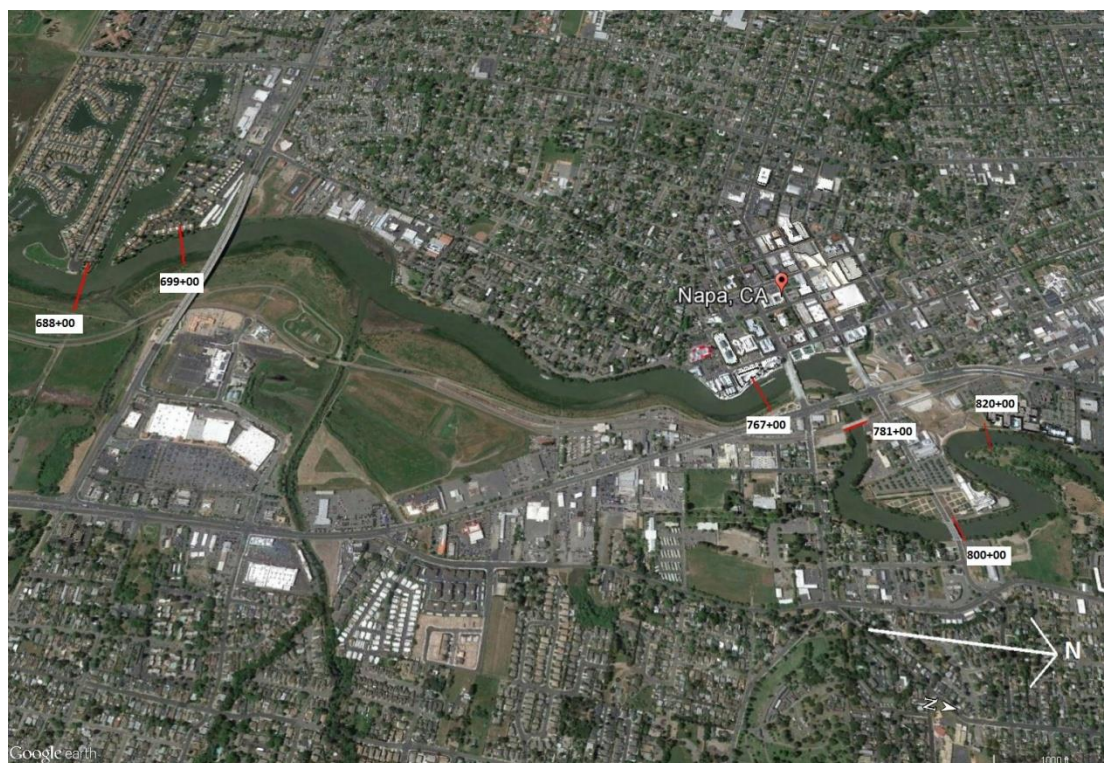
### Channel Geometry

The Napa River carries large amounts of sediment. Possible erosion and deposition in the project reach are matters of concern. A channel stability study was carried out by Phillip Williams & Associated, Ltd., San Francisco, California, 1997. The results of the study were presented in a report entitled “Sediment Transport Assessment for Napa River Flood Damage Reduction Plan.” The study assesses the sediment



transport characteristics of a geomorphically-based channel proposed for flood management of a six-mile tidally influenced reach of Napa River.

Sections of the river that show tendencies for substantial local bed erosion of 3 feet or more for a 100-year flood based on modeling include stations 820+00 (upstream of the Bypass entrance), 800+00 (First Street bridge), 781+00 (Wine Train bridge), 767+00 (between Third Street and the Hatt Building), 699+00 (between Imola Avenue and River Park Marina), and 688+00 (between River Park Marina and Newport North Marina). These locations are shown on Figure 11-3. Note that a small amount of erosion very close to a structure is frequently more critical than a larger amount of erosion that occurs further away from structures. Sections of river bed expected to receive 3 feet or more of deposition for a 100-year flood are downstream of the Bypass entrance and between Soscol Avenue and Third Street at stations 817+00 and 774+00, respectively.



**Figure 11-3: Potential Erosion Locations.**

Deposition rates on the marshplain and floodplain terraces are conservatively expected to range from 0.02 – 0.09 feet/year (5 to 28 mm/year). In limited areas (i.e., on the marshplain terrace upstream of Third Street at station 774+00 and on the west floodplain terrace across from the Kennedy Park constructed wetland at stations 638+00 and 650+00), deposition rates are expected to reach 50 mm/year.

Sediment survey stations are fixed cross-section locations in the channel used to evaluate the changes in the cross-sectional areas due to sediment deposition and erosion in the river channel. These survey stations listed in Table 11-2 are selected based on the 1997 sediment study report by Phillip Williams & Associated.

**Table 11-2: Cross Section Monitoring Locations**

Cross Section	River Station	Location Description
1	638+00	Approximately 300 feet downstream of Newport North Marina north of the boat ramp@ Kennedy Park
2	650+00	At Kennedy Park ponded tidal wetland
3	685+00	Downstream-most HEC-RAS Model Cross Section
4	688+00	Between River Park Marina and Newport North Marina
5	699+00	Just downstream of Imola Avenue
6	767+00	Between Hatt Building and 3 <sup>rd</sup> Street Bridge
7	774+00	Peninsula between Dry Bypass and Napa Creek across to the intersection of Soscol Avenue and 3 <sup>rd</sup> Street
8	781+00	Upstream of Napa Valley Wine Train Bridge
9	800+00	Upstream of 1 <sup>st</sup> Street Bridge
10	817+00	Southwest tip of Peninsula Building at Napa River
11	822+00	Swimming pool at Westin Hotel Napa 1314 McKinstry Street)

The reach downstream of Third Street is part of the Napa River Navigation Project and a hydro-survey has been performed by USACE San Francisco District since 2003. Survey data is available at the following website or by contacting USACE San Francisco District:

<http://www.spn.usace.army.mil/Missions/Surveys,StudiesStrategy/HydroSurvey/NapaRiver.aspx>

Figure 11-4 shows 1 of 25 hydro-survey data sheets performed in 2014. Permanent survey monuments are therefore not required for River Stations downstream of 3<sup>rd</sup> Street Bridge at 638+00, 650+00, 688+00, 699+00 and 767+00. Figure 11-5 depicts permanent cross section monitoring locations upstream of 3<sup>rd</sup> Street Bridge.







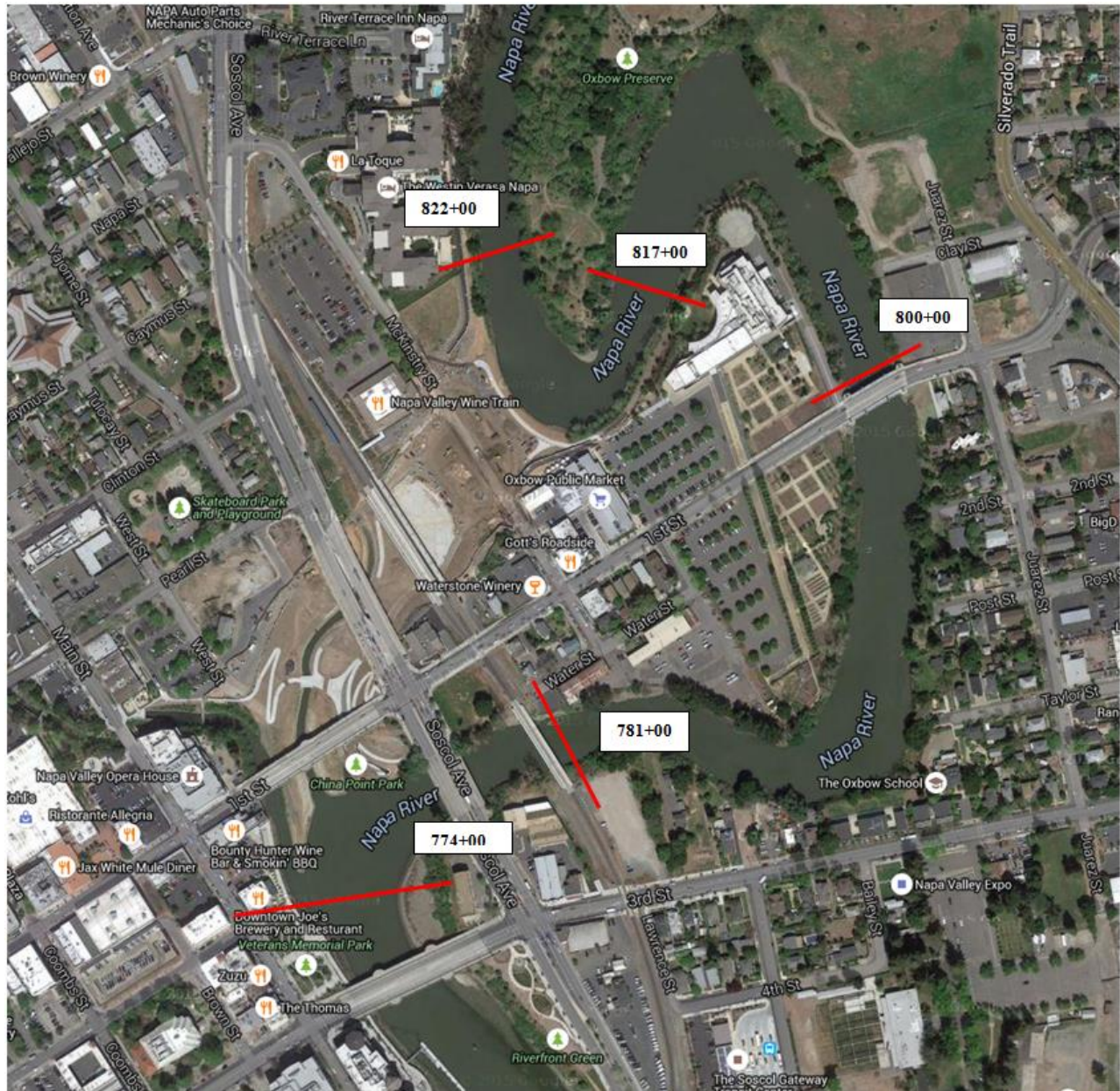


Figure 11-5: Permanent Survey Monitoring Cross Sections

### **Vegetation and Debris**

While the establishment of vegetation is important to the Project for both mitigation and erosion control, there are some restrictions to vegetation establishment to protect flow conveyance. After establishment, vegetation must be maintained to achieve project objectives. However, vegetation cannot become excessive enough to interfere substantially with water or sediment movement. Vegetation growth could hinder conveyance of flood flows if not controlled. Maintenance requirements such as mowing of terraces or clearing of excess woody debris are needed to maintain the flood conveyance and realize the FRM benefits of the project.

