ALUM ROCK FISH PASSAGE PROJECT MITIGATION MONITORING REPORT YEAR THREE, 2015

PREPARED FOR:

Santa Clara Valley Transportation Authority
3331 North First Street, Bldg. B-2
San Jose, CA 95143-1906
Contact: Ann Calnan
408.321.5976

PREPARED BY:

ICF International
75 E. Santa Clara Street, Suite 300
San Jose, CA 95113
Contact: Donna Maniscalco
408.216.2802

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Acronyms and Abbreviations

FAC	Facultative
FACW	Facultative Wetland
HMMP	Habitat Mitigation and Monitoring Plan
HTH	H. T. Harvey & Associates
OBL	Obligate
Plan	Fisheries Monitoring Plan
Project	VTA's Alum Rock Fish Passage Project
VTA	Valley Transportation Authority
YSI	Youth Science Institute

Alum Rock Fish Passage Project
Mitigation Monitoring Report

This Mitigation Monitoring Report represents a full accounting of the required vegetation monitoring in accordance with the *Habitat Mitigation and Monitoring Plan – Alum Rock Park Bank Repair and Stream Restoration Projects* (Winzler & Kelly 2012 (HMMP) associated with VTA's Alum Rock Fish Passage Project (Project), which consists of several project elements contained in the City of San Jose's larger Alum Rock Park Bank Repair and Stream Restoration Project. This report also provides a summary of the Geomorphic/Physical Site Monitoring and Fish Passage Improvement Monitoring required under permit conditions for the Project. The full Geomorphic and Fish Passage Improvement Monitoring reports are attached to this report and in full represent a complete accounting of the required monitoring for 2015 and the status of the Project as related to achievement of performance objectives.

The Alum Rock Fish Passage Project is located in Alum Rock Park (Figure 1) and consists of four separate sites. Site 10 is a newly constructed floodplain about 120 feet long by 30 to 40 feet wide that begins just south of the Alum Rock Park Bridge L (Figure 2). Site 13 is a newly constructed fish passage located directly downstream of the Youth Science Institute (Figure 3). Site 3, consisting of removal of a rock wall downstream of Bridge L, and Site 5, consisting of repair of an eroded rill, are included in the Project; however, there are no monitoring requirements assigned specifically to these two sites.

Year Three, 2015

Executive Summary

Geomorphic Monitoring

Geomorphic monitoring of Sites 10 and 13 for the Project began in September 2013, will extend for a 5-year period, and is being conducted by Balance Hydrologics, Inc.

Site 10 Floodplain

Monitoring at Site 10 includes installation of level loggers that record water surface elevation depths every 15 minutes. Two loggers were installed on September 26, 2013 directly adjacent to Site 10. Two sedimentation plates were installed to provide a means to directly measure sedimentation on the floodplain. In addition to these passive methods of floodplain inundation measurements, two cross-sections and one floodplain 'longitudinal profile' were initially surveyed on October 17, 2013. These will be re-surveyed on a yearly basis to measure any changes to floodplain geometry at these locations. Photo point locations were established, with an initial set of photos taken to record existing conditions.

Visual assessment of geomorphic change on the floodplain was marked by vigorous growth of alders and willows. Aggradation was observed on top of the floodplain; evidence included organic debris wrack lines from high water and fresh sediment deposits. The thickness of this vegetation may have the capacity to divert most of the high flows away from the floodplain, protecting it from erosion and encouraging sedimentation, but may strongly divert flows into the opposite bank, increasing the potential for erosion. Such flow patterns and bank changes will be assessed visually during and/or following high flows in the upcoming water years. The depth of sediment accumulated on the floodplain sedimentation plates was measured on October 15, 2015. Both plates had accumulated less than 0.01 feet (2-3 millimeters) of sediment and approximately 0.2 feet of organic debris that appears to be largely deposited by flows from December 2014. The floodplain is functioning as intended, and sediment deposition, while not excessive, is occurring.

Comparisons of the October 2015 cross section survey to the previous surveys generally confirm the results of the visual observations: other than some aggradation, little geomorphic change took place in the floodplain over WY2015. The comparison of the surveyed cross sections shows some reworking of the channel bed sediments, but no evidence of channel widening or downcutting. There is a significant change in topography between the stream channel and the floodplain wall due to the deposition of sediment during the storms of December 2014. Additionally, the dense vegetation at this location likely enhanced deposition locally.

Site 13 Fish Passage

At Site 13, the uppermost step in the original channel design failed in the first year's set of storms (i.e. two large storms in December, 2012). The step was rebuilt in mid-September, 2013. All monitoring work commenced after the step was rebuilt. To monitor channel evolution, seven cross-sections and one longitudinal profile were initially surveyed on October 17, 2013. These sections will be re-surveyed on a yearly basis to measure any changes to channel geometry at these locations. Photo point locations were established, with an initial set of photos taken to record existing conditions.

Visual inspections and photo point comparisons from Year 1 to Year 3 of Project Site 13 show that the fish passage seems to be functioning as intended. Little to no erosion of the bed or construction elements was observed, and the structure was in good condition. Some scour of the bed and reworking of gravel to cobble-size sediments was also observed. These reworked sediments provide an additional increase in habitat complexity, and are not expected to interfere with the structural integrity of the channel. The flows of December 2014 moved large wood in the channel. A large log shifted a few feet up the bank. While no new large wood accumulated in the channel, this may provide a mechanism for additional habitat development in future flows.

Comparisons of October 2015 cross section survey data to September 2014 survey data generally confirm the results of the visual observations – major geomorphic change, such as significant bank widening, downcutting or aggradation, did not take place in the fish passage over WY2015, but small and localized variations in bed elevations are present. The longitudinal profile shows the most scour took place downstream of the YSI Bridge. The pool bottoms are about 1 foot deeper than previous years, attributable to the December storm event. Sediment appears to have accumulated in some pools. The tops of rock band structures and weirs are at the same elevations as last year. These surveyed profiles suggest geomorphic stability and active channel dynamics. (For details of the geomorphic site monitoring, refer to Appendix C.)

Fisheries Monitoring

H. T. Harvey & Associates (HTH) developed and implemented a Fisheries Monitoring Plan (Plan) to meet the requirements of the Project's Biological Opinion prepared by the National Marine Fisheries

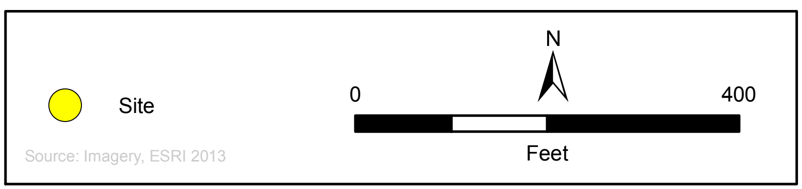

Figure 1
Project Location and Sites
Alum Rock Park Bank Repair and Stream Restoration Project
Santa Clara Valley Transportation Authority

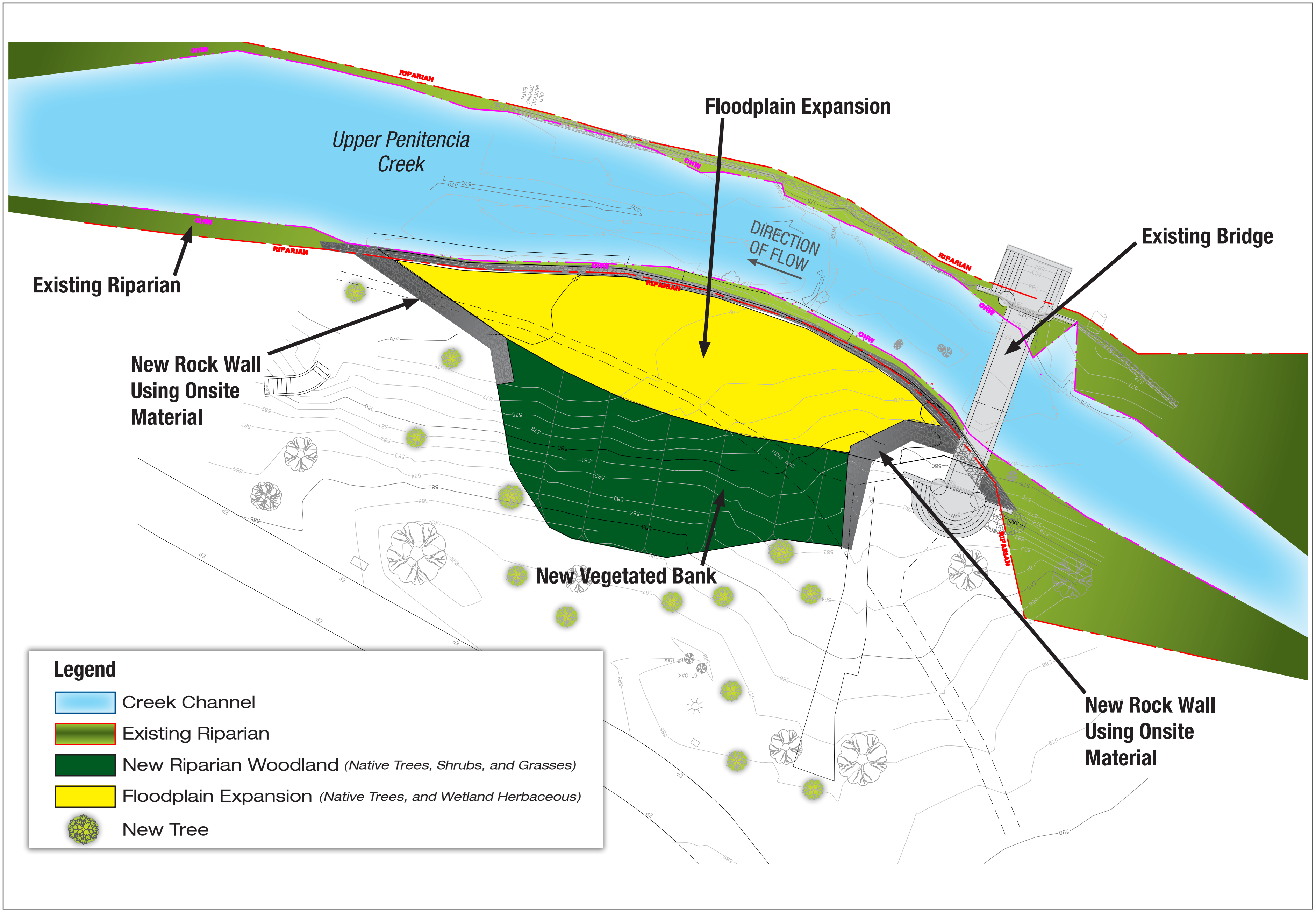

Figure 2
Site 10 Floodplain Restoration
Alum Rock Park Bank Repair and Stream Restoration Project
Santa Clara Valley Transportation Authority