Within the HEC-RAS 1D2D model domain, photographic monitoring of vegetation, such as setting up and maintaining fixed photo points, is needed. The primary purpose of this photographic monitoring is to visually track changes to vegetation growth to help inform establishing Manning's  $n$  values for performance based maintenance and monitoring (see Section 11.2.4). A photographic monitoring plan will be developed by FCD to track changes to vegetation to inform estimating Manning's  $n$  values for the HEC-RAS 1D2D model. For estimating purposes the photography can be used to inform staff to check the hydrology to calculate the Manning's " $n$ " value. These locations are expected to include the Dry Bypass, Napa Creek, and the Marsh and Floodplain Terraces and other key areas for estimating Manning's roughness in the HEC-RAS 1D2D model.

### **Bank Stability and Erosion**

Certain areas of the existing bank and the transition slopes between the terraces will be subject to erosive forces from either waves or high flow velocities. Where this erosion does not threaten floodwalls, levees, or bridge structures, it can be allowed to occur naturally. The project will be monitored for erosion and bank stability issues. Sites experiencing erosion and bank stability will be tracked and monitored to determine if and when they need to be repaired. These sites and monitoring results will be reported in the annual report to USACE. Immediate remedial actions will need to be implemented if erosion and bank stability threaten to reduce the flood risk damage protection of the project, such as undermining project features. Some areas of concern for erosion and bank stability include, but are not limited to, the Dry Bypass, just upstream of the Dry Bypass, Napa Creek, and training levees that are designed to overtop.

The reach upstream of the Bypass is of particular concern for erosion, because hydraulic analysis suggests that this will be a reach of high velocities after construction of dry bypass. The analysis also shows that this reach is subject to high, apparently erosive velocities under existing conditions. This reach has well-established riparian vegetation along the banks that helps to stabilize them. The approach adopted for erosion control in this reach is to rely on the established riparian vegetation to stabilize the banks, and to augment this with plantings where existing vegetation is sparse. FCD shall monitor this reach to ensure that plantings are providing needed bank stabilization. Emergency actions (e.g., rock protection) will need to be implemented immediately if significant erosion (defined below) is detected.

### **Other Monitoring Activities**

- (1) FCD is responsible for monitoring and maintaining the flow split between the dry bypass and the oxbow and taking corrective action as necessary.
- (2) FCD is responsible for maintaining operation of the features for future relative sea level rise as needed.

### 11.2.3 Hydraulic Maintenance and Monitoring Considerations

Section 11.2.3 is inactive during the interim status until the project is complete. As the project reaches completion, Section 11.2.3 should below should be activated.

*Factors which affect the river channel water surface profiles include vegetative growth which increases channel roughness and sediment deposit which decreases the flow conveyance area. In order to determine the impact of vegetation and channel geometry on the water surface profiles, FCD shall periodically re-survey representative cross sections and update bathymetric maps, re-evaluate Manning's n values and develop a modified HEC-RAS 1D2D model. Future maintenance activities shall be based on results from the updated 1D2D model.*

- (1) *The representative cross sections listed in Table 11-2 shall be surveyed at least once every 5 years and after major flood events. High-water mark elevations at the sediment survey locations, gage stations and other critical locations, such as at the inlets of Napa Creek lower bypass and upper bypass will be documented in the annual reported provided to USACE. The model shall be calibrated using actual observed river and creek stages with discharges from gage data.*
- (2) *If the change in average channel bed elevation at a monitoring station is greater than +/-2 ft, the cross sectional channel survey will need to extend to cross sections upstream and downstream of the permanent cross sections. The cross-section that will need to be added will vary and depends on the extent of the change. At a minimum, cross-section will need to be added to this monitoring effort to fully measure the upstream and downstream extent of the change. These cross-sections will be used to update the bathymetric maps in the HEC-RAS 1D2D model as part of Performance Based Maintenance and Monitoring Report in Section 11.2.4.*
- (3) *The baseline with-project HEC-RAS 1D2D model shall be revised and rerun to determine if there is a change in water surface for the 1/100 (1%) ACE event. In the event that significant maintenance is required, the program will fall under the permit activities between the Flood Control agency and the resource agencies. If encroachment is noted and maintenance is found to be necessary on a significant scale, a team involving county and resource agencies would determine how best to lower the WSE through sediment removal, vegetation management, or a combination of both. If the 50% threshold is exceeded, maintenance of the channel shall be initiated as soon as possible for the specific reach in question as noted in 11.2.3 (2) which may encompass upstream and downstream cross sections. If maintenance is found to be necessary on a significant scale, a team involving county and resource agencies would determine how best to lower the WSE through sediment removal, vegetation management, or a combination of both. The revised HEC-RAS 1D2D model shall include current bathymetric maps and newly estimated Manning's n values. The HEC-RAS 1D2D models will be provided to USACE when providing the annual report to USACE.*

### 11.2.4 Performance Based Maintenance and Monitoring Report

Section 11.2.4 is inactive during the interim status until the project is complete. As the project reaches completion, Section 11.2.4 should below should be activated.



*It is possible that hydraulic analysis would show that maintenance would only be required in certain reaches of the floodway and not necessarily throughout the floodway. This maintenance plan could be a mixture of vegetation removal or deposition removal that would result in computed water surface elevation less than or equal to design water surface elevations once the maintenance measures were completed. The plan needs to address the conditions that are creating the greatest increase in water surface elevation. Upon the completion of the performance based maintenance plan, the FCD shall submit the plan to USACE SPN and required agencies for final acceptance before implementation. The HEC-RAS 1D2D models showing the results of implementing the maintenance actions shall be provided to USACE along with the HEC-RAS 1D2D model without the maintenance actions when the maintenance plan is submitted to USACE.*

**SECTION 12 – REPAIR, REPLACEMENT AND REHABILITATION (RR&R)**

Repair is considered to entail those activities of a routine nature that maintain the project in a well kept condition. Replacement covers those activities taken when a worn-out element or portion thereof is replaced. Rehabilitation refers to a set of activities, as necessary, to bring a deteriorated project back to original condition. RR&R actions are to conform to the project as-built plans and specifications and all applicable conditions in this manual, unless other arrangements are made with the USACE (SPN) District Engineer. These activities are the responsibility of the project sponsor. Any evidence of distress, as listed in Paragraph 6 of ER 1110-2-401, needs to be reported to USACE.

When performing RR&R actions, the FCD must follow all local, State, and Federal laws. Specifically they must comply with project environmental documentation as discussed in Section 10.3.

## SECTION 13 – NOTIFICATION OF DISTRESS

### 13.1 INTRODUCTION

This section prescribes the responsibilities and procedures for the immediate notification to USACE of evidence of distress or potential failure of any project element in accordance with ER 1110-2-101, Reporting of Evidence of Distress of Civil Works Structures.

### 13.2 RESPONSIBILITIES

If evidence of distress is found, the FCD must report it immediately to USACE San Francisco District in accordance with ER 1110-2-101.

### 13.3 PROCEDURES

Procedures for reporting evidence of distress are outlined in ER 1110-2-101. Typical distress signals include the following:

- Sloughs, settlement, or slides in structures such as dikes, levees, and channels.
- Evidence of piping, muddy water, or sand boils in the landside of any dike or levee. Any increase in seepage quantities through or under any dike or levee.
- Unusual vertical or horizontal movement or cracking of dikes and levees.
- Significant cracking, spalling, or other damage to the concrete drainage structures through the levees and dikes.
- Sinkholes or localized subsidence in the foundation of or adjacent to dikes or levees.
- Significant damage to any structure.
- Significant damage to or changes in structures, foundations, groundwater conditions, and adjacent terrain as a result of seismic events. Special inspections for damage need to be made immediately following the events as described in ER 1110-2-1802.
- Any other indications of distress or potential failure that could inhibit the operation of the projects or endanger life and property.
- Abnormal increase or decrease of flow from foundation drains, or from structural joints in concrete floodwalls.
- Any increase in seepage quantities through or under levee embankments or abutments.
- Any significant change in pore-water pressure in either levees embankments or their foundations.
- Any significant change in uplift pressures under concrete structures.
- Significant cracking of mass concrete structures, either during construction or after completion.
- Excessive deflection, displacement, or vibration of concrete structures (e.g. tilting or sliding of floodwalls).
- Significant damage to any structure, closure, pump station, gate well, etc.
- Frequent power interruptions to major pump stations.
- Erratic movement, binding, excessive deflection, or vibration of gates and control valves observed during operations.
- Any other indications of distress or potential failure that could inhibit the operation of a project or endanger life and property.