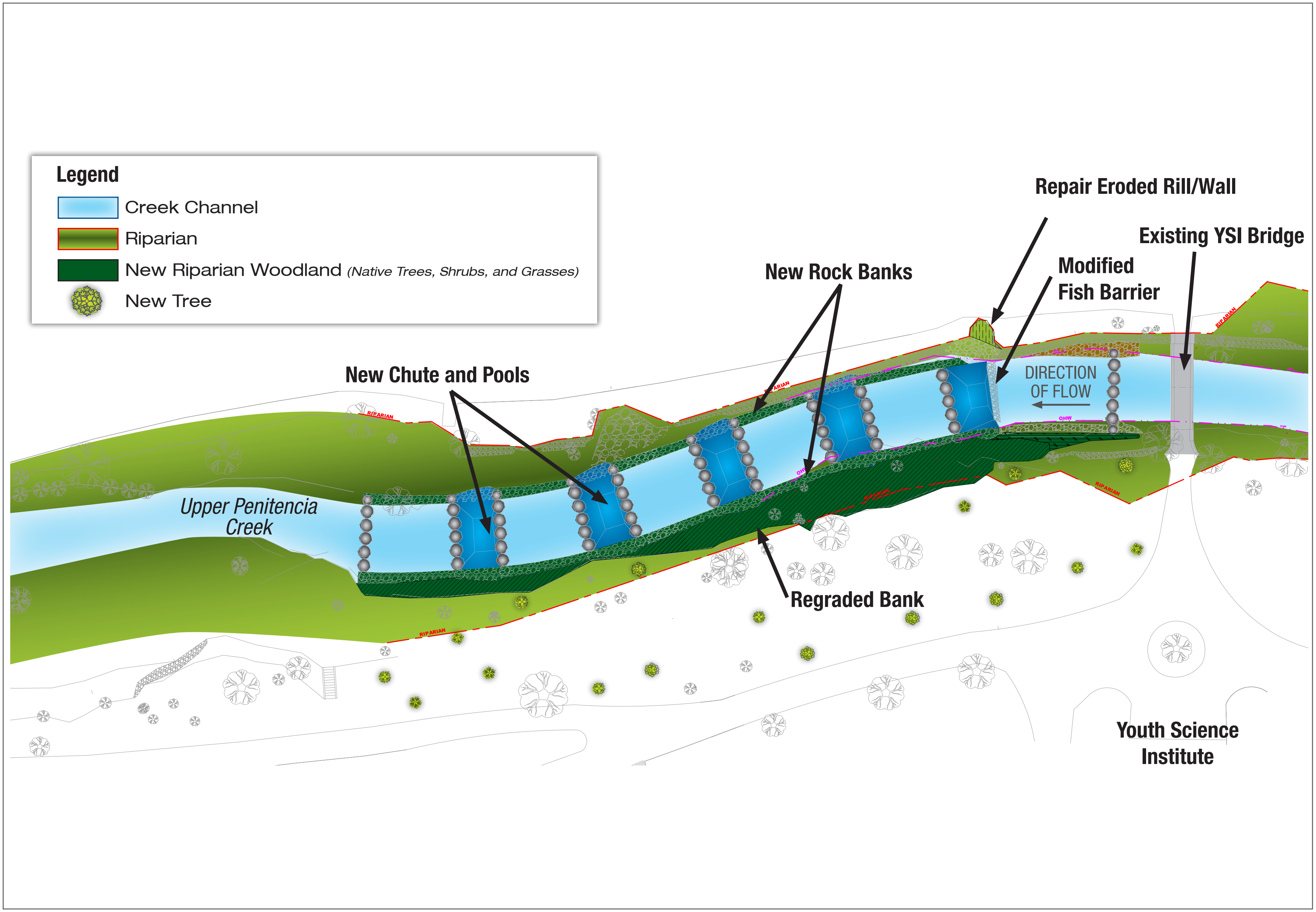

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Figure 3
Site 13 Fish Passage Improvement Restoration
Alum Rock Park Bank Repair and Stream Restoration Project
Santa Clara Valley Transportation Authority

Service (May 31, 2012). Plan goals were to: 1) document the fish species occupying Site 13, and 2) document habitat associations in the Project and reference reaches upstream. Special attention was given to the occurrence of Central California Coast steelhead (*Oncorhynchus mykiss*) due to their special status.

Spring electrofishing surveys were conducted on May 13, 2015; HTH fish ecologists surveyed 17 contiguous habitat units in the Project Area (Sites 13 and 10) and 10 habitat units in the Upstream Reach. Fall electrofishing surveys were conducted on November 15 and 16, 2015 and the same habitat units were sampled. The fish community documented during Year 3 surveys was composed of four native species: California roach (*Lavinia symetricus*), riffle sculpin (*Cottus gulosus*), Sacramento sucker (*Catostomus occidentalis*), and steelhead. Spring and fall surveys found no steelhead at Site 13; at Site 10, one steelhead was captured during the spring survey in pool habitat and none during the fall. In total, 281 fish were captured during the spring and 872 fish were captured during fall.

The results of the 2015 Year 3 surveys indicate that the Project goals have been met; native fish, including steelhead, inhabit both sites. (For details of the Alum Rock Park Fish Passage Improvement Project: Year 3 Fisheries Monitoring refer to Appendix D.

Vegetation Monitoring

The HMMP was completed for the Project to aid in mitigating the vegetation effects of the restoration activities. The HMMP states that once during the growing season herbaceous species will be monitored for five years and woody species for ten years to determine the success of the re-vegetation. ICF International biologists conducted the vegetation monitoring for Year-3 on September 23, 2015.

The Project met all performance objectives for Year-3 monitoring. Wetland species averaged a total of 68% aerial cover; the required aerial cover in the HMMP was 40%. Aerial cover of native plants averaged a total of 73% of the Project area; the required aerial cover in the HMMP was 30%. Survival of trees and woody plants averaged 103%; the required survival in the HMMP was 75%. Lastly, invasive species were not widespread during Year-3 monitoring and did not prevent the achievement of any performance objectives.

Management Recommendations

There are no management recommendations for Fisheries Monitoring.

There are no management recommendations for Geomorphic Monitoring.

To continue the high plant survival trend in following monitoring years, it is recommended that invasive species are assessed monthly and controlled, as described in the HMMP. Although these species did not prevent the achievement of the performance objectives in Year-3, with neglect, invasive species could spread quickly and become more difficult to control. Stinkwort invasion is the most urgent management issue in the Project area. No stinkwort was observed in any of the planting zones, except for several plants in Zone 1, but continued management by spraying or pulling by hand prior to seeding (this species blooms from September to November) is important in control. No other invasive species were observed in any of the zones.

Introduction

The Mission-Warren/Truck Rail project was completed by the Santa Clara Valley Transportation Authority (VTA) in 2012 and as mitigation, VTA constructed four mitigation projects along Upper Penitencia Creek known collectively as the Alum Rock Fish Passage Project (Project). These projects included removal of a rock wall downstream of Bridge L (Site 3) floodplain expansion downstream of Bridge L (Site 10) (Figure 2), fish passage improvement (Site 13) (Figure 3), and repair of eroded rill (Site 5). These projects served as compensatory mitigation for permanent, unavoidable impacts due to the Mission-Warren/Truck Rail project. Project Sites 3 and 10 excavated and graded the right bank (from the perspective of looking downstream), creating a 0.06 acre floodplain area (Figure 2). In Project Site 13, a stable roughened channel was created below an undercut weir in order to allow salmonids to migrate over the weir and access the upper part of Upper Penitencia Creek (Figure 3). The Project resulted in impacts to jurisdictional waters; mitigation for these impacts comprises revegetation of temporarily disturbed areas with native riparian, wetland, and herbaceous plant species.

Several monitoring activities associated with Sites 10 and 13 are required to ensure success of the Project. These include geomorphic (physical) and biological (fisheries) monitoring, which are required by the Project permits and Biological Opinion. Vegetation is in accordance with the *Habitat Mitigation and Monitoring Plan Alum Rock Park Bank Repair and Stream Restoration Projects* (Winzler & Kelly 2012) (HMMP). There are no monitoring requirements assigned specifically to Sites 3 and 5.

Project Location

The Project is located on Upper Penitencia Creek within Alum Rock Park in the County of Santa Clara, California; Latitude 37°23'301' N, Longitude 121°47'30" W; Assessor's Parcel Numbers: 595-07-01 5, 599-25-001, 612-46-001 (Figure 1). Alum Rock Park is a 720-acre municipal park run by the City of San Jose, Department of Parks, Recreation, and Neighborhood Services. The four projects, as described above, are grouped at two locations, the YSI (Youth Science Institute) Bridge and Bridge L along Upper Penitencia Creek. The YSI Bridge is located near a facility operated by the Youth Sciences Institute and Bridge L is located 1400 feet upstream. Sites 13 and 5 surround the YSI bridge and Sites 10 and 3 are located immediately downstream of Bridge L.

Geomorphic Monitoring

The 5-year geomorphic monitoring program (Appendix C) is intended to evaluate the restoration and enhancement of Sites 10 and 13 (Figures 2 and 3). Data collected is used to assess, on an annual basis, whether the sites meet the criteria for success set forth in the Biological Opinion, RWQCB 401 certification document, and HMMP, and to inform the response to any physical conditions that need immediate attention. The program includes monitoring the creek for bank stability and channel stability, as well as the new floodplain for inundation. Please refer to Appendix C for the complete geomorphic monitoring report.

Fisheries Monitoring

Fisheries monitoring at Sites 10 and 13 utilizes the electrofishing protocol specified in Appendix D. The purpose of this monitoring is to document the fish community at the project sites, with particular emphasis on the presence of Central California Coast steelhead (*Oncorhynchus mykiss*). Please refer to Appendix D for the complete fisheries monitoring report.

Vegetation Monitoring

The HMMP completed for the Project states that once during the growing season herbaceous species will be monitored for five years and woody species for ten years to determine the success of the re-vegetation.

In December 2012, native vegetation was planted to coincide with the onset of the rainy season. Construction and planting of the Project was fully completed February 5, 2013. Ecological Concerns Inc. is currently performing landscape maintenance twice a week and has been continuous since March 2013. The monitoring for Year-3 was conducted on September 23, 2015 by Donna Maniscalco and Amy May, ICF International biologists.

Methods

The methods for the Geomorphic and Fisheries monitoring are discussed in Appendices C and D.

The vegetation monitoring protocol was designed to evaluate the performance of native vegetation, as described in the HMMP. Additional modifications to the protocol are recommended as a result of Year-3 monitoring and are included in the Management Recommendations section below. A description of the study design and monitoring protocol follows.

Study Design

The study design for the Geomorphic and Fisheries monitoring is discussed in Appendices C and D.

Vegetation was counted and assessed in four zones: Zone 1, 2, 4, and 5 (Figure 4), which follow the zones in the Planting Site Plans for the Project (Appendix A) and the HMMP. Zones 1 and 2 comprise riparian woodland species planted along the mid to top of the left bank of Upper Penitencia Creek at Site 13 downstream of the YSI Bridge. Zones 4 and 5 comprise floodplain species at Site 10 immediately downstream of Bridge L. Note that Zone 3 comprises herbaceous species planted at Site 13. Zone 3 was planted with hydroseed, so plants were not counted. In each of the four zones, all living and dead trees, shrubs, and herbaceous species were counted individually and tallied in a notebook. Total aerial percent cover and percent cover of native species in each zone were estimated and invasive species were noted.

Trees and woody shrubs in the Project area were not tagged or numbered; rather the total number of individuals from each monitoring year will be compared to the total number originally planted to determine survival.

One or two permanent photo-documentation stations were established to document each zone, and monitoring photographs were taken at each location (Figure 5 and Appendix B). These locations were marked with a Trimble GeoXT GPS Unit and, in most cases, demarcated on-site with a wooden stake or rebar. Photos will be taken from these locations in years two through ten. For Year-3, additional photos were taken to present a better picture of the project site. Bankside erosion was also documented in the vicinity of each zone.

Performance Objectives

The performance objectives for the geomorphic and fisheries monitoring are discussed in Appendices D and E. The objectives for the vegetation monitoring are discussed below.

Wetland Species

The HMMP requires a minimum of 40% aerial cover of native facultative and wetter species within both sites during Year-3 monitoring. Percent aerial cover was calculated individually for each zone and totaled for the entire Project area.

Native Species

The HMMP requires a minimum of 30% aerial cover of native species within the riparian and restored upland areas during Year-3 monitoring. Percent aerial cover was calculated individually for each zone and totaled for the entire Project area.

Trees and Woody Plants

The HMMP requires that at each annual monitoring event, the Project area will exhibit a 75% survival rate of trees and woody plants. Survival was calculated for each zone and totaled for the entire Project area.

Invasive Species

The HMMP requires that at each annual monitoring event, invasive species will be assessed and managed as appropriate to ensure the performance objectives described above are met.

Results

The results from this year's geomorphic and fisheries monitoring are discussed in Appendices C and D.

The results from this year's vegetation monitoring indicates that survival is high for both trees, woody plants, and herbaceous species, and restoration is exceeding the required performance objectives for Year-3. Specific results for each objective are summarized below.

Wetland Species - Objective One

Per the performance objectives in the HMMP, plants with a Facultative (FAC), Facultative Wetland (FACW), or Obligate (OBL) wetland indicator status must be present to determine site success of the floodplain and shrub/scrub and emergent floodplain areas. Species in the planting palette that meet this criterion include: California blackberry (*Rubus ursinus*), mugwort (*Artemisia douglasiana*), white

Figure 4
Planting Zones
Alum Rock Park Bank Repair and
Stream Restoration Project
Santa Clara Valley Transportation Authority

Photo Station
Photo Direction
Bridge L
YSI Bridge
Project Area

N
0 200
Feet

Source: Imagery, ESRI 2013

Figure 5
Photo Station Locations
Alum Rock Park Bank Repair and
Stream Restoration Project
Santa Clara Valley Transportation Authority

alder (*Alnus rhombifolia*), arroyo willow (*Salix lasiolepis*), snowberry (*Symphoricarpos alba* var. *laevigatus*), common bulrush (*Scirpus robustus*) [now called seacoast bulrush (*Bolboschoenus robustus)*], common monkeyflower (*Mimulus guttatus*), nut-sedge (C*yperus eragrostis*), slough sedge (*Carex obnupta*[1]), hedge nettle (*Stachys ajugoides*), California rose (*Rosa californica*), big leaf maple (*Acer macrophyllum*), and blue elderberry (*Sambucus mexicana*). The combined aerial percent cover of the above species is listed in Table 1 for each zone.

Table 1. Aerial Percent Cover of Wetland Species

	Year 1		Year 2		Year 3	
Zone	Aerial % Cover	Criterion of 20% Met?	Aerial % Cover	Criterion of 35% Met?	Aerial % Cover	Criterion of 40% Met?
Zone 1	30%	Yes	50%	Yes	75%	Yes
Zone 2	75%	Yes	80%	Yes	80%	Yes
Zone 4	80%	Yes	100%	Yes	95%	Yes
Zone 5	15%	No	20%	No	20%	No
Average	50%	Yes	63%	Yes	68%	Yes

Note: For Year 3, the success criterion for Objective 1 is a minimum of 40% aerial cover of native facultative and wetter species within the re-established scrub/shrub and emergent floodplain area.

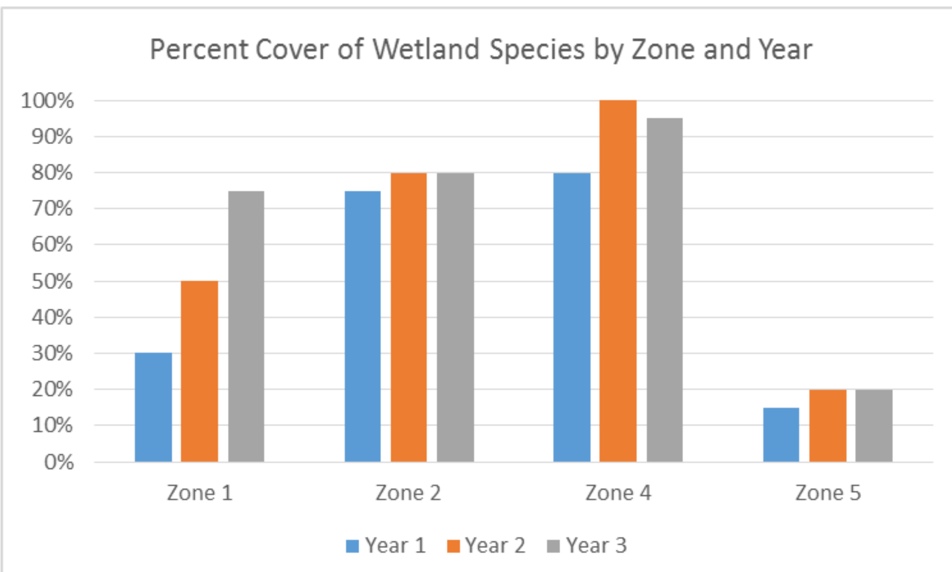


Figure 6. Percent Cover of Wetland Species by Zone and Year

[1] *Carex obnupta* was substituted for *Carex nudata* for the following reasons*:* the *Carex obnupta* delivered was collected for propagation in Alum Rock Park for riparian restoration, but was initially misidentified as *Carex nudata.* After researching, it was found that both species are native to the region and found in wetland-riparian communities locally according to Calflora and both are obligate wetland indicator species. For these reasons, VTA concluded that *Carex obnupta* was an appropriate substitute for *Carex nudata*.

Zone 5, mid to top of bank plants at Site 10, does not currently meet the Year-2 success criteria of 40% aerial cover. The reason for the lower percentage of aerial extent is because big leaf maple is not a fast growing tree and the increase in aerial extent is less than the other planted species. However, the entire Project area averages 68% aerial cover, which is over the criterion of 40%.

Native Species - Objective Two

Quantities of native herbaceous species, which include California rose, California blackberry, Torrey's melic (*Melica torreyana*), mugwort, nut-sedge, common bulrush, slough sedge, common monkeyflower, and hedge nettle, are shown in Table 2 and native trees and woody plants are shown in Table 3 (dead plants are not included). Zone 2 is not included in Table 2 because it contains only trees (alder and willow).

Table 2. Extant Native Herbaceous Species

	Total Planted			Year 1 Survival			Year 2 Survival			Year 3 Survival			Difference Between Total Planted and Year 3 Survival		
Species	Zone 1	Zone 4	Zone 5	Zone 1	Zone 4	Zone 5	Zone 1	Zone 4	Zone 5	Zone 1	Zone 4	Zone 5	Zone 1	Zone 4	Zone 5
California rose	7	0	4	6	0	6	8	0	4	6	0	4	-1	0	0
California blackberry	18	0	2	19	0	2	15	0	2	26	0	3	8	0	1
Mugwort	18	25	0	17	21	0	15	22	0	13	22	0	-5	-3	0
Nut-sedge	0	25	0	0	24	0	0	24	0	0	23	0	0	-2	0
Common bulrush	0	30	0	0	21	0	0	45	0	0	59	0	0	29	0
Slough sedge	0	25	0	0	18	0	0	23	0	0	21	0	0	-4	0
Hedge nettle	0	4	0	0	4	0	0	5	0	0	3	0	0	-1	0
SUBTOTAL	43	109	6	42	88	8	38	119	6	45	128	7	2	19	1
GRAND TOTAL			158			138			163			180			22
				Percent Survival		87%	Percent Survival		103%	Percent Survival		114%			

*Note: In Year 1 all of the common monkeyflower (4 plants) did not survive. In Year 2, all of the Torrey's melic (11 plants) died. Neither of these species were observed in Year 3. Since it is highly unlikely they will grow back, they are now excluded from this table.

The aerial percent cover value in Table 3 includes the native herbaceous species in Table 2, native woody species, native seed mix species, and any natural recruitments. The entire Project area averages 73% aerial cover.

Table 3. Aerial Percent Cover of Native Species

	Year 1		Year 2		Year 3	
Aerial Percent Cover of Native Species Zone	Aerial % Cover	Criterion of 10% Met?	Aerial % Cover	Criterion of 25% Met?	Aerial % Cover	Criterion of 30% Met?
Zone 1	70%	Yes	85%	Yes	90%	Yes
Zone 2	60%	Yes	80%	Yes	85%	Yes
Zone 4	90%	Yes	95%	Yes	95%	Yes
Zone 5	10%	Yes	10%	No	20%	No
Average	58%	Yes	68%	Yes	73%	Yes

Note: For Year 3, the success criterion for Objective 2 is a minimum of 30% aerial cover of all native species within the riparian and restored upland area.

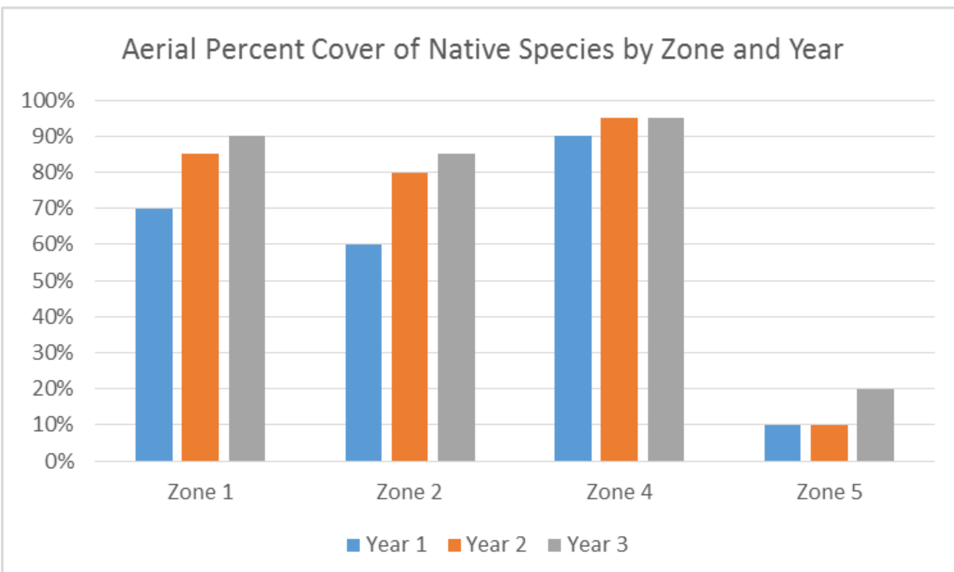


Figure 7. Percent Cover of Native Species by Zone and Year

Trees and Woody Plants- Objective Three

Trees and woody plants installed in the Project area include white alder, arroyo willow, coast live oak (*Quercus agrifolia*), big leaf maple, blue elderberry, toyon (*Heteromeles arbutifolia*), snowberry, and hollyleaf cherry (*Prunus ilicifolia*). See Table 4 for the quantity of each species present in individual zones during Year-3. Zone 2 is the only zone that is comprised exclusively of trees (alder and willow).

Dead trees and woody plants in each zone include one snowberry and three holly leaf cherry in Zone 1, four white alders in Zone 2, one white alder in Zone 4, and three toyon in Zone 5. There were additional species found in Zone 1 (six coast live oak, one big leaf maple, two blue elderberry, seven toyon), Zone 2, (one arroyo willow), and Zone 5 (two coast live oak). Including dead individuals in the Project area, the total number of trees and woody plants planted was 297 individuals, with 305 individuals surviving. The entire Project area demonstrated a 103% survival rate.

Table 4. Extant Trees and Woody Plant Species

Species	Total Planted				Year 1 Survival				Year 2 Survival				Year 3 Survival				Difference Between Total Planted and Year 3 Survival			
	Zone 1	Zone 2	Zone 4	Zone 5	Zone 1	Zone 2	Zone 4	Zone 5	Zone 1	Zone 2	Zone 4	Zone 5	Zone 1	Zone 2	Zone 4	Zone 5	Zone 1	Zone 2	Zone 4	Zone 5
White alder	0	26	49	0	0	24	47	0	0	24	49	0	0	22	48	0	0	-4	-1	0
Arroyo willow	0	78	73	0	0	71	75	0	0	78	73	0	0	79	74	0	0	1	1	0
Coast live oak	2	0	0	2	1	0	0	0	2	0	0	3	8	0	0	4	6	0	0	2
Big leaf maple	6	0	0	6	5	0	0	0	6	0	0	3	7	0	0	6	1	0	0	0
Blue elderberry	11	0	0	4	11	0	0	5	12	0	0	4	13	0	0	4	2	0	0	0
Toyon	4	0	0	7	3	0	0	7	11	0	0	5	11	0	0	4	7	0	0	-3
Snowberry	4	0	0	7	5	0	0	7	3	0	0	8	3	0	0	7	-1	0	0	0
Holly leaf cherry	18	0	0	0	16	0	0	0	19	0	0	0	15	0	0	0	-3	0	0	0
SUB TOTAL	45	104	122	26	41	95	122	19	53	102	122	23	57	101	122	25	12	-3	0	-1
		Grand Total		297		Grand Total		277		Grand Total		300		Grand Total		305		Grand Total		8
						Percent Survival		93%		Percent Survival		101%		Percent Survival		103%				

Note: At each annual monitoring event, there will be a minimum of 75% survival rate of planted trees and woody plants.

Invasive Species- Objective Four

Invasive species are present in the Project area. During Year-3 monitoring, these species were not widespread and did not prevent the achievement of the Year-3 performance objectives. Species rated as having a high or moderate negative ecological impact (California Invasive Plant Council 2013) that were observed in or near the mitigation areas and could prevent the achievement of the following year's success criteria include: yellow star-thistle (*Centaurea solstitialis*), purple star-thistle (*Centaurea calcitrapa*), stinkwort (*Dittrichia graveolens*), periwinkle (*Vinca major*), and black mustard (*Brassica nigra*). Management recommendations for invasive species are discussed below.

Photo-Documentation

A map of the permanent photo-documentation stations and photos taken during Year-3 monitoring are included in Figure 5 and Appendix B. For consistency, each photo was assigned a general compass direction and zone, as shown in Table 5. Photographs were taken during the September 2015 survey, except for Photo Station 3. Photos for Station 3 were retaken in December when vegetation was not blocking the camera.

Table 5. Photo-Documentation Stations

Photo Station	Compass Direction	Zone	Latitude	Longitude
1	Southwest	Zone 2 (south bank)	37.396855	-121.799791
2	Southwest	Zone 1 & Zone 2 (south bank)	37.396829	-121.799954
3	Panorama (SW, NW, SE, NE)	Zone 1 & Zone 2	37.396671	-121.800495
4	Southeast	Zone 4 & Zone 5	37.399124	-121.797272

Natural Recruitment

Natural recruitment was observed in many of the planting zones (See Table 2 and Table 4). Small willow saplings and California sagebrush (*Artemisia californica*) were prevalent on the north bank of Zone 2 and pre-existing California blackberry was re-establishing in many of the exposed areas in Zones 1, 2, 4, and 5. California figwort (*Scrophularia californica*) was also observed in Zone 1. Common bulrush is spreading in Zone 4. This trend is expected to continue in the following years and aid in the achievement of the performance objectives.

Erosion

Erosion was observed along the bank in Zone 1. The banks of the creek are on naturally erodible soil and ground squirrel burrows were observed in Zone 1. However, with more plants and volunteer trees establishing, the erosion seems to be under control.

Management Recommendations

There are no management recommendations for Geomorphic Monitoring or Fisheries Monitoring.