The extent and significance of distress signals should be reviewed by a licensed engineer before reporting requirements are finalized.

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**PLATES SECTION**



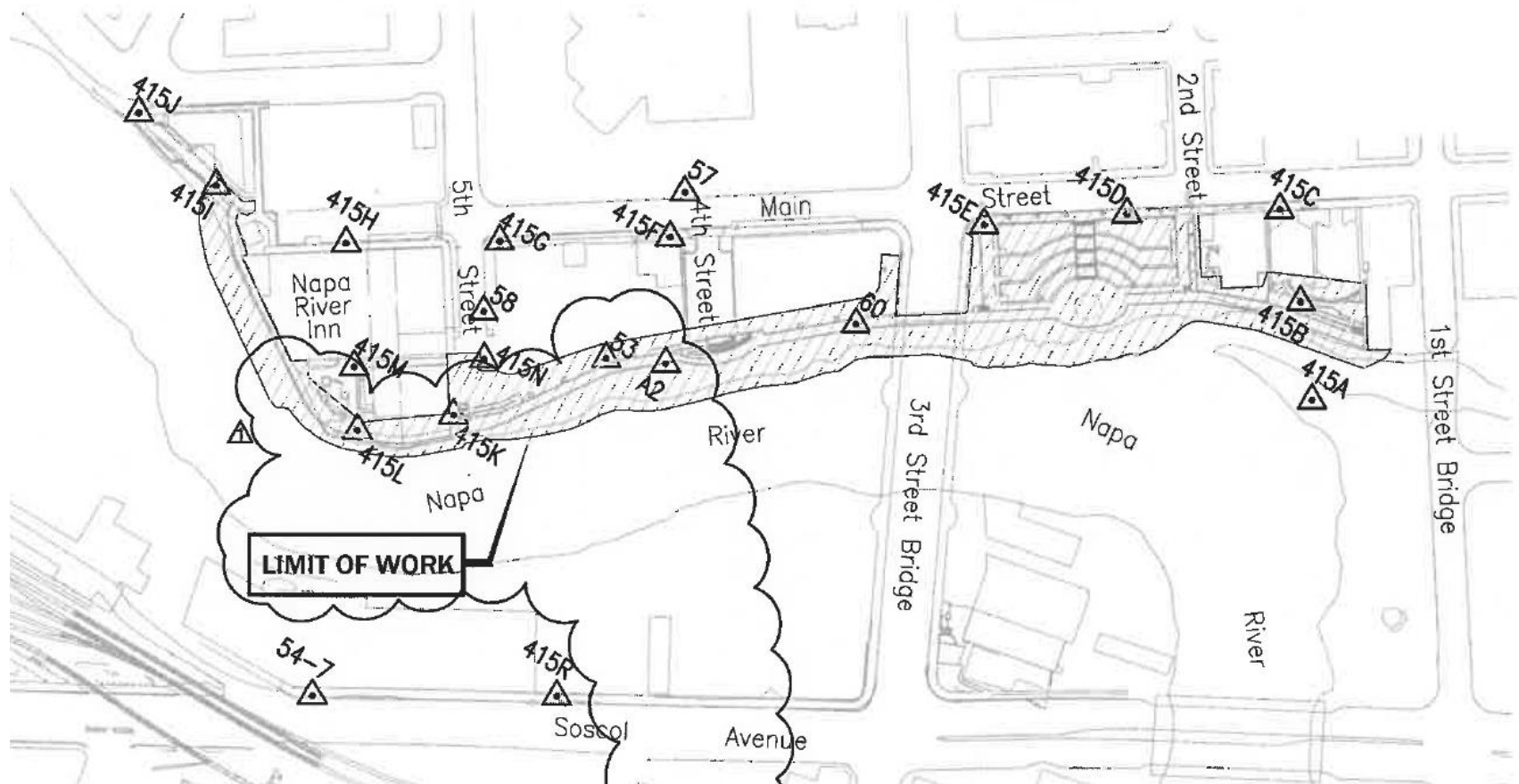


Plate 1.1 Site 2W – Hatt to 1<sup>st</sup> Project Limits

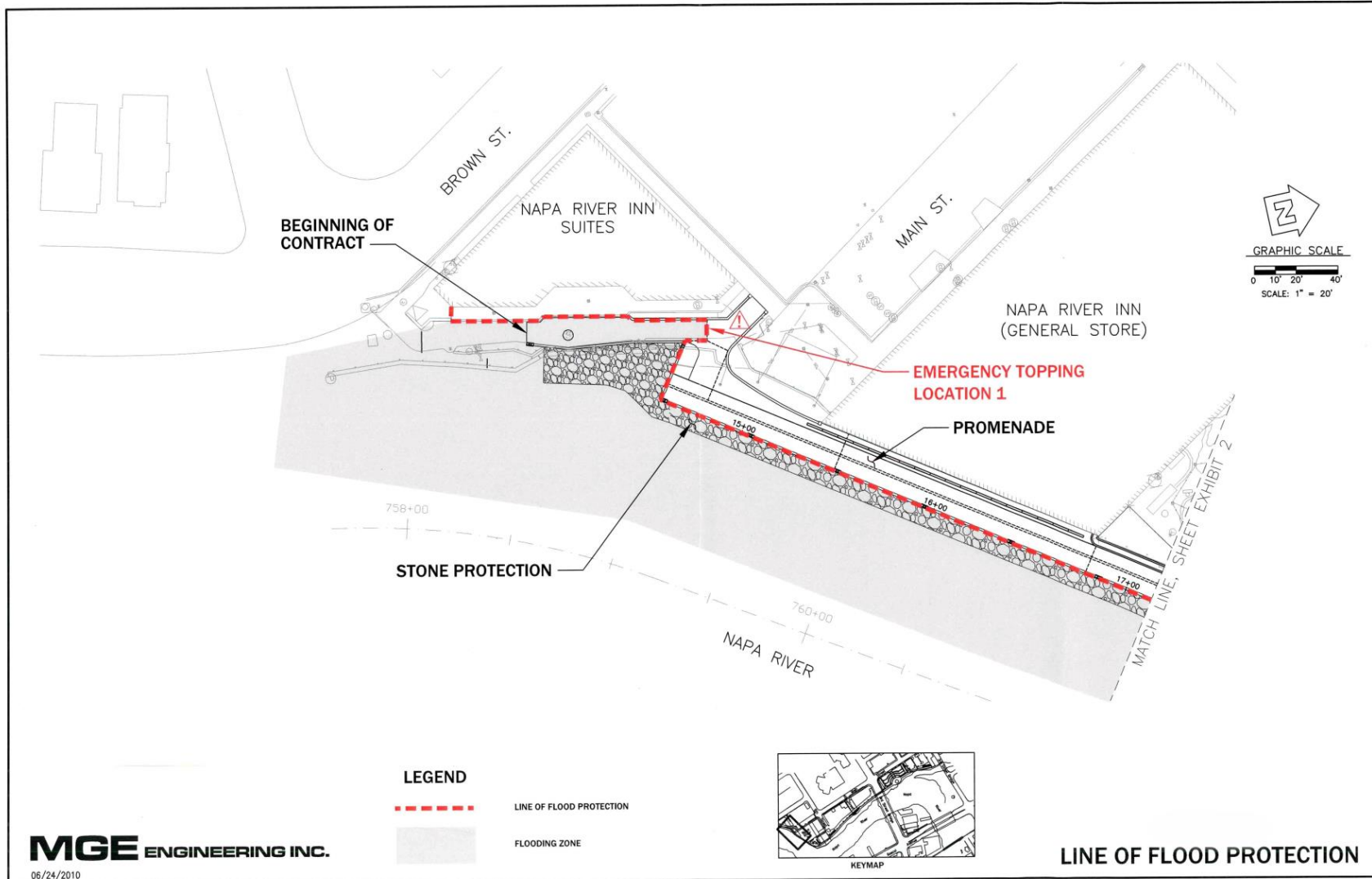


Plate 1.2 - Line of Flood Protection, Napa River Stations 758+00 to 760



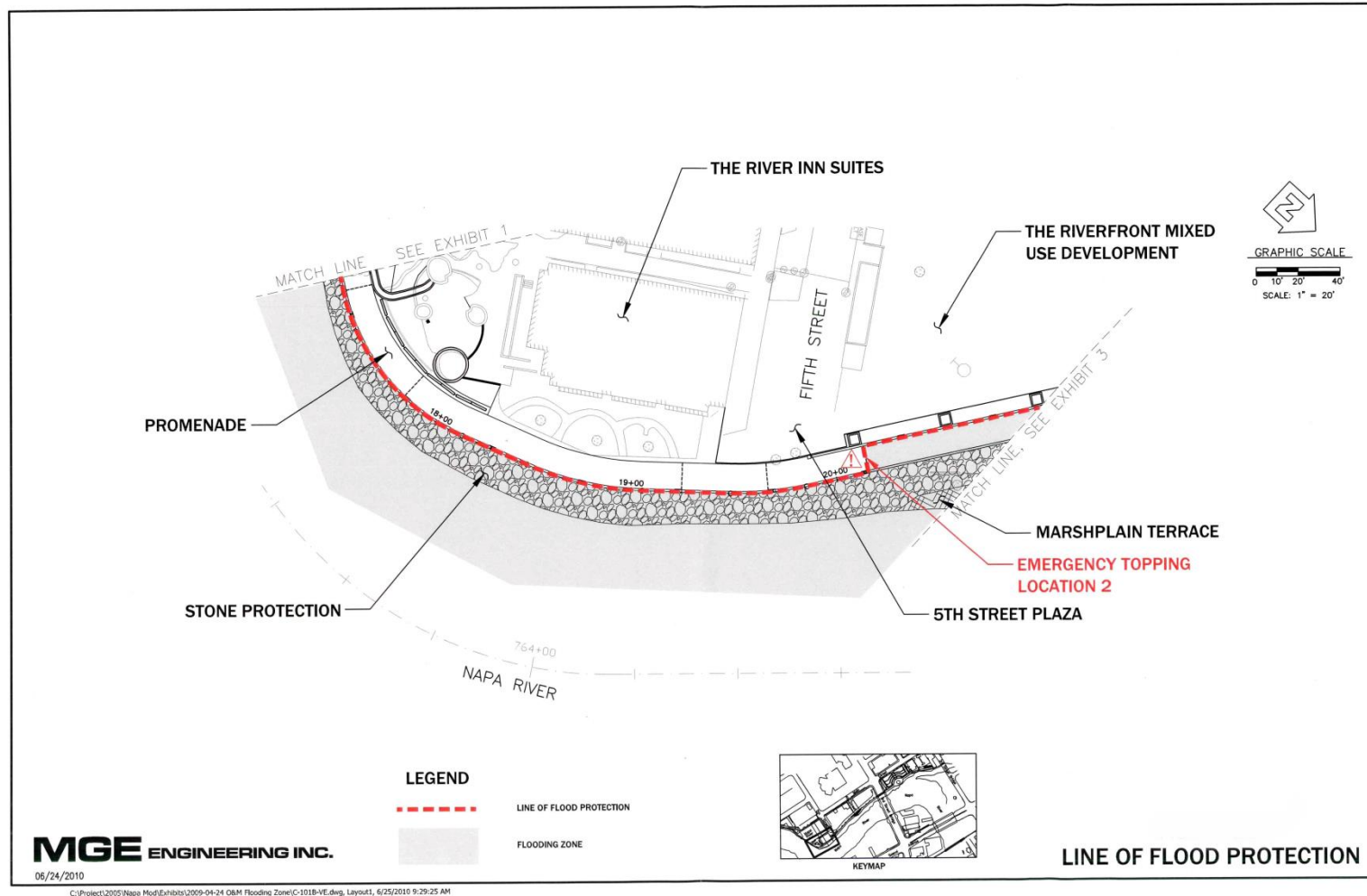


Plate 1.3 - Line of Flood Protection, Napa River Stations 760+50 to 765+00

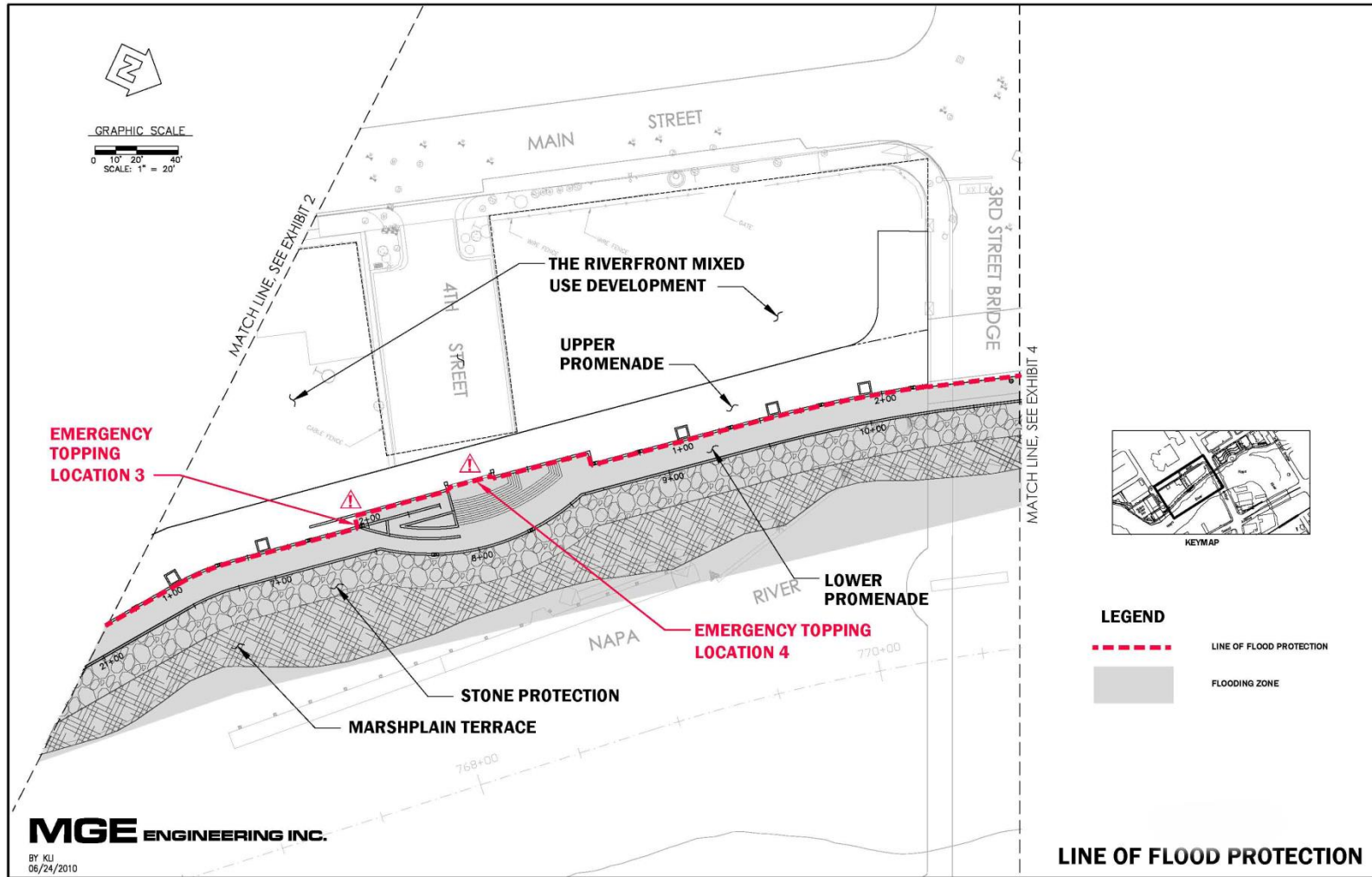


Plate 1.4 - Line of Flood Protection, Napa River Stations 765+00 to 770+50

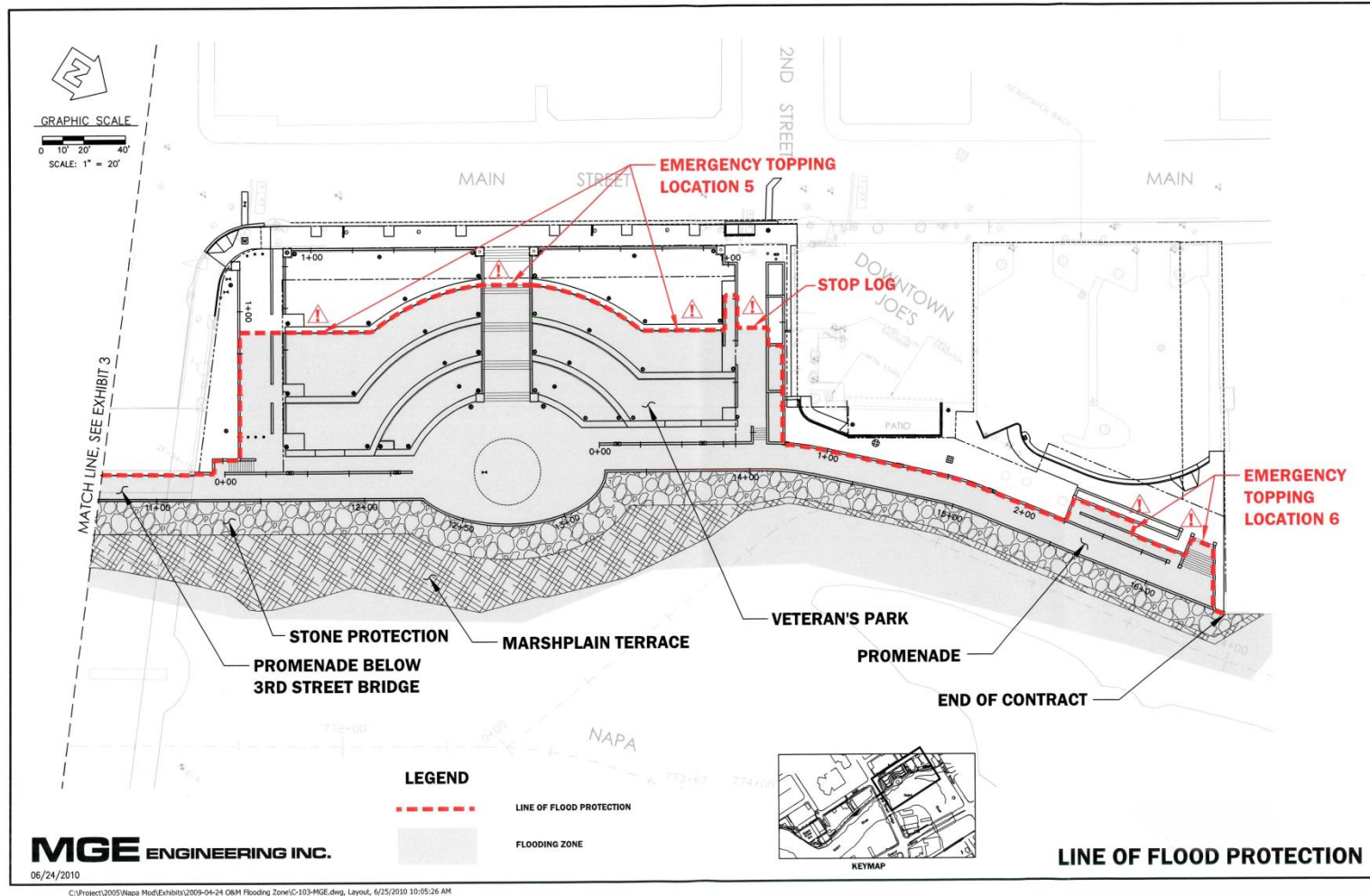


Plate 1.5 - Line of Flood Protection, Napa River Stations 770+50 to 775+00



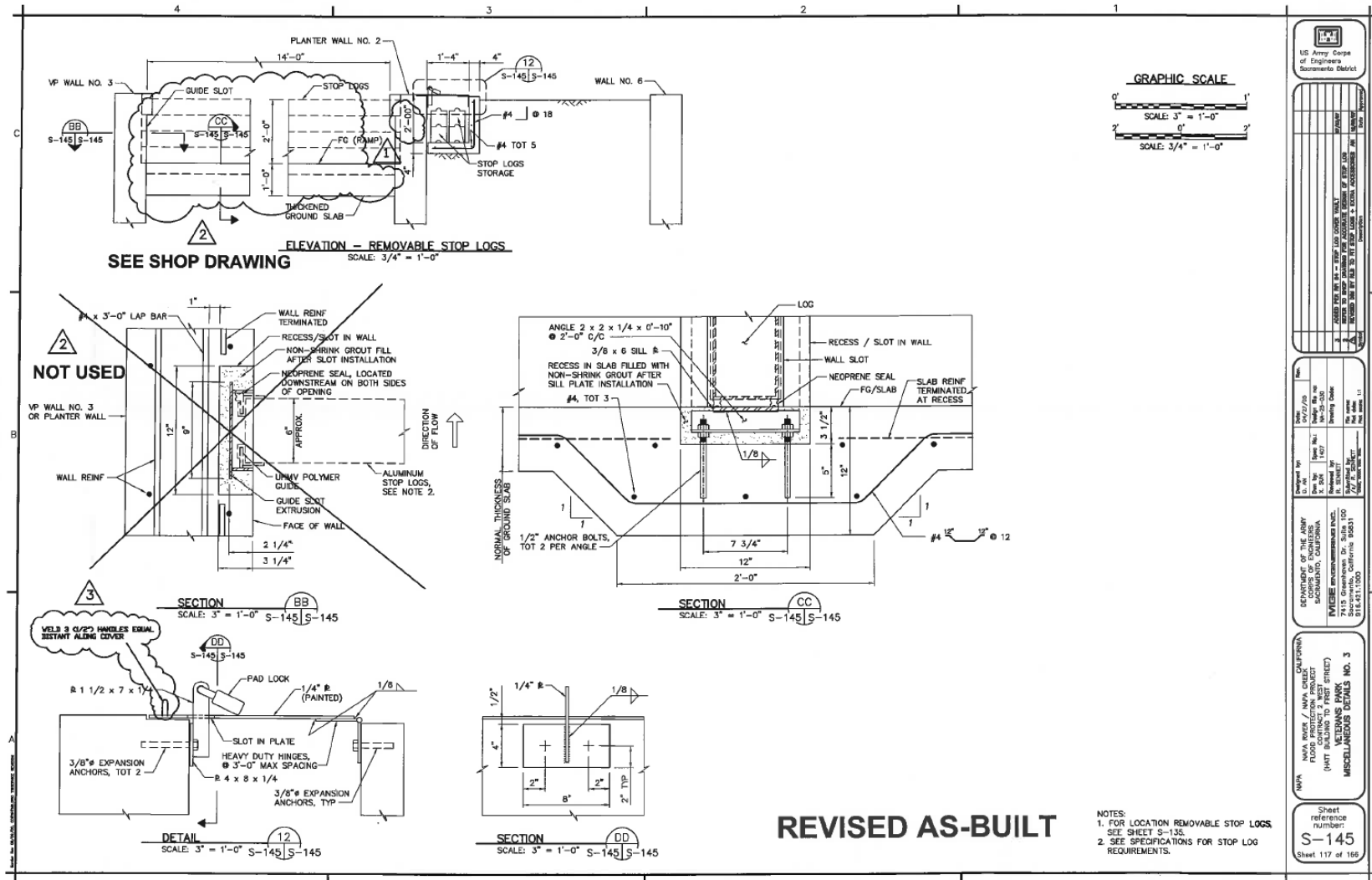


Plate 1.6 – Stop Log As-built drawing

# PLATES SECTION

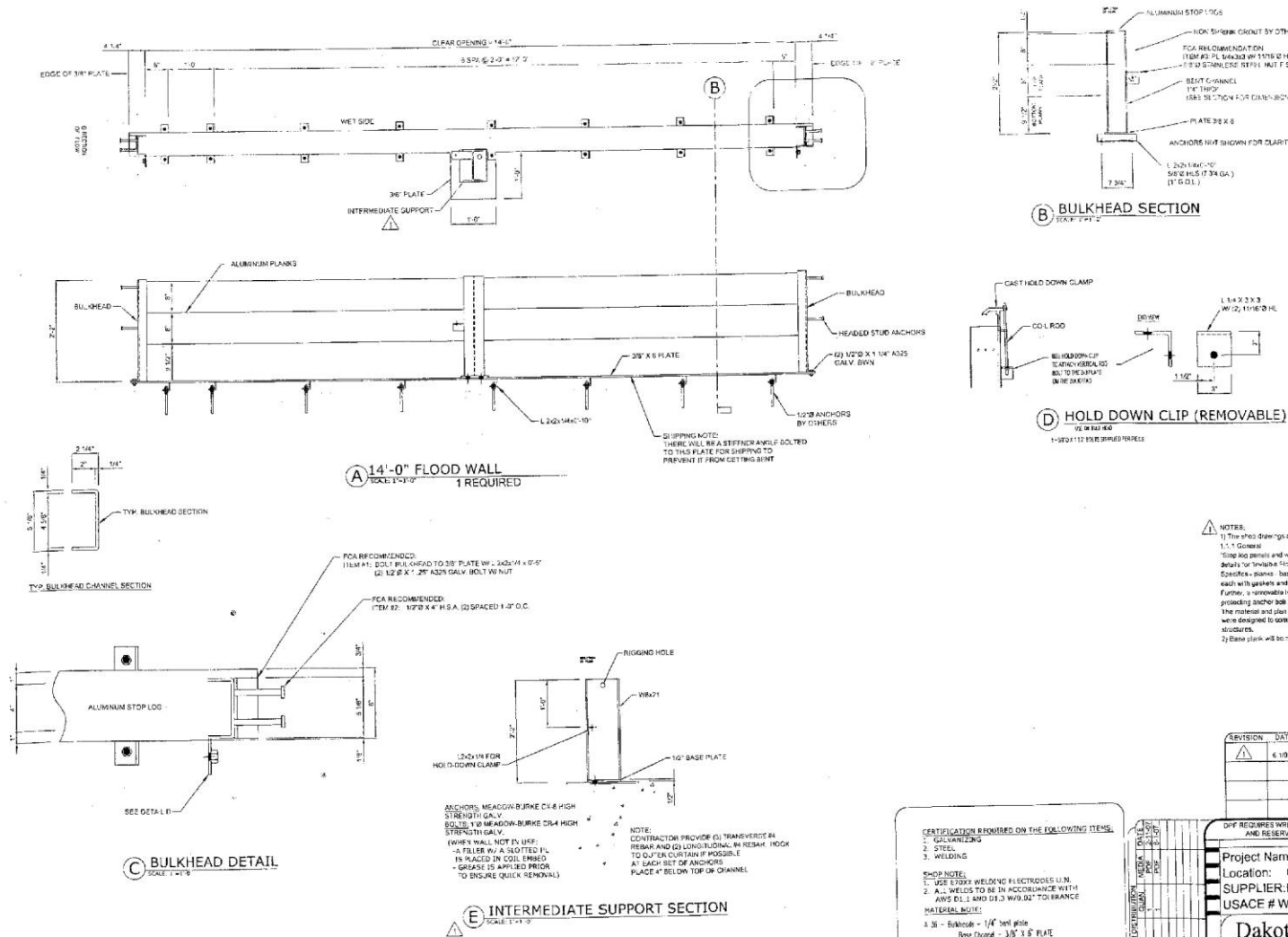


Plate 1.7 - Stop Log Fabrication Drawing

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- A-6 Contract 1B – Specifications**
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- A-8 Contract 1B Revegetation – Specifications**
- A-9 Contract 2E – Duden Construction Plans**
- A-10 Contract 2E – Duden Specifications**
- A-11 Contract 2E – NSD Construction Plans**
- A-12 Contract 2E – NSD Specifications**
- A-13 Contract 2E – 6<sup>th</sup> to 3<sup>rd</sup> Construction Plans**
- A-14 Contract 2E – 6<sup>th</sup> to 3<sup>rd</sup> Specifications**
- A-15 Contract 2W – Floodwall As Built Plans**
- A-16 Contract 2W – Floodwall Specifications**
- A-17 Contract 2 – Revegetation Construction Plans**
- A-18 Contract 2 – Revegetation Irrigation As Built Plans**
- A-19 Contract 2 – Revegetation Specifications**
- A-20 Contract 3 – Dry Bypass Construction Drawings (Placeholder for As built)**
- A-21 Contract 3 – Dry Bypass Specifications (Placeholder for completed project Specs)**
- A-22 Contract 3 – NVWT As Built Plans**
- A-23 Contract 3 – NVWT Specifications**
- A-24 Contract 4 – Napa Creek As Built Plans**
- A-25 Contract 4 – Napa Creek Specifications**
- A-26 Contract 2E – Levee Repair As Built Plans**
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(see DVD – inside back cover)

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**E-2 National Marine Fisheries Service Biological Opinion (12/14/98)**

**E-3 U.S. Fish & Wildlife Service (USFWS) Endangered Species Act (ESA) approvals**

- a) 1999 April 9 Biological Opinion (BO)
- b) 2000 June 9 BO reinitiation modifying project for south Wine Track work
- c) 2000 June 22 BO reinitiation modifying in-water work window
- d) 2007 May 17 BO reinitiation modifying project for 2W floodwall work
- e) 2009 November 24 BO reinitiation to account for delta smelt impacts
- f) 2012 May 21 BO reinitiation to account for saltmarsh harvest mouse impacts of operation and maintenance of project segments 1A and 1B.

**E-4 California Regional Water Quality Control Board (RWQCB) Orders**

- a) No. 99-074 (for entire project; 9/15/99)
- b) No. R2 01-066 (for 2E monitoring wells; 6/01)

**E-5 California (CA) Department of Fish & Wild Life(CDFW)**

- a) 1602 Streambed Alteration Agreement (10/20/09)
- b) CA ESA Incidental Take Permit (10/06/14)

**E-6 Napa Sites 1A and 1B Revegetation Fire and Logistics Plan Guide California Department of Fish and Wildlife MOU June 2002**

**E-8 Napa River Mitigation and Monitoring Plan**

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(see DVD – inside back cover)

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**G-2 SPK installed Transect Survey Data**

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- I-3 Dry Bypass White Paper**