The Project area displayed a high level of success, surpassing the performance objective thresholds in Year-3 monitoring. To continue this trend in following monitoring years, it is recommended that invasive species are assessed monthly and controlled, as described in the HMMP. Although these species did not prevent the achievement of the performance objectives in Year-3, with neglect, invasive species could spread quickly and become more difficult to control. Stinkwort invasion is the most urgent management issue in the Project area; its range currently extends along the bank near Zone 4, outside the project area. It is recommended that stinkwort is either sprayed or pulled by hand prior to seeding next year (this species blooms from September to November). Natural recruitment is occurring in the Project area, so great care should be taken during invasive species management to retain the maximum amount of native recruitments possible. Naturally erodible soil is present in Zone 1 of Site 13. Crews should be careful during weeding of this site and keep walking on the bank to a minimum.

Due to the fact that numerous plants were installed in each zone, a high percentage of those plants survived, and these plants will increase in both aerial cover and root establishment, Year-3 monitoring does not indicate a need for plant replacement.

References

California Invasive Plant Council. 2013. California Invasive Plant Inventory Database. Berkeley, CA. Available: http://www.cal-ipc.org/paf/. Accessed October 28, 2013.

Winzer and Kelly. 2012. Habitat Mitigation and Monitoring Plant for Alum Rock Park Bank Repair and Stream Restoration Project. Prepared for: City of San Jose, Parks, Recreation and Neighborhood Services, San Jose, CA.

Appendix A
Planting Site Plans

PLANT AND COMPOSITION SCHEDULE

RIPARIAN WOODLAND FISH PASSAGE — ACRES 0.06

OVERALL SPACING (FEET OFF CENTER)	QUANTITY PER ACRE	FREQUENCY (%)	SPECIES QUANTITY	VEGETATION STRATA/ SPECIES NAME	COMMON NAME	UNIT	SPACING TYPE	INDIVIDUAL SPACING (FT.)
ZONE 1								
18	134							
		30	2	*Quercus agrifolia*	COASTAL LIVE OAK	DP	RANDOM	36
		70	6	*Acer macrophyllum*	BIG LEAF MAPLE	DP	RANDOM	36
		100	8	= TOTAL				
12	303							
		60	11	*Sambucus mexicana*	BLUE ELDERBERRY	D6	RANDOM	15
		20	4	*Heteromeles arbutifolia*	TOYON	DP	RANDOM	26
		20	4	*Symphoricarpus alba*	SNOWBERRY	DP	RANDOM	26
		100	19	= TOTAL				
6	1210							
		25	18	*Prunus ilicifolia*	HOLLY LEAF CHERRY	TP	RANDOM	12
		10	7	*Rosa californica*	CALIFORNIA ROSE	DP	RANDOM	19
		25	18	*Rubus ursinus*	CALIFORNIA BLACKBERRY	D6	RANDOM	12
		15	11	*Melica torreyana*	TORREY MELICA	4" PLUG	RANDOM	15
		25	18	*Artemesia douglasiana*	MUGWORT	D6	RANDOM	12
		100	72	= TOTAL				
ZONE 2[1]								
5	1742						ACRES	0.05
		25	26	*Alnus rhombifolia*	WHITE ALDER	TP	CLUSTER	10
		75	78	*Salix lasiolepis*	ARROYO WILLOW	LIVESTAKES	CLUSTER	6
		100	104	= TOTAL				

1. ZONE TWO LIVESTAKE PLANTING IN CLUSTERS OF 2-3 STAKES AROUND THE BANKROCK

CONTAINER NAME SIZE USES

DP = DEEPOT 40 = 2 1/2" DIAMETER x 10" LONG
D6 = DEEPOT 16 = 2" DIAMETER x 7" LONG
TP = TREEPOT 4 = 4' SQUARE x 14" DEEP

PLANT AND COMPOSITION SCHEDULE

RIPARIAN WOODLAND EROSION CONTROL SEEDING LIST — ACRES 0.50

OVERALL SPACING (FEET OFF CENTER)	QUANTITY PER ACRE	FREQUENCY (%)	SPECIES QUANTITY	VEGETATION STRATA/ SPECIES NAME	COMMON NAME	UNIT	SPACING TYPE	INDIVIDUAL SPACING (FT.)
ZONE 3[1]								
NA	60							
		6 LBS/ACRE	3	*Bromus carinatus*	CALIFORNIA BROME	LB OF P.L.S. 76%	SEED	NA
		12 LBS/ACRE	6	*Elymus glaucus*	BLUE WILD RYE	LB OF P.L.S. 76%	SEED	NA
		11 LBS/ACRE	5.5	*Vulpia micorstachys*	THREE WEEK FESCUE	LB OF P.L.S. 76%	SEED	NA
		12 LBS/ACRE	6	*Hordeum branchyantherum*	MEADOW BARLEY	LB OF P.L.S. 76%	SEED	NA
		4 LBS/ACRE	2	*Tritolium tridentantum*	TOMCAT CLOVER	LB OF P.L.S. 76%	SEED	NA
		6 LBS/ACRE	3	*Lupinus nanus*	SKY LUPINE	LB OF P.L.S. 76%	SEED	NA
		3 LBS/ACRE	1.5	*Eschscholtzia california*	CALIFORNIA POPPY	LB OF P.L.S. 76%	SEED	NA
		6 LBS/ACRE	3	*Hordeum californium*	CALIFORNIA BARLEY	LB OF P.L.S. 76%	SEED	NA
		60 LBS/ACRE	30	= TOTAL				

1. EROSION CONTROL MIX SHALL BE APPLIED ON AREAS DEPICTED ON THE DRAWINGS AND IN ANY LOCATIONS THAT HAS DISTURBED OR BARE SOIL RESULTING FROM CONSTRUCTION (INCLUDING SKID ROUTES).

PLANT AND COMPOSITION SCHEDULE

FLOODPLAIN CREATION AREA

OVERALL SPACING (FEET OFF CENTER)	QUANTITY PER ACRE	FREQUENCY (%)	SPECIES QUANTITY	VEGETATION STRATA/ SPECIES NAME	COMMON NAME	UNIT	SPACING TYPE	INDIVIDUAL SPACING (FT.)
ZONE 4 (FLOODPLAIN)								
5	1742						ACRES	0.05
		40	49	*Alnus rhombifolia*	WHITE ALDER	TP	TRIANGULAR	8
		60	73	*Salix lasiolepis*	ARROYO WILLOW	LIVESTAKES	TRIANGULAR	6
		100	122	= TOTAL				
10	436						ACRES	0.07
		100	30	*Scirpus robustus*	COMMON BULRUSH	TB	RANDOM	10
		100	30					
6	1210							
		30	25	*Artemesia douglasiana*	MUGWORT	D6	RANDOM	11
		5	4	*Mimulus guttatus*	COMMON MONKEYFLOWER	4" PLUG	RANDOM	28
		30	25	*Cyperus eragrostis*	NUT-SEDGE	TB	RANDOM	11
		30	25	*Carex nudata*	TORRENT SEDGE	TB	RANDOM	11
		5	4	*Stachys ajugoides*	HEDGE NETTLE	TB	RANDOM	28
		100	83	= TOTAL				
ZONE 5 (MID-TOP OF BANK)								
18	134						ACRES	0.06
		20	2	*Quercus agrifolia*	COASTAL LIVE OAK	TP	SCATTERED	35
		80	6	*Acer macrophyllum*	BIG LEAF MAPLE	TP	RANDOM	35
		100	8	= TOTAL				
10	436							
		15	4	*Sambucus mexicana*	BLUE ELDERBERRY	D6	RANDOM	25
		30	7	*Heteromeles arbutifolia*	TOYON	DP	RANDOM	19
		30	7	*Symphoricarpus alba*	SNOWBERRY	DP	RANDOM	19
		15	4	*Rosa californica*	CALIFORNIA ROSE	DP	RANDOM	25
		10	2	*Rubus ursinus*	CALIFORNIA BLACKBERRY	D6	RANDOM	35
		100	24	= TOTAL				
NA	60							
		8 LBS/ACRE	0.48	*Bromus carinatus*	CALIFORNIA BROME	LB OF P.L.S. 76%	SEED	NA
		10 LBS/ACRE	0.6	*Elymus glaucus*	BLUE WILD RYE	LB OF P.L.S. 76%	SEED	NA
		12 LBS/ACRE	0.72	*Vulpia micorstachys*	THREE WEEK FESCUE	LB OF P.L.S. 76%	SEED	NA
		10 LBS/ACRE	0.6	*Hordeum branchyantherum*	MEADOW BARLEY	LB OF P.L.S. 76%	SEED	NA
		4 LBS/ACRE	0.25	*Eschscholtzia california*	CALIFORNIA POPPY	LB OF P.L.S. 76%	SEED	NA
		6 LBS/ACRE	0.36	*Lupinus nanus*	SKY LUPINE	LB OF P.L.S. 76%	SEED	NA
		2 LBS/ACRE	0.12	*Tritolium tridentantum*	TOMCAT CLOVER	LB OF P.L.S. 76%	SEED	NA
		8 LBS/ACRE	0.48	*Hordeum californium*	CALIFORNIA BARLEY	LB OF P.L.S. 76%	SEED	NA
		60 LBS/ACRE	3.61	= TOTAL				

DP = DEEPOT 40 = 2 1/2" DIAMETER x 10" LONG
D6 = DEEPOT 16 = 2" DIAMETER x 7" LONG
TP = TREEPOT 4 + 4' SQUARE x 14" DEEP
TB = TREEBAND 2 + 2.25" SQUARE x 3.75" DEEP

PLANT AND COMPOSITION SCHEDULE

MITIGATION TREES — ACRES NA

SPECIES QUANTITY	VEGETATION STRATA/ SPECIES NAME	COMMON NAME	UNIT	SPACING TYPE
15	*Quercus agifolia*	COASTAL LIVE OAK	15-GALLON CONTAINER	AS SHOWN ON DRAWINGS FP-L002, FP-L003 AND FP-L006
8	*Acer macrophyllum*	BIG LEAF MAPLE	15-GALLON CONTAINER	AS SHOWN ON DRAWINGS FP-L002, FP-L003 AND FP-L006
7	*Umbellularia californica*	CALIFORNIA BAY	15-GALLON CONTAINER	AS SHOWN ON DRAWINGS FP-L002, FP-L003 AND FP-L006
30	= TOTAL			

LEGEND

ZONE 1 PLANTING, SEE TABLES

ZONE 2 PLANTING, SEE TABLES

ZONE 3 PLANTING, SEE TABLES

ZONE 4 PLANTING, SEE TABLES

ZONE 5 PLANTING, SEE TABLES

SYMBOLS FOR MITIGATION TREES

(N) OAK TREE

(N) MAPLE TREE

(N) BAY TREE

DOMESTIC WATER IRRIGATION PIPING

UTILITY BOX

ABBREVIATIONS

LB POUNDS

PLS PURE LIVE SEED

FOR REFERENCE ONLY

REV	DATE	BY	SUB	APP	DESCRIPTION
A	20131024	AT	MN	RK	REQUEST FOR PROPOSAL

DESIGNED BY R. KEISH
DRAWN BY A. TOLENTINO
CHECKED BY M. NG
IN CHARGE R. KEISH
DATE

HNTB Corporation
Engineers Architects Planners
1735 Technology Drive, Suite 650
San Jose, CA 95110-1005
Tel (408) 451-7300
Fax (408) 451-6942