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- I-6 Contract 2E Geotechnical Design Report**
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- I-8 Contract 2W Civil/Structural Design Report**
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- I-10 Napa Creek Geotechnical Design Report**
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<b>NAPA CREEK BOX CULVERT AND TERRACE PROJECT</b>				
<b>Summary of Landscape Water Meters</b>				
Meter No.	T=Temporary P=Permanent S=Sub-meter	Location	Service Area	Comment
1	1" – T	Main St., east side, north of bridge, from (N) 12" Main St. main.	Left bank between 1 <sup>st</sup> St. Bridge and Main St. Bridge	City may wish to consider this as a permanent meter for area between decorative fence and sidewalk following Oxbow bypass construction.
2	2" – S	South side of Pearl St., east of Bridge.	Upper and Lower Channel Smoothing areas	Existing 2" Landscape meter to be provided with 2" Sub-meter for Revegetation.
3	1" – T	North Side of Pearl St, in Heritage Park from Pearl St. Main	Right bank across from inlet between Pearl St. Bridge and (E) Saccrete bank protection.	
4	¾" – S	West side of Main Street Parking Lot, north of Ped Bridge, served from (E) Main Street Parking meter	Left bank between DS face of Pearl St Bridge and US face of Pedestrian Bridge.	Service point near back of sidewalk between driveways. POC at base of (E) concrete wall near top of bank.
5	2" – T	East side of Coombs Street, north of Pedestrian Bridge, top of right bank	Right bank (E) saccrete to approx Creek Station 21+50	Route behind Coombs Street Retaining Wall within Flood Protection Levee Easement (FPLE)
6	2" – P	Clinton-Brown Parking Lot, north side service from Brown St. Main.	<u>Permanent</u> : Brown Street Parking Lot <u>Temporary</u> : Left Bank from DB Inlet to approx. Sta.19+75	Future Uses: Clinton/Main Street Parking Lot, 9/11 Monument