SUBMITTED ____________ APPROVED ____________

NOT FOR CONSTRUCTION

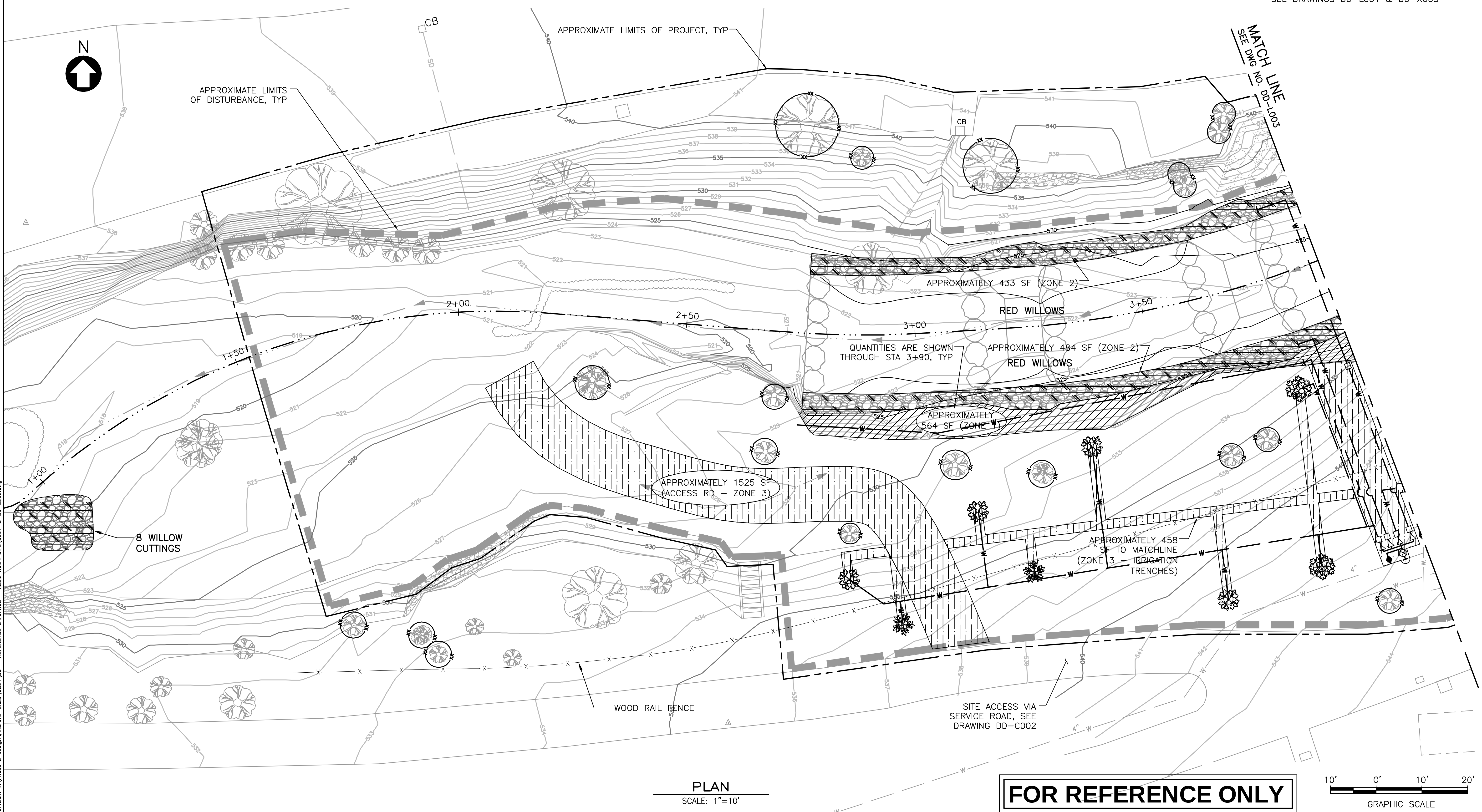
VTA BART SILICON VALLEY
BART SILICON VALLEY BERRYESSA EXTENSION

SVRT ENVIRONMENTAL MITIGATION - PLANT ESTABLISHMENT
ATTACHMENT B
REFERENCE DRAWINGS - ALUM SITE
PLANTING & IRRIGATION LEGEND
SHEET 6 OF 15

CADD FILENAME C801-S-DD-L001.dwg
SIZE D SCALE NONE
CONTRACT NO. C801 REV. A
AREA CODE DD SHEET NO. L001 PAGE NO. 06

NOTE:

FOR LEGEND, SYMBOLS, AND ABBREVIATIONS, SEE DRAWINGS DD-L001 & DD-X003



PLAN

SCALE: 1"=10'

FOR REFERENCE ONLY

10' 0' 10' 20'

GRAPHIC SCALE

REV	DATE	BY	SUB	APP	DESCRIPTION
A	20131024	AT	MN	RK	REQUEST FOR PROPOSAL

DESIGNED BY R. KEISH
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HNTB
HNTB Corporation
Engineers Architects Planners
1735 Technology Drive, Suite 650
San Jose, CA 95110-1005
Tel (408) 451-7300
Fax (408) 451-6942

SUBMITTED ____________

APPROVED ____________

NOT FOR CONSTRUCTION

VTA BART SILICON VALLEY

BART SILICON VALLEY BERRYESSA EXTENSION

SVRT ENVIRONMENTAL MITIGATION – PLANT ESTABLISHMENT
ATTACHMENT B
REFERENCE DRAWINGS – ALUM ROCK SITE
PLANTING PLAN: FISH PASSAGE & RILL REPAIR SITE
SHEET 7 OF 15

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SIZE D | SCALE 1"=10'
CONTRACT NO. C801 | REV. A
AREA CODE DD | SHEET NO. L002 | PAGE NO. 07

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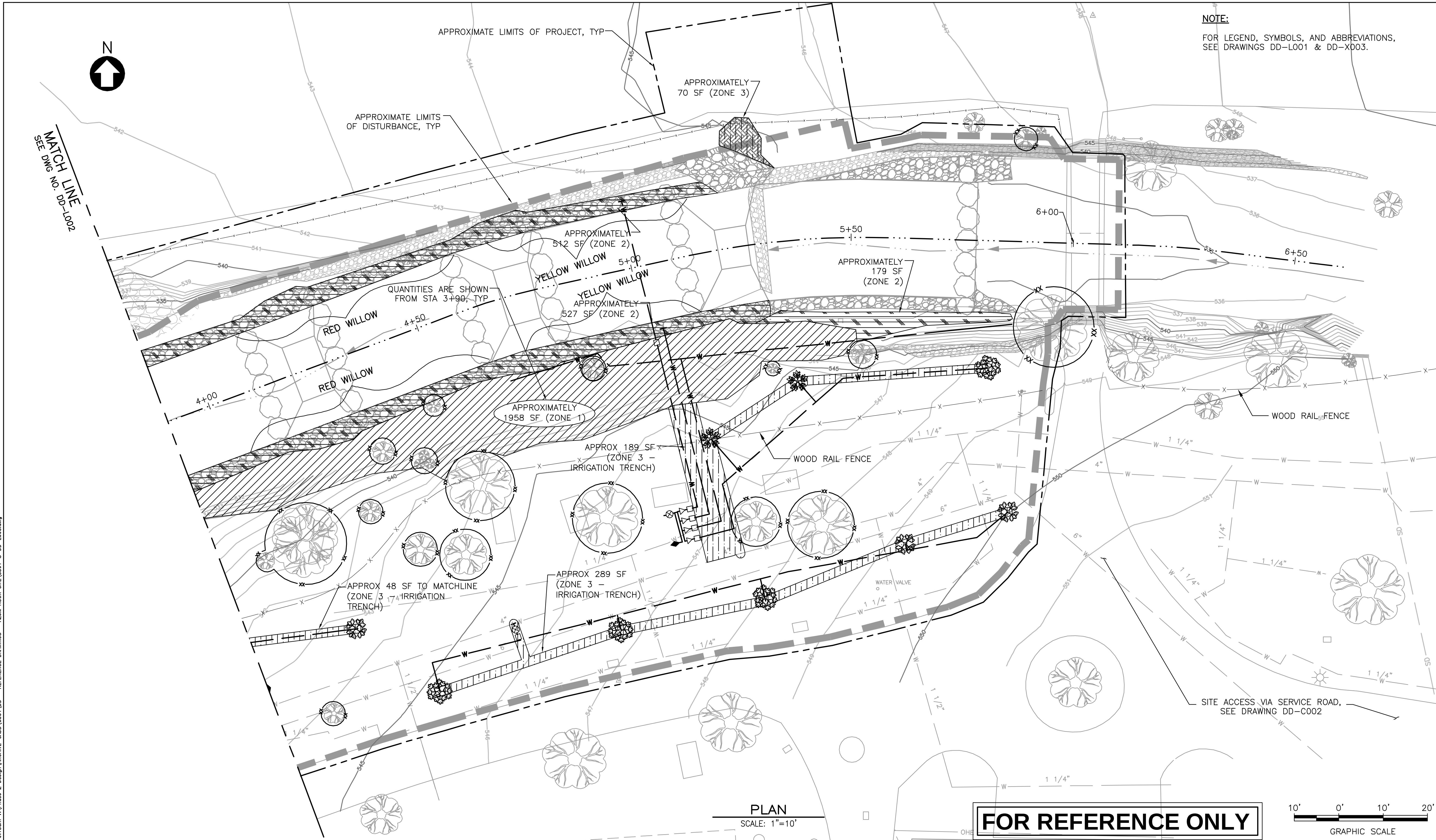

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REV	DATE	BY	SUB	APP	DESCRIPTION
A	20131024	AT	MN	RK	REQUEST FOR PROPOSAL

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DRAWN BY A. TOLENTINO
CHECKED BY M. NG
IN CHARGE R. KEISH
DATE

HNTB — HNTB Corporation, Engineers Architects Planners
1735 Technology Drive, Suite 650, San Jose, CA 95110-1005
Tel (408) 451-7300, Fax (408) 451-6942

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VTA BART SILICON VALLEY
BART SILICON VALLEY BERRYESSA EXTENSION

SVRT ENVIRONMENTAL
MITIGATION – PLANT ESTABLISHMENT
ATTACHMENT B
REFERENCE DRAWINGS – ALUM ROCK SITE
PLANTING PLAN: FISH PASSAGE & RILL REPAIR SITE
SHEET 8 OF 15

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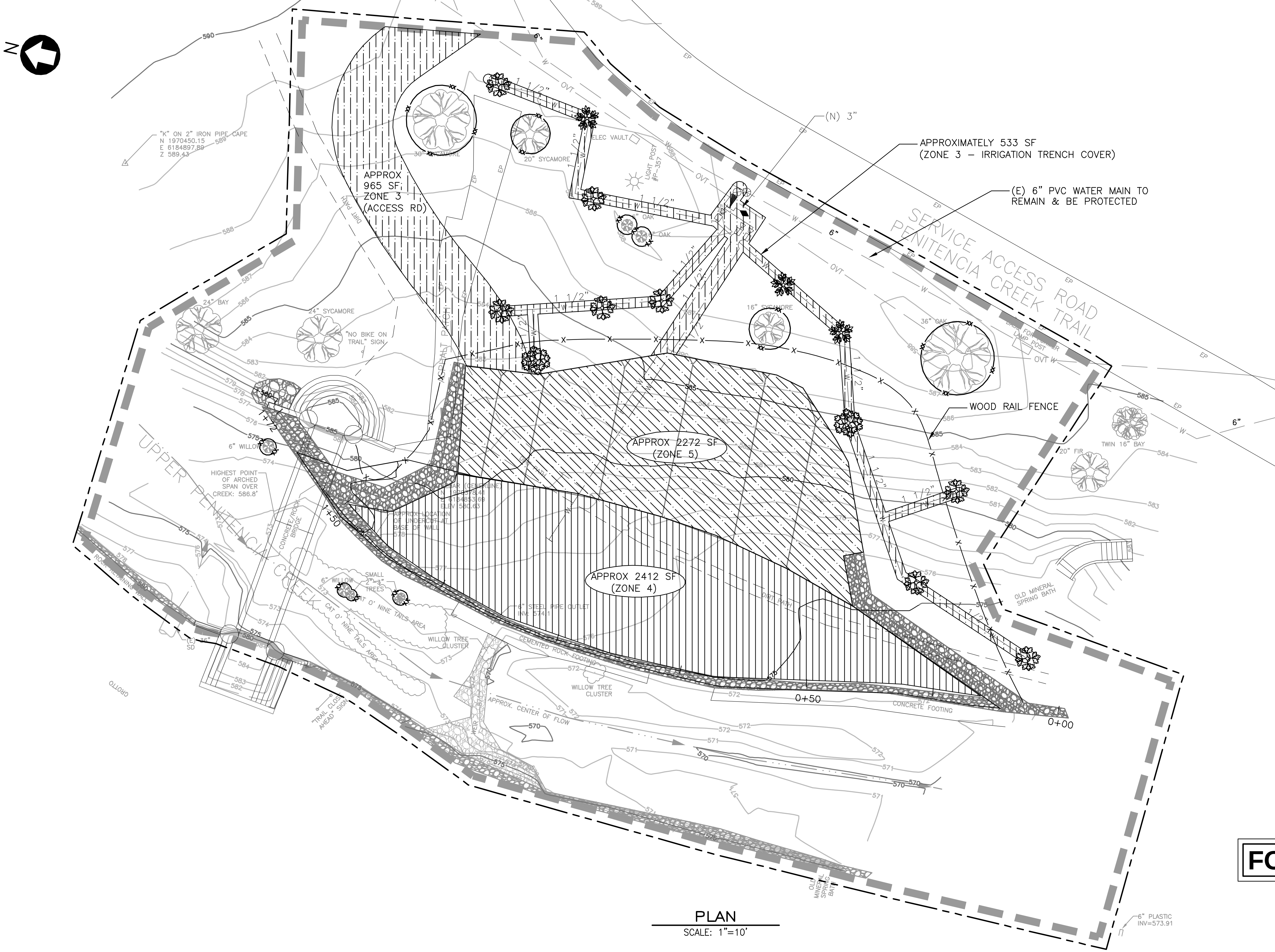
CONTRACT NO.: C801 | REV.: A
AREA CODE: DD | SHEET NO.: L003 | PAGE NO.: 08

NOTE:

FOR LEGEND, SYMBOLS, AND ABBREVIATIONS, SEE DRAWINGS DD–L001 AND DD–X003.