<b>NAPA CREEK BOX CULVERT AND TERRACE PROJECT</b>				
<b>Summary of Landscape Water Meters</b>				
7	2" – T	Arroyo St, south side, behind back of walk, from Arroyo St. Main	Left bank from approx Sta 19+75 to DF face of Seminary St Bridge.	
8	2" - T	Seminary St. at UB outlet, from Seminary St. main near Center	Right bank, UB outlet to approx. 21+50	Routed behind "UB1 wall. Meter and In-ground double check at back of new sidewalk near UB outlet at Seminary St.
9	1" – T	Sub-meter from (E) irrigation supply at north side of Senior Center, routed behind building, along top of bank to Ped Bridge	Left bank between 37+50 and Pedestrian Bridge, and right bank, low bank Revegetation between UB Inlet and 39+40	Left bank POC at top of bank, downstream of Ped Bridge.  Right bank POC fed from 1" line temporarily hung on Ped bridge

**Dry Bypass**

<b>DRY BYPASS - Landscape Water Meter Location</b>				
Meter No.	T=Temporary P=Permanent S=Sub-meter	Location	Service Area	Comment
1	4 inches – P	North side of McKinstry Street at approximate station 7+20 across from the Wine Train Depot	Complete Project area.	The 4-inch irrigation water service crosses McKinstry Street in an 8 inch Schedule 80 PVC sleeve.

# Appendix N

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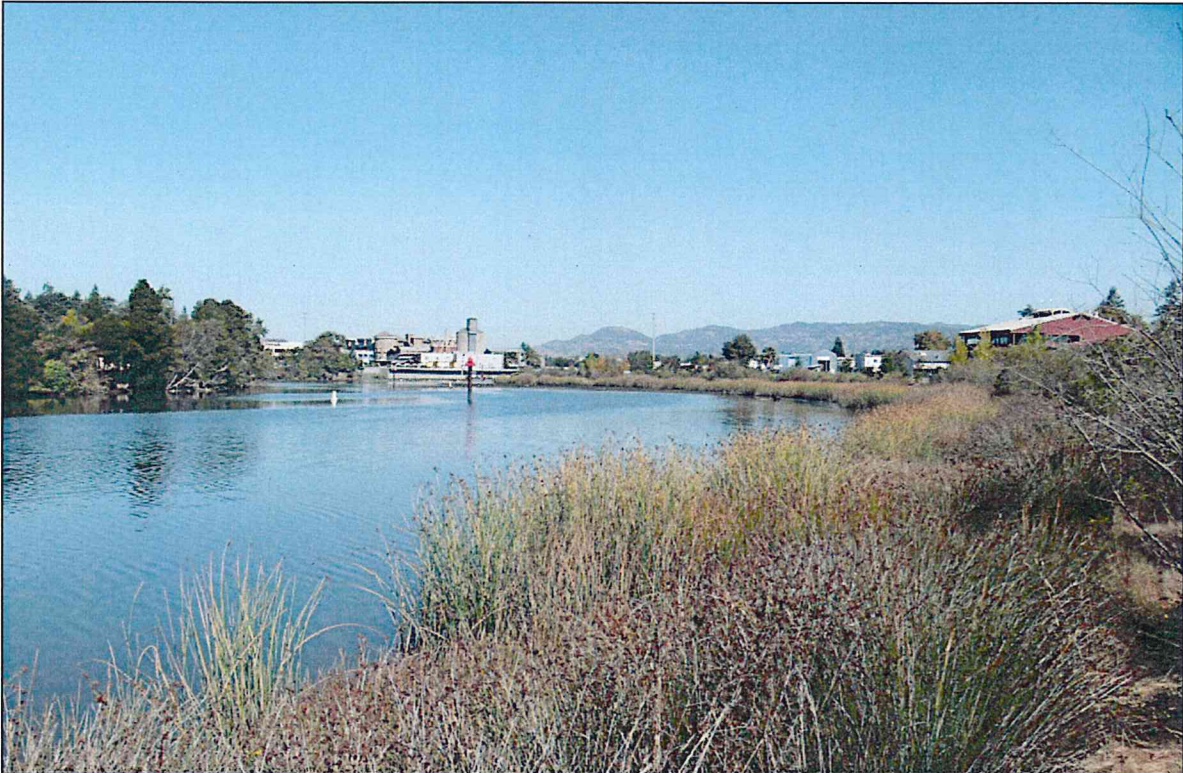
Post Closure Contingency Plan  
Napa River/Napa Creek Flood Protection Project  
Consolidated Remedial Action



**POST CLOSURE CONTINGENCY PLAN  
NAPA RIVER/NAPA CREEK FLOOD PROTECTION PROJECT  
CONSOLIDATED REMEDIAL ACTION**

**Task 9 – Site Cleanup Requirements Order No. R2-2001-066**

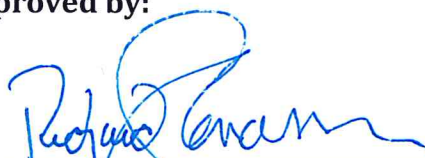
**Revised February 1, 2019**



View looking north along Napa River showing restored floodplain terrace on the east bank of the river (right side of photo). The tidally-inundated marsh plain terrace is under water at the time of this photo.

**Prepared by:**  
**Napa County Flood Control and Water Conservation District**

**Approved by:**

  
\_\_\_\_\_  
**Richard M. Thomasser, P.G.**  
**Operations Manager**



**Post Closure Contingency Plan  
Napa River/Napa Creek Flood Protection Project  
Consolidated Remedial Action**

**Revised February 1, 2019**

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## 1.0 INTRODUCTION

The Napa County Flood Control and Water Conservation District (District or NCFCWCD) has prepared this Post Closure Contingency Plan (PCCP) in compliance with Site Cleanup Requirements (SCR) Order No. R2-2002-066, Task 9, as required by the Executive Officer in the March 14, 2017 letter from the San Francisco Bay Regional Water Quality Control Board (RWQCB). In the March 14, 2017 letter, the RWQCB approved the District's *2016 Request for Closure Report*, dated March 28, 2016 (NCFCWCD, 2016). The *2016 Request for Closure Report* documented the site conditions and summarized the results of groundwater monitoring and sampling associated with the Napa River/Napa Creek Flood Protection Project (Flood Project); specifically the monitoring associated with the cleanup actions related to several former oil storage terminals along the Napa River in accordance with the *Consolidated Remedial Action Plan for Petroleum-Impacted Properties Located between Stations 737+00 and 756+00, Napa, California* (Montgomery Watson, 2001) (Consolidated RAP). The RWQCB requested the Closure Report to justify closure of the Flood Project (Case No. 28S0046) and the following five related cases: Former Basalt Rock Company (Case No. 28S0031), Former North Bay Oil Company (Case No. 28S0008), Former Phillips Oil Terminal (Case No. 28S0032), Former Texaco Oil Terminal (Case No. 28S0033), Former Exxon Oil Terminal (Case No. 28S0035).

The District submitted a draft PCCP on May 31, 2017. In a letter dated, January 18, 2019, the RWQCB responded to the draft indicating that the plan as submitted was deficient and required the PCCP to be revised to address Water Board comments. Specifically, the revised PCCP was to include provisions to conduct timely inspections after seismic and high water events, followed by prompt notification to Water Board staff as needed. This version of the PCCP has been revised as requested to add Section 5.0 - Post Seismic or Flood Event Monitoring.

## 2.0 BACKGROUND

The District is the local sponsor for the Flood Project, which is being constructed by the US Army Corps of Engineers (Corps) to provide flood protection along seven miles of the Napa River and one mile of Napa Creek within the City of Napa, California. The District's role in the Project is to acquire the necessary land rights for Flood Project construction and relocate businesses and utilities that may be affected in advance of the Corps construction. The Flood Project includes setting back active land uses along the river, creating or restoring floodplains, marsh plains and wetlands to increase the river's capacity for floodwater conveyance, and construction of floodwalls and levees to provide protection of homes and businesses up to the 100-year flood.

This PCCP pertains to the post closure monitoring and management of a limited area of Napa River Marsh Plain and Floodplain where subsurface soils contain residual contamination above the cleanup levels approved for remedial actions associated with the Flood Project construction. These remedial actions took place along approximately 2,500 feet of the eastern bank of the Napa River between Third Street on the north and Tulocay Creek on the south (Figure 1). This portion of the Flood Project is referred to as the Contract 2 East Floodplain and Marsh Plain Terracing Contract (Contract 2 East) by the District and Corps. During Flood Project planning and design in the 1990's, the District and Corps identified environmentally impacted properties within the Flood Project's reach for investigations to determine the appropriate approach to address these issues in advance, or as part of the Flood Project construction. Nine properties were identified by these early investigations within the Contract 2 East Project that had prior uses involving petroleum products. These properties were given Napa River (NR) Site name designations as shown on Figure 2.

## 2.1 Geology and Hydrogeology

The Napa Valley is located in the Coast Range geomorphic province. The valley is bounded by the Mayacamas Mountains to the west and the Vaca Mountains to the east. The valley is alluvium filled and underlain by Pliocene and Pleistocene age unconsolidated marine and continental sediments and volcanic rocks.

The Napa River has a watershed area of 426 square miles. The river flows 55 miles from its headwaters near Mt St. Helena to San Pablo Bay. The area of the Consolidated Remedial Action associated with the Flood Project is located within the estuarine reach of the Napa River with shallow groundwater in hydraulic communication with the tidally affected river. Local shallow stratigraphy is characterized by silts and clays with lesser occurrences of interbedded coarser grained deposits of sands and gravels. Groundwater depths correspond with the level of water in the river.

## 2.2 Previous Investigations and Remedial Activities

Review of data from prior investigations documented that significant soil and groundwater contamination existed in the Contract 2 East area, which would be encountered during excavation by the Corps. The District needed to investigate the extent of this contamination to evaluate remedial actions and ensure that Flood Project objectives of creating restored marsh plain and floodplain habitat could be accomplished. The District worked with the responsible parties for each of the impacted properties to gather site-specific data on the extent of contamination.

The District conducted a Remedial Investigation of the extent of contamination and presented its findings in the Consolidated RAP (Montgomery Watson, 2001). The



District estimated that over 89,000 pounds of gasoline and over 375,000 pounds of diesel fuel were present within the Remedial Action area. Other constituents of concern associated with the former site uses were also evaluated, including volatile and aromatic hydrocarbons, polycyclic aromatic hydrocarbons, and metals. The results indicated that the concentrations were consistent with former petroleum uses (Montgomery Watson, 2001).

Figures 3 and 4 illustrate the extent of groundwater contamination by diesel-range and gasoline-range total petroleum hydrocarbons (TPH) prior to Flood Project remedial actions.

### 2.3 Cleanup Levels Approved in SCR Order R2-2001-066

The District conducted an ecological assessment to determine appropriate soil and groundwater cleanup levels for the constituents of concern at the sites, as well as to determine soil reuse and disposal criteria for excavated soils. These criteria took into account the future land use at the sites, which was to become brackish emergent marsh and flood plain habitat and in the case of soil reuse and disposal evaluated potential off site commercial and residential reuse. The proposed soil and groundwater cleanup criteria and soil reuse criteria were presented in the Consolidated RAP and were approved by the RWQCB in Site Cleanup Requirements (SCR) Order No. 01-066 in 2001. The SCR Order named the former site owners and operators and the District (new property owner) as responsible parties.

Figure 5 presents the cleanup criteria for soils and illustrates how they were to be applied in relation to the Flood Project marsh plain and floodplain excavation performed by the Corps of Engineers. The criteria evaluated the future depth of the soils remaining in place and the contact with ecological and human receptors.

### 2.4 Flood Project Excavation and Remedial Actions

The Corps of Engineers retained MWH to conduct the remedial actions in conjunction with Contract 2 East marsh plain and floodplain terracing. Prior to commencing terracing work, MWH conducted an extensive pre-excavation soil characterization program in 2002. Soil sampling was conducted on a grid basis at multiple depths to evaluate the concentrations of petroleum contamination across the entire terracing area. This sampling program was used by MWH to determine concentrations of soil to be excavated for soil reuse and disposal purposes and also to determine where over-excavation beyond the planned Flood Project terrace elevations was necessary in order to meet the approved cleanup criteria for soils left in place. The pre-excavation soil sampling data was presented in *Final Pre-Construction Site Investigation Report* (MWH, 2002) and *Summary Report for Site Investigations North of 7<sup>th</sup> Street and Nord Vineyard* (MWH, 2003a).

Two phases of soil excavation and terracing work was performed by MWH under contract to the Corps of Engineers; in 2002 excavation and terracing work began in the southern end of the site near Tulocay Creek and extended northward to approximately Oil Company Road. In 2003 excavation continued north to the northern terminus of the Consolidated Remedial Action Plan area (see Figure 6). To accomplish excavation and isolate contamination from potential contact with the Napa River water during tidal fluctuations, sheet piling was installed along the edge of the river at the outer edge of the future marsh plain terrace. Dewatering of the excavation area was performed, and extracted water was treated to remove constituents of concern prior to discharge in accordance with an RWQCB-approved plan and permit. Excavation deeper than the planned marshplain and floodplain design elevations was conducted if pre-construction sampling data indicated concentrations of constituents of concern exceeded approved cleanup criteria. Over-excavated areas were backfilled with clean soils from the terracing excavations that met marsh plain and floodplain criteria. The maximum practical depth of excavation was defined as five feet below the future marsh plain surface, an elevation of approximately -4.3 feet National Geodetic Vertical Datum (NGVD). In total over 235,000 tons of petroleum-contaminated soils were excavated and disposed of at a Class 2 landfill as part of the remedial action.

The Contract 2 East remedial excavations and terrace construction was reported in *Summary Report for Phase 1 Remedial Action*, and *Summary Report for Phase 2 Remedial Action* (MWH, 2003b and 2004).