PLAN

SCALE: 1"=10'

10' 0' 10' 20'

GRAPHIC SCALE

REV	DATE	BY	SUB	APP	DESCRIPTION
A	20131024	AT	MN	RK	REQUEST FOR PROPOSAL

DESIGNED BY R. KEISH
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DATE

HNTB HNTB Corporation
Engineers Architects Planners
1735 Technology Drive, Suite 650
San Jose, CA 95110-1005
Tel (408) 451-7300
Fax (408) 451-6942

SUBMITTED ______________ APPROVED ______________

NOT FOR CONSTRUCTION

VTA BART SILICON VALLEY

BART SILICON VALLEY BERRYESSA EXTENSION

SVRT ENVIRONMENTAL
MITIGATION – PLANT ESTABLISHMENT
ATTACHMENT B
REFERENCE DRAWINGS – ALUM ROCK SITE
PLANTING PLAN: FLOOD PLAIN EXPANSION SITE
SHEET 11 OF 15

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SCALE 1"=10'
CONTRACT NO. C801
REV. A
AREA CODE DD
SHEET NO. L006
PAGE NO. 11

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Appendix B

Permanent Photo Documentation Stations and Miscellaneous Site Photos

Photo Station 1

Photo Station 2

Photo Station 3 (Panorama). In order: SW, NW, SE, NE (taken December 2015)

Photo Station 4

Miscellaneous Photos

Photo 1. Looking west from YSI Bridge (Zones 1 and 2)

Photo 2. Looking southwest from north bank (Zones 1 and 2)

Photo 3. Looking northeast to floodplain from pedestrian path (Zones 4 and 5).

Photo 4. Looking south at Zone 4 from north bank of creek.

Appendix C

Geomorphic and Hydrologic Monitoring Annual Report: Water Year 2015

Balance Hydrologics, Inc.®

800 Bancroft Way • Suite 101 • Berkeley, CA 94710 • (510) 704-1000
224 Walnut Avenue • Suite E • Santa Cruz, CA 95060 • (831) 457-9900
PO Box 1077 • Truckee, CA 96160 • (530) 550-9776
www.balancehydro.com • email: office@balancehydro.com

January 29, 2016

Ms. Ann Calnan
Manger, Environmental Program and Resources Management
Santa Clara Valley Transportation Authority
3331 North First Street, Building B-2
San Jose, California 95134-1927

Submitted via email

RE: Alum Rock Fish Passage Project geomorphic and hydrologic monitoring annual report: Water Year 2015

Dear Ms. Calnan,

We are pleased to provide you with the annual report for Water Year[1] 2015 (WY2015) geomorphic and hydrologic monitoring of the Alum Rock Fish Passage Project along Upper Penitencia Creek in Alum Rock Park in the City of San Jose. The project provides mitigation for the Santa Clara Valley Transportation Authority (VTA) Mission-Warren Truck Rail Project.

Geomorphic monitoring of this mitigation project began in September 2013 and will extend for a 5-year period through WY2018. The work is being conducted by Balance Hydrologics, Inc. (Balance) staff geomorphologists and hydrologists. The following provides a brief description of the project sites, the monitoring methods established at these sites, and discussion of the data collected in October 2015 in relation to baseline conditions.

Site Description and Monitoring Criteria

Project Site 13 is a recently-constructed (Summer 2012) fish passage project located downstream of the Youth Science Institute (YSI) Bridge (**Figure 1**), designed to improve riverine habitat conditions to support the recovery of Central California Coast steelhead (Oncorhynchus mykiss) through the removal of a barrier to fish passage, and enhancement of the quality and complexity of the creek habitat. The project reach is situated in a straight, deeply incised portion of the channel that is adjacent to a parking lot on the right bank, and the grounds of YSI on the left bank[2]. The project reach is about 300 feet in length, and consists of a series of pools, chutes, rock band structures, and one modified concrete grade control structure, designed to slow water velocity through the reach, prevent erosion, and control the streambed elevation. The uppermost rock band structure in the original channel design moved in the first year's set

[1] A Water Year (WY) is defined as that period from October 1st of a preceding year through September 30th of the following year, and is named according to the following year. For example, WY2015 occurred from October 1, 2014 through September 30, 2015.
[2] Right and left bank orientation referred to in this document is from the perspective of looking downstream.

of storms (i.e. two large storms in December 2012). This rock band structure was rebuilt in mid-September, 2013, after which all monitoring work commenced.

Project Site 10 is a recently-constructed (Summer 2012) floodplain about 120 feet long by 30 to 40 feet wide that begins just south of Bridge L (**Figure 2**). The elevated floodplain has been designed to be inundated periodically during high flows, and has been planted with riparian vegetation, including willow and alder saplings.

Per the National Marine Fisheries Service (NMFS) Biological Opinion (June 2012) and the Regional Water Quality Control Board (RWQCB) 401 certification (July 2012), the mitigation project has several success criteria that are based on the development of post-construction conditions, which must be assessed through qualitative and quantitative monitoring techniques. Each year, the monitoring program focuses on assessing geomorphic conditions of the project sites, characterizing hydrologic conditions over the past water year, and using these data and observations to assess the evolution, condition, and functionality of the fish passage and floodplain. The end of water year geomorphic and hydrologic monitoring is designed to address the following questions:

- Have the sizes and shapes of the pools, chutes, rock band structures, and floodplain benches evolved? Have the riffles or pools aggraded or scoured?
- Have connections from the main channel to the newly constructed floodplain changed significantly over the year?
- Has the bed composition of the channel changed based on visual assessments? Has sedimentation on the floodplain affected its functionality?
- Has the floodplain flooded every 1 to 2 years? Have the creek corridor, thalweg, pools and riffles, floodplain benches, banks and backwater wetlands been stable?
- Has the stream corridor increased in habitat complexity? Has woody debris been deposited in the reach?

Assessment of these questions has been undertaken according to the geomorphic and hydrologic monitoring methods described below.

Monitoring Methods

Hydrologic Monitoring

Because high flows in storm events are the main agent of geomorphic change through the project sites, and are the most important test of the functionality of the fish passage and floodplain, hydrologic data were collected over the course of the year. These data include water level measurements within the channel and summaries of year-round precipitation measurements from area gages. To provide context for the hydrologic and geomorphic data collected at Alum Rock, we present precipitation data from two nearby stations: the California Irrigation Management Information System (CIMIS) Station 171 in Union City (Union City Station, hereafter) and Weather Underground Station KCASANJO17 (Berryessa Station, hereafter). The Berryessa Station is located approximately 4 miles west of the Alum Rock mitigation site and the Union City Station is approximately 19 miles northwest of the mitigation site. The Berryessa Station and Union City Station are characterized by a mean annual rainfall total similar to that for the Alum Rock mitigation site. The records from these stations are compared to each other to check for consistency. The San Jose Airport station (KSJC) precipitation record is used for comparing WY2015 precipitation records to long-term averages; however, this record will not be used for analysis of individual storms as it was found to have missing values in WY2012 and WY2013.

Monitoring efforts at Project Site 10 included installation of two stream stage gages. Each gage consists of a self-contained water level recorder that records water depth and temperature[3] every 15 minutes, paired with a staff plate, which is a vertical ruler adjacent to the logger that is used for manual readings of water level. Staff plate readings are used to calibrate the 15-minute depth data recorded by the logger. The two gages were installed on September 26, 2013 directly adjacent to the floodplain. Locations of these gages are shown in **Figure 2**. One gage, referred to hereafter as the “in-channel gage”, was positioned to continuously record water surface elevations at baseflow conditions. Because the bank geometry is complex and dense riparian vegetation is present, which may deflect flows and obscure our understanding of floodplain inundation, a second gage was positioned up-slope with the intent that it will record overbank water surface elevations that are inundating the floodplain during high flow events. This gage is hereafter referred to as the “overbank gage”.

The water levels recorded at the project site are compared to those recorded at the Santa Clara Valley Water District’s Upper Penitencia Creek at Dorel Drive gage (Dorel, hereafter) for consistency, and to estimate discharge at the project site. This is a low-flow gage that has been operated by the SCVWD since 1935, excepting a period from 1961 to 1987 when it was operated by the USGS. Records of 15-minute stage and discharge extend from 1935 to the present. The Dorel WY2015 record will be compared to the project site gages to check for consistency, and to estimate discharge at the project site.

Geomorphic Monitoring, Project Site 13 (Fish Passage)

Quantitative surveys

Monitoring criteria for channel evolution indicate whether pools, chutes, rock band structures, and floodplain benches evolved and if aggradation or scour took place over the year. To quantitatively address these questions, seven cross-sections and one longitudinal profile were surveyed within the fish passage site on October 15, 2015 (shown in planview, **Figure 1**) and compared to data collected in previous years. These profiles were originally established and surveyed in September 2013 for the purpose of establishing baseline conditions and documenting channel form soon after construction. All subsequent surveys are compared to the baseline survey as a quantitative method for tracking aggradation and scour in the channel and assessing change, if any, to constructed elements such as rock band structures and pools. Cross sections (XS) were selected to represent a range of constructed geomorphic structures: XS 1 and XS 4 cross the channel at the upstream portion of chutes. XS 2, 3 and 5 cross the channel through portions of pools 1, 2, and 4, respectively. XS 6 was established at the rock structure that forms the upstream edge of pool 5. XS 7 crosses at the downstream end of the final chute. The longitudinal profile

[3] Temperature data is not presented here, but has been archived and is available upon request.

survey begins at pedestrian bridge “L” (Station 0 feet) and continues downstream approximately 300 feet through five constructed pools and six constructed chutes.

The October 2015 survey was performed using the existing project benchmarks and datum established during construction, as well as temporary benchmarks established by Balance during the September 2013 survey. The survey was conducted with total station equipment. The survey was based on site control established during the construction phase, and therefore elevations and locations are in the project datum (NAVD 88). Cross sections and longitudinal profile repeated in this year’s survey were plotted against the previous survey profiles as an assessment of geomorphic change.

Geomorphic Visual Observations

Ten photo point locations were established in the fall of 2013 (**Figure 1**, PP #1 to #10), with an initial set of photos taken to record existing conditions. Repeat photographs were taken at each of the photo points to document year-to-year geomorphic change. Additional observations were noted, including composition of the bed, the presence of woody debris, and habitat complexity for steelhead, as well as the geomorphic evolution of pools and rock band structures.

Geomorphic Monitoring, Project Site 10 (Floodplain)

Quantitative Surveys

Two cross-sections and one floodplain elevational profile, originally established and surveyed in September 2013, were re-surveyed on October 15, 2015. At this site, the term floodplain elevational profile, or elevational profile, is used to distinguish it as a profile that extends across the floodplain, parallel to but not within the channel. This is distinct from a longitudinal profile, a term used to refer to a survey of the deepest part of a channel, or thalweg. The elevational profile survey for the Project Site 10 floodplain was conducted in the central portion of the floodplain, parallel to the channel, showing the overall slope and topography. Cross sections XS 101 and XS 102 (**Figure 2**) were surveyed at the upstream and downstream ends of the floodplain, and included the floodplain, the rock wall that bounds the floodplain near the creek, the active channel, and across the existing pathway on river right and onto the adjacent hillslope. These profiles will be re-surveyed on a yearly basis to measure any potential changes to floodplain geometry. Riparian vegetation has grown very densely on the floodplain and it is conceivable that all or portions of the cross sections and the profile, may need to be skipped, or their locations estimated, due to the challenge of orientation within the riparian growth, and line of site to the total station survey equipment.

To directly measure sedimentation on the floodplain, Balance staff installed two sedimentation plates (approximately 1 square-foot plates mounted at the ground surface on a shaft driven into the floodplain) at the site (shown in **Figure 2**). On October 15, 2015 Balance staff measured the depth of accumulated sediment (not including organic litter) at four locations on each plate, one at each of the four cardinal directions, halfway between the center and edge of the plate. The average depth of accumulated sediment for each sedimentation plate location is presented in the results.

Geomorphic Visual Observations

Six photo point locations were established in the fall of 2013, with an initial set of photos taken to record existing conditions. Repeat photographs were taken at each of the photo points to document year-to-year geomorphic change on the floodplain, and compared to the baseline photos.

Overview of Annual Conditions

Overall, WY2015 was characterized by a wet December, including a large 2-day atmospheric river storm event. From January through the end of the monitoring year (September 30), dry conditions returned to the area, with rainfall totals well below average for these months.