Soil samples were collected at the maximum depth of excavation in areas that required over-excavation beyond design elevations. Soils exceeding approved cleanup levels for the marsh plain and floodplain were excavated throughout the entire remedial action area, with the exception of a few limited areas where the maximum extent of excavation was limited. Figure 7 illustrates the location, elevation and TPH concentration of soils that were left in place because they exceeded the maximum practicable extent of excavation, in accordance with the approved cleanup criteria and Remedial Action Plan. This area is the former location of two sites, NR-17 the former Palzis property and NR-18 the former Basalt Rock property. A 20,000 gallon concrete vault with associated steel product fill lines extending towards the Napa River existed in this area (see Figure 7). The vault and the product lines were removed as part of Flood Project remedial actions. Significant free product was encountered in this area that was removed by excavation and associated groundwater extraction/dewatering to the maximum extent practicable. A 48-inch reinforced concrete pipe (RCP), which is the storm drain for Eighth Street, needed to be protected in place and also limited the over-excavation in this area.



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## 2.5 Post Remedial Action Groundwater Monitoring (2007 through 2014)

Figure 8 illustrates a plan view of the maximum concentrations of TPH left in place following remedial excavation and terracing in the Contract 2 East reach. The depth of remaining concentrations of TPH in soil remaining in place varies according to the approved criteria (see Figure 5), but generally exceeded five feet below the design surface elevation for the Marsh Plain (greater than -4.3 feet NGVD). The most stringent cleanup levels (established 93 mg/kg background level for the Napa River) were required within five feet of the Marsh Plain design surface and transition slope to the Floodplain, as this area is in diurnal contact with Napa River water associated with tidal fluctuations. Slightly higher concentrations of TPH were allowed to remain in place within the upper 6.5 feet of the Floodplain (elevations of 7.2 to 0.7 feet NGVD; up to 629 mg/kg TPH as gasoline and up to 518 mg/kg TPH as diesel fuel). As described above, soil excavation accomplished removal of all soil exceeding cleanup criteria as approved in SCR Order 01-066. Furthermore, over-excavation was conducted to the maximum extent practicable.

MWH prepared the *Post Remedial Action Groundwater Monitoring Plan* (MWH, 2003c) in accordance with SCR Order 01-066. Figure 8 illustrates the location of nine groundwater monitoring wells that were proposed and installed to monitor groundwater following remedial excavation. The well locations were selected based on the pre-excavation groundwater concentrations (as shown in Figure 8) and the concentrations of TPH in soil remaining following excavation. A monitored attenuation approach was proposed for residual groundwater concentrations.

The Corps conducted four years (2007 through 2010) of groundwater monitoring and sampling from the nine groundwater monitoring wells in accordance with the *Post Remedial Action Groundwater Monitoring Plan*. This timeframe exceeded the minimum required sampling period of two years as proposed in the approved Groundwater Monitoring Plan. In their Annual Report for 2010 monitoring and sampling (Corps, 2011), the Corps recommended no further sampling of seven of the nine wells (MW-1 and MW-4 through MW-9) because monitoring indicated that these wells had been shown to meet approved groundwater cleanup criteria. They recommended that sampling be continued in MW-2 and MW-3 on a reduced (biennial) frequency by the District following turnover of the wells to the District in 2012. Furthermore, they recommended that the District should request abandonment of the seven wells no longer being sampled.

The District took responsibility of the groundwater monitoring program in 2012 and performed the first biennial groundwater sampling in September 2014. The District submitted the *2014 Annual Report of Groundwater Monitoring and Sampling* (NCFCWCD, 2015) in July 2015. The 2014 data demonstrates that well MW-2 now also meets the RWQCB-approved groundwater cleanup criteria, showing non-detectable concentrations of TPH as gasoline, diesel fuel or oil. MW-3, which previously had shown evidence of light non-aqueous phase liquid (LNAPL) now



showed no measureable thickness in the well and only minor sheen on the sampling bailer. TPH as Gasoline was also non-detectable in MW-3. TPH as Diesel and Oil were detected at 12,500 micrograms per liter (ug/L) and 11,000 ug/L, respectively.

The RWQCB reviewed and approved the District's 2014 Annual Report and required the submittal of this report in a letter dated February 8, 2016. The RWQCB indicated that the report should apply the *Low-Threat Underground Storage Tank Closure Policy* (LTCP) (SWRCB, 2012) to compare the data available to ensure all sites meet the general and media specific criteria in the policy. Figure 9 illustrates the final concentrations of TPH in groundwater at each monitoring well. The District proposed well abandonment as part of the 2016 Closure Request, which was approved by the RWQCB in its March 14, 2017 letter. The District plans to abandon the wells in summer 2017 and will provide a letter report document the completion of such within 30 days following the abandonment activities.

### 3.0 CONTAMINATION REMAINING AT THE SITE

As described above and as shown in Figures 7 and 8, a minor amount of soil exhibiting residual concentrations of TPH remains at depth underlying the marsh plain and floodplain in limited locations at the site. This PCCP has been prepared to ensure procedures are in place to document the existence of this minor residual contamination, to monitor the site conditions to ensure they are not exposed, and to outline procedures that must be followed if any excavation activities are taken in the relevant areas.

### 4.0 ROUTINE POST CLOSURE EROSION MONITORING

The District is the property owner and responsible entity that will monitor the site conditions in the future. The District conducts annual post flood season inspections of the site as part of its Operations and Maintenance responsibilities to the USACE. These inspections include inspection of the constructed marsh and floodplains. These annual inspections will continue into the future and as it pertains to this PCCP, the surface along monitoring cross sections 10A and 10B (see Figure 10) will be inspected for any visual evidence of erosion. The results of visual inspections will be documented in the District's semi-annual monitoring reports submitted by June 1<sup>st</sup> each year. If any evidence of erosion is observed, a survey will be conducted along the cross sections to document the extent of the erosion and determine if exposure of residual TPH impacted soils threatened. The District will propose measures to address any documented erosion that threatens exposure of residual TPH in subsurface soils exceeding the cleanup levels established for the site.



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## 5.0 POST SEISMIC OR FLOOD EVENT MONITORING

Sustained high river flows such as occur during larger floods (10 year return frequency or greater) and other significant events such as earthquakes (magnitude 5.0 or greater) may result in erosion or displacement of the surface of the marsh or flood plain, which could potentially expose soils with residual contamination at depth. In order to not delay timely discovery of such soil exposure, the District will conduct visual inspections of the constructed marsh and floodplains as soon as possible, but not later than 72 hours following such events. If evidence of erosion or soil displacement is observed, a survey will be conducted to document the extent of the erosion or soil displacement and determine if exposure of residual TPH impacted soils is threatened. The District will notify the RWQCB within 48 hours if evidence of contaminated soil exposure is discovered or threatened and propose measures to address such exposure of residual TPH in subsurface soils exceeding the cleanup levels established for the site.

## 6.0 PROCEDURES TO BE FOLLOWED IN THE EVENT OF FUTURE SOIL EXCAVATION

Excavation of marsh plain or flood plain soils in the future is not expected. However, in the event any excavation is planned in the locations of soils exceeding cleanup levels, the District will notify the RWQCB of such plans in advance and propose appropriate soil characterization methods to evaluate the concentrations of TPH in any soils excavated. Excavated soils exceeding site cleanup levels will be disposed of at an approved offsite disposal facility. Only soils meeting approved cleanup levels will be used for backfill of any excavations.

## 7.0 SITE OWNERS RESPONSIBILITIES FOR PCCP IMPLEMENTATION

The Napa County Flood Control and Water Conservation District is the owner and responsible party to implement this PCCP and to ensure the information and procedures contained herein is available to any entity that might conduct soil excavation in the future. The areas of residual TPH in soil exceeding cleanup levels are located within defined areas of the Napa River marsh and floodplains. No development of such areas is allowed. No transfer of property ownership shall be approved without prior written approval of the RWQCB.



View looking north along Napa River of constructed marsh plain and floodplain terrace, at low tide, at the former location of Sites NR-19 (foreground) across NR-35, NR-34, NR-33 and NR-18 (background).



## 8.0 REFERENCES

- Montgomery Watson, 2001. *Consolidated Remedial Action Plan for Petroleum-Impacted Properties Located between Stations 737+00 and 756+00 Napa, California*. Prepared for the Napa County Flood Control and Water Conservation District.
- MWH, 2002. *Final Pre-Construction Site Investigation Report*. Prepared for the U.S. Army Corps of Engineers.
- MWH 2003a. *Summary Report for Site Investigations North of 7<sup>th</sup> Street and Nord Vineyard*. Prepared for the U.S. Army Corps of Engineers.
- MWH 2003b. *Summary Report for Phase 1 Remedial Action*. Prepared for the U.S. Army Corps of Engineers.
- MWH 2003c. *Post Remedial Action Groundwater Monitoring Plan*. Prepared for the U.S. Army Corps of Engineers.
- MWH 2004. *Summary Report for Phase 2 Remedial Action*. Prepared for the U.S. Army Corps of Engineers.
- NCFCWCD 2014. *2014 Annual Groundwater Monitoring Report*.
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- SWRCB, 2012. *Low-Threat Underground Storage Tank Closure Policy*.
- United States Army Corps of Engineers (Corps) 2011. *Annual Report for 2010 Groundwater Monitoring and Sampling*.