Hydrologic Monitoring Results

WY2015 was characterized by very wet conditions in December 2014 followed by very dry conditions for the rest of the year in the Alum Rock area. In the vicinity of the project, approximately 80% of the rain recorded for the entire season fell before January 2015. The Berryessa Station received 16.19 inches of rainfall for the season, (**Figure 3**), 1.10 inches more than the long-term average of 15.09 inches for the San Jose Airport (KSJC), the closest long-term station. Of that total, 12.03 inches of rain fell before January. The Union City Station received 15.49 inches of rainfall (**Figure 4**) or 0.40 inches more than the long-term average for that location. Of that total, 11.87 inches of rain fell before January.

By far, the largest daily rainfall totals for nearby stations were recorded on December 11, 2014, during an atmospheric river event. On this day, 3.74 inches fell at the Berryessa Station, with another 0.44 inches the following day, bringing the 2-day storm total to 4.18 inches. At the Union City Station, 4.21 inches fell on December 11, followed by 0.36 inches on December 12, for a 2-day total of 4.57 inches. An analysis of the hourly rainfall data for the Union City Station indicates that the 12- and 24-hour rainfall duration intensities associated with this event correlate to approximately a 50-year recurrence interval, while shorter 1-4 hour duration intensities correlate to approximately a 10- to 25- year recurrence[4]. Another large multi-day storm event had preceded this, occurring from November 29 to December 6, with rainfall totals of 4.25 inches recorded at the Berryessa Station, and 2.46 inches recorded at the Union City Station. Watershed conditions were therefore already very wet and well-suited for the generation of runoff at the time of the atmospheric river event.

Balance visited the site two times during the rainy season to calibrate and download water level recorders. These data were used to create a continuous stage record for the site **(Figure 5).** Stage at the in-channel gage is plotted against time for the duration of the water year. A stage observation, superimposed as a red square on the time series, was used in calibrating the record. Also plotted is the stage record for the nearby Dorel gaging station.

Figure 5 also shows the relationship between precipitation and water levels recorded at the gaging station. Similar to last season, small early-season rainfall events (e.g. October 31 and November 20, 2014) do not correlate to peaks in the stage record at the project site; we surmise that the watershed was wetting up during this time period, and that soils were not saturated enough to produce a response in the channel at the gaging location. Starting on December 3, 2014, the watershed appears wet enough to produce at least small spikes in the stage record during the small early-December rain events. The greatest responses

[4] Based on intensity-duration-frequency curves in the Santa Clara County Drainage Manual, 2007.

in stage to rainfall events at the Alum Rock in-channel gage are on December 12, 16, and 20, 2014 when stage peaked at 4.2, 2.9, and 2.6 feet, respectively. In between these peaks, and until December 31, 2014, the water level remains elevated, finally receding to a baseflow level that is about 0.3 feet higher than preceding the storms. This implies that sediment accumulated downstream of the gage, forming a new hydraulic control for the pool containing the pressure transducer. This was confirmed during a May 2015 site visit, and during end-of-year surveys. On February 6, 2015, a smaller rainfall event (1.1 inches) triggered a stage peak of 2 feet; this was the only notable stage peak that occurred after December 2014.

When comparing the in-channel stage record to the Dorel stage record, there are some notable differences in the timing of peaks. The largest peak at Dorel occurred on December 20, 2014, at 6.0 feet, in response to only 0.07 inches of rain recorded at the Berryessa Station and the Union City Station. Because the duration of the peak is only one hour long, and we do not have records of gage maintenance here, we assume this is faulty data, and that a sub-peak of 50 cfs recorded later that day is a more reasonable representation of the peak flow. Similar unexplained peaks occurred on November 1, 2014, February 19, 2015 and May 21, 2015, with little to no rain recorded at nearby gages.

Figure 6 shows the Alum Rock in-channel stage data converted to elevation in feet NAVD 88, which displays the stage in the context of the elevation of the floodplain. Superimposed on this plot are portions of the stage record from the overbank gage. Due to the dry year, this gage was out of the water for most of the year. Data recorded during these times were removed, and the peaks that represent inundation of the overbank gage are displayed in blue. Because the sensor is located below the elevation of the floodplain, peaks at this gage do not necessarily represent inundation of the floodplain.

The upper and lower extent of floodplain elevations adjacent to the gage are plotted with green dashed lines (**Figure 6**). According to the stage record, the floodplain was inundated two times in December: one inundation began on December 11 and continued into December 12, and a separate inundation occurred on December 16, 2014. Balance was on site on December 11 to confirm that there was flow at the floodplain gage. The record shows that peaks at the overbank gage are slightly lower (~6 inches) in elevation than the in-channel gage peaks. This is reasonable, as the overbank gage is located downstream of the in-channel gage.

A small daily fluctuation in water level was recorded in the in-channel stage record and the Dorel stage record. The cause of this fluctuation is presently unknown, but we commonly observe natural daily fluctuations in stage during low flow periods due to changes in evapotranspiration, and even direct evaporation. We will continue to monitor these fluctuations during future site visits.

Hourly discharge records available from the Dorel gage have been used to approximate discharge at the Alum Rock sites. Terrain maps of the watershed were used to calculate the difference in drainage area between Project Site 10 and the Dorel gage. Project Site 10 has a contributing drainage area of approximately 21 square miles, and the Dorel gage, located 2.5 miles downstream, has a drainage area of 22.3 square miles, an additional 1.3 square miles. In order to provide some context for flows to evaluate inundation at Project Site 10, the Dorel discharge record is scaled by a factor of 0.94 to serve as rough estimate of discharge[5]. When flow reaches the overbank gage, the corresponding discharge at Dorel is approximately 2.4 cubic feet per second (cfs). The corresponding scaled discharge required to inundate the overbank gage is calculated to be 2.3 cfs, but because the gage is at a lower elevation than the floodplain, a higher discharge is required to inundate the floodplain.

As discussed above, the greatest peaks in stage at Project Site 10 occurred on December 12 and December 16, 2014. These stage peaks correspond to discharges at Dorel of 472 cfs and 73 cfs, respectively. According to the in-channel stage record, the third largest peak in stage on December 20, 2014, peaked at an elevation just below the floodplain elevation. The peak discharge recorded at Dorel on that day was 50 cfs. We therefore conclude that the Project Site 10 floodplain is inundated when the Dorel gage exceeds approximately 50 cfs. It is our understanding that the Dorel gage is a low-flow gage and higher flows are not necessarily accurate, so these values should be used for reference only, and simply as an indicator of when the Project Site 10 floodplain is becoming inundated.

The peak flow of 472 cfs recorded at Dorel in WY2015 is much greater than WY2014 peak of 3.6 cfs (scaled as 3.4 cfs at the project site), recorded on December 8, 2013. WY2014 was also an extremely dry year, and unlike WY2015, it was not punctuated with any larger storms, such as the December 2014 event. No flows inundated the floodplain in WY2014.

Geomorphic Monitoring Results, Project Site 13 (Fish Passage)

Visual Geomorphic Observations, Project Site 13

Visual inspections and photo point comparisons **(Figures 7-16)** of Project Site 13 show that the fish passage seems to be functioning as intended. Little to no erosion of construction elements was observed, and the structure was in good condition. Last year (WY2014), thick algal mats had been observed growing in some pools, and riparian vegetation growth was generally vigorous from the edges of the channel to the toe of the steepened slopes. As shown in the photo points (for example photo point 5 (**Figure 11**), some of this vegetation and algae has been scoured away, presumably during the December 2014 event. However, the remaining vegetation looks healthy and is anticipated to continue to provide habitat complexity. Some scour of the bed and reworking of gravel to cobble-size sediments was also observed. For example, in photo point 2 (**Figure 8**) the gravel bed that is visible at the glide upstream of the pool and at the bank near the toe of the slope has been scoured down by a few inches to form a deeper pool. These reworked sediments provide an additional increase in habitat complexity, and are not expected to interfere with the structural integrity of the channel.

The flows of December 2014 did move large wood in the channel. Photo point 1 (**Figure 7**) shows that a large log has shifted a few feet up the bank. Similarly-sized woody material may be transported into the project site during future flows, providing additional habitat.

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[5] Stage and discharge data available through the SCVWD ALERT website is preliminary; information was not available on the Dorel gage flow rating curve and maintenance record. These data are used here for information purposes only.

Quantitative Geomorphic Observations, Project Site 13

Figures 17-23 show the results of the September 2014 cross sections surveys. Comparisons of October 2015 survey data to the previous years' data generally confirm visual observations –major geomorphic change, such as significant bank widening, downcutting or aggradation, did not take place in the fish passage over WY2015, but small and localized variations in bed elevations are present. XS 1 (**Figure 17**) shows that while the channel profile is stable, the large log that shifted during high flows (**Figure 7**) is now located within the cross section. XS 2 (**Figure 18**) shows that aggradation of organic debris and sediment is present on the heavily vegetated left bank of the channel, as well as on the channel bed. Slight changes in the channel bed due to the reworking of fine sediments, as observed in the visual observations and photo points, can be seen in XS 3 and XS 4 (**Figure 19**, **Figure 20**). The most appreciable changes of this type occurred between XS 1 and XS 2, and while they are not captured in cross section surveys, they are readily visible in the longitudinal profile (discussed below).

Figure 24 shows the results of the 2015 longitudinal profile survey. This profile provides greater detail on which areas were scoured and which aggraded. The most scour took place from about 20 to 60 feet downstream of the YSI bridge. Here the bottoms of pools are about 1 foot deeper than in previous years. Sediment appears to have accumulated in pools from Station 175 to 200 and below Station 300. As expected from visual observations, the tops of rock band structures and weirs are at the same elevations as last year. These surveyed profiles suggest geomorphic stability and active channel dynamics at Project Site 13.

Geomorphic Monitoring Results, Project Site 10 (Floodplain)

Visual Geomorphic Observations, Project Site 10

Visual assessment of geomorphic change on the floodplain was marked by vigorous growth of alders and willows, as is evident in the photo points (**Figures 25-30**). Aggradation was observed on top of the floodplain; evidence included organic debris wrack lines from high water and fresh sediment deposits. This is consistent with the stage record of inundation, as well as with the aggradation around the gage that was observed during the May 2015 site visit. The connections from the main channel to the constructed floodplain have not changed significantly, other than a continued increase in the vegetation growing around them. The thickness of this vegetation may have the capacity to divert most of the high flows away from the floodplain, protecting it from erosion and encouraging sedimentation, but may strongly divert flows into the opposite bank, increasing the potential for erosion. Such flow patterns and bank changes will be assessed visually during and/or following high flows in the upcoming water years.

Quantitative Geomorphic Observations, Project Site 10

Table 1 gives a summary of the depths of sediment accumulated on the sedimentation plates installed on the floodplain.

Table 1. Summary of sediment accumulation on sedimentation plates 1 and 2.

	Sedimentation Plate 1 *feet of accumulation*	**Sedimentation Plate 2** *feet of accumulation*
Year 1 - WY2014	0.00	0.00
Year 2 – WY2015	<0.01	<0.01

The depth of sediment accumulated on the floodplain sedimentation plates was measured on October 15, 2015. Both plates appeared to have been inundated. Both plates had accumulated less than <0.01 feet (approximately 2-3mm) of sediment, as well as approximately 0.2 feet of organic material that appears to be largely deposited by flows from December 2014. Our observations suggest the floodplain is functioning as intended, and sediment deposition, while not excessive, is occurring.

Figures 31-32 show the results of the September 2014 cross sections surveys. Comparisons of the October 2015 survey to the previous surveys generally confirm the results of the visual observations: other than some aggradation, little geomorphic change took place in the floodplain over WY2015. This result was expected, as it was a relatively dry year, and high flows were infrequent. The comparison of the surveyed cross sections shows some reworking of the channel bed sediments, but no evidence of channel widening or downcutting. The floodplain is included in the survey of XS 101; however, we did not survey the right channel bank or channel thalweg during the September 2014 or October 2015 surveys. In Figure 32, we observe a significant change in topography between the stream channel and the floodplain wall. We attribute the change to deposition of sediment during the storms of December, 2014. In addition, we noted dense vegetation at this location, which likely enhanced deposition, locally.

Figure 33 shows the results of the 2014 floodplain elevational survey. The elevation of the floodplain generally appears to be consistent from the baseline survey to the present, suggesting that the aggradation observed in visual observations is localized, and does not hinder the habitat function of the floodplain. The surveyed profile suggests geomorphic stability within Project Site 10. Note that the vigorous growth of vegetation on the floodplain is starting to hinder our ability to stay on this profile line; this will likely be an ongoing issue in future surveys.

Conclusions

Overall, as of the end of WY2015, the Alum Rock mitigation projects at Project Sites 10 and 13 remain in a condition very similar to that of the constructed condition, with natural channel and floodplain dynamics beginning to develop through localized sedimentation and scour. All structural elements held up well to the December 2014 storms, up to a 50-year event in the area. Habitat complexity associated with the fish passage design at Project Site 13 has increased, largely through the continued increase in riparian vegetation cover and the reworking of bed sediments. Some scour and aggradation was observed in pools, but overall constructed elements remain stable. The floodplain at Project Site 10 did not change geomorphically in appreciable ways, although some localized aggradation was observed. As the floodplain flooded twice during WY2015, so far the project meets the criteria requiring inundation every one to two years. Monitoring high stages and flows at these sites will continue to be a priority for the upcoming water year.

Closing

We greatly appreciate the opportunity to assist you with this monitoring effort and look forward to reporting on the geomorphic and hydrologic monitoring efforts one year from now.

Sincerely,

BALANCE HYDROLOGICS, Inc.

Krysia Skorko, M.S.
Geomorphologist

Eric Donaldson, P.G.
Project Manager

Shawn Chartrand, M.S., P.G., CEG
Principal-in-charge

Encl. Figures 1 through 33

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Hydrology and Water Quality Existing Conditions for San José California. Schaaf and Wheeler Consulting Civil Engineers Report. May 18, 2009.

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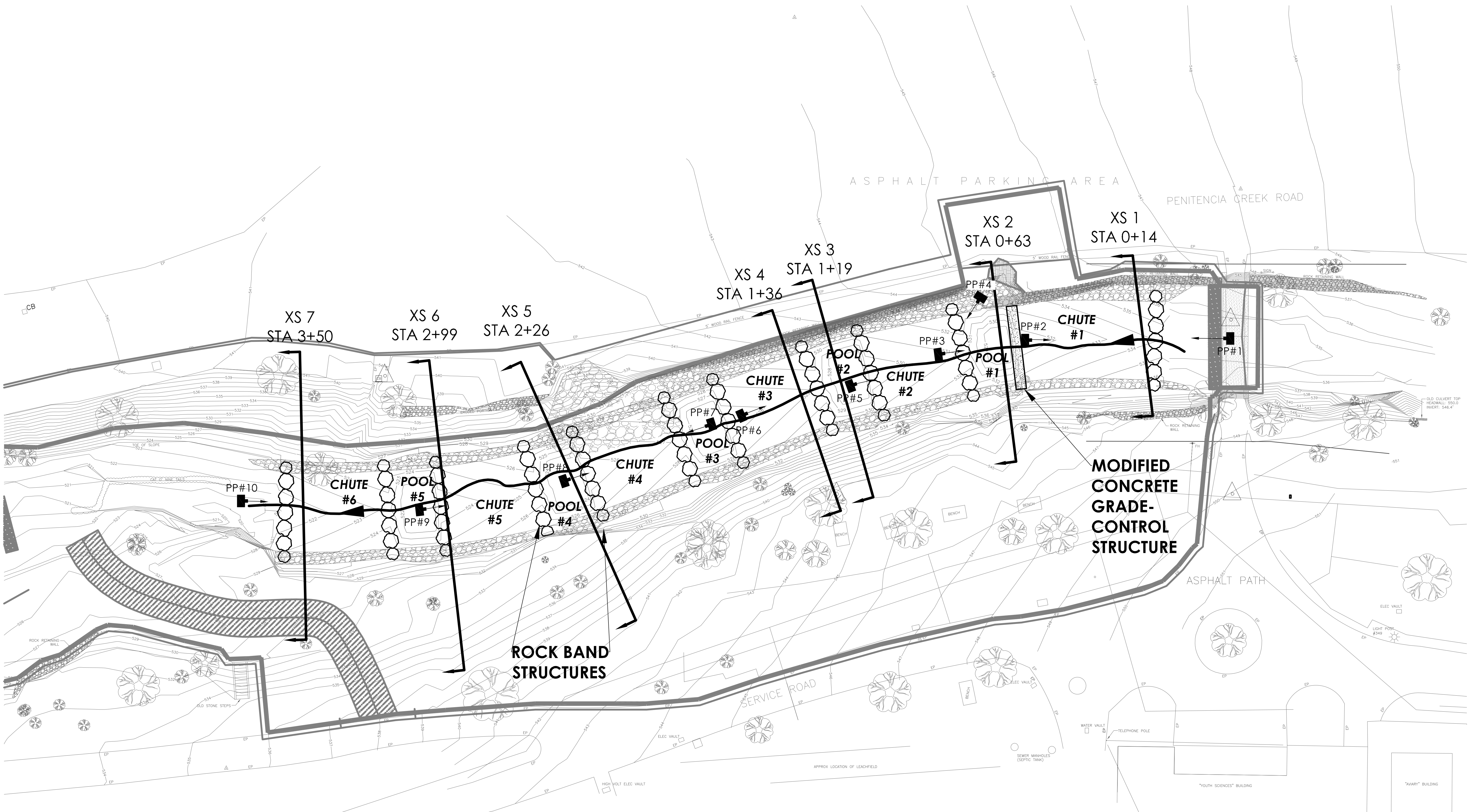

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213017 monitoring workmap.dwg

Figure 1. Upper Penitencia Creek, Alum Rock Monitoring, Santa Clara County, California.
Project Site 13, a 300-foot long fish passage improvement project.

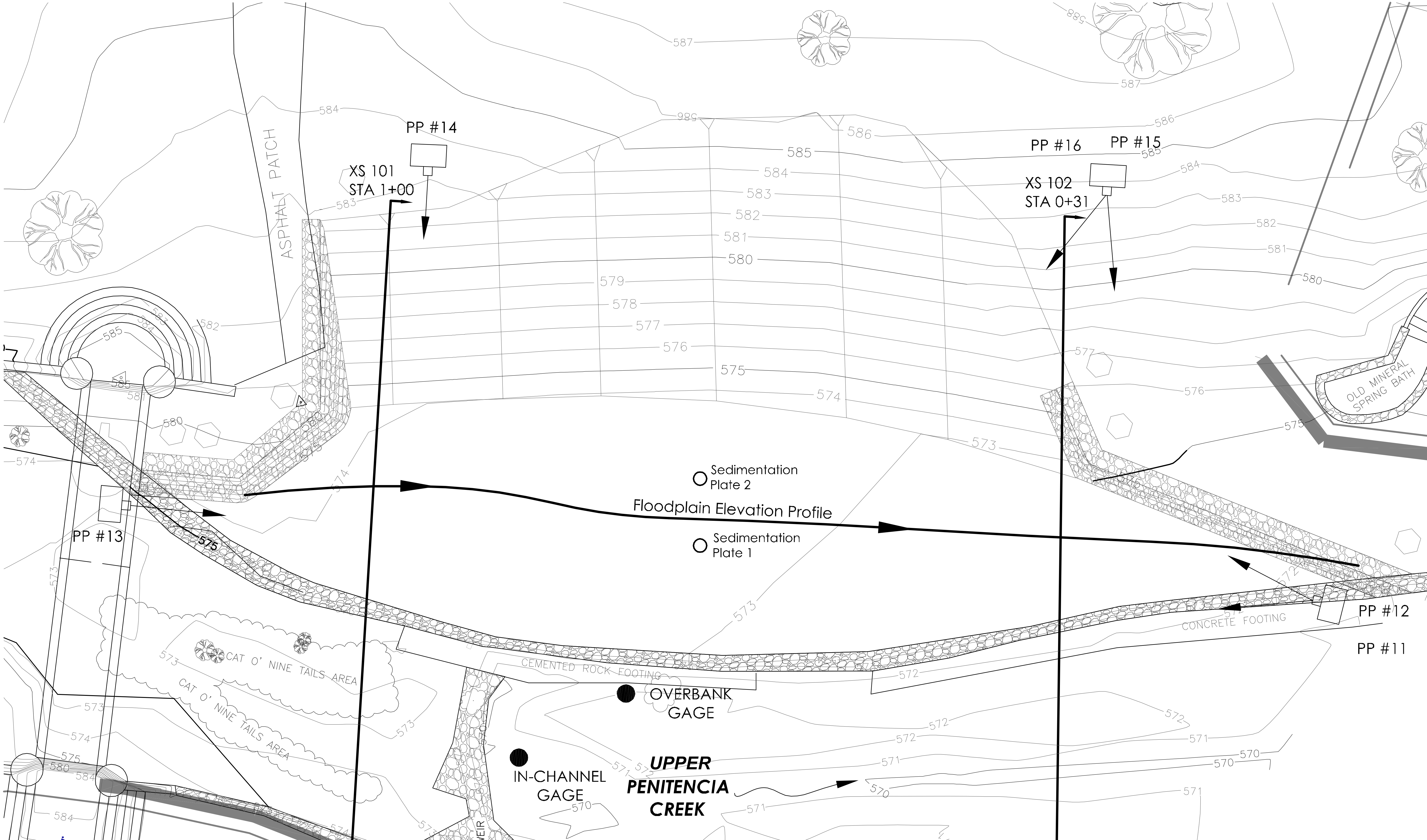

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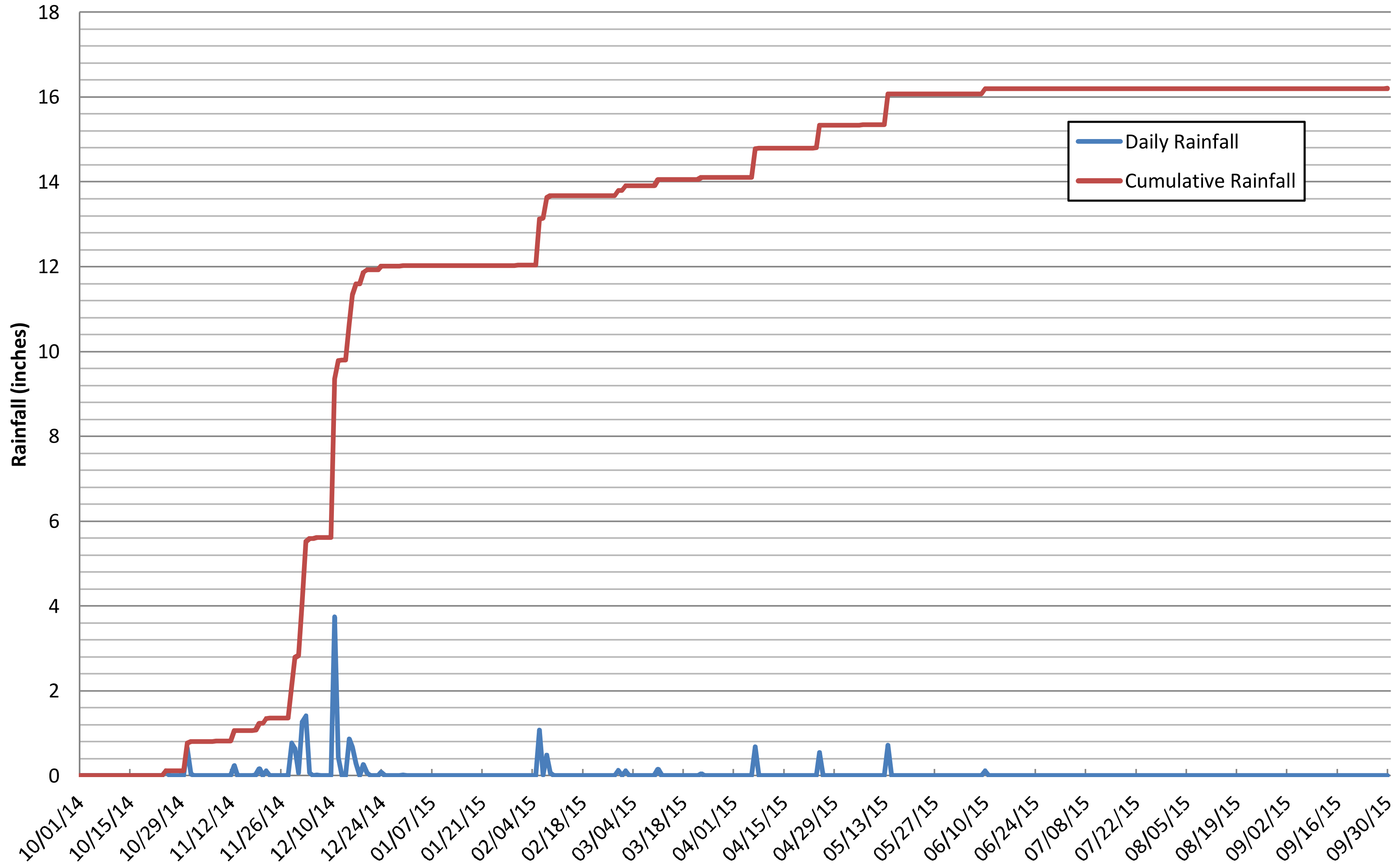
Figure 2. Upper Penitencia Creek, Alum Rock Monitoring, Santa Clara County, California. Project Site 10, a 120-foot long, 30-40 foot wide newly constructed floodplain.

0' 5' 10' 20'
SCALE: 1" = 10'

N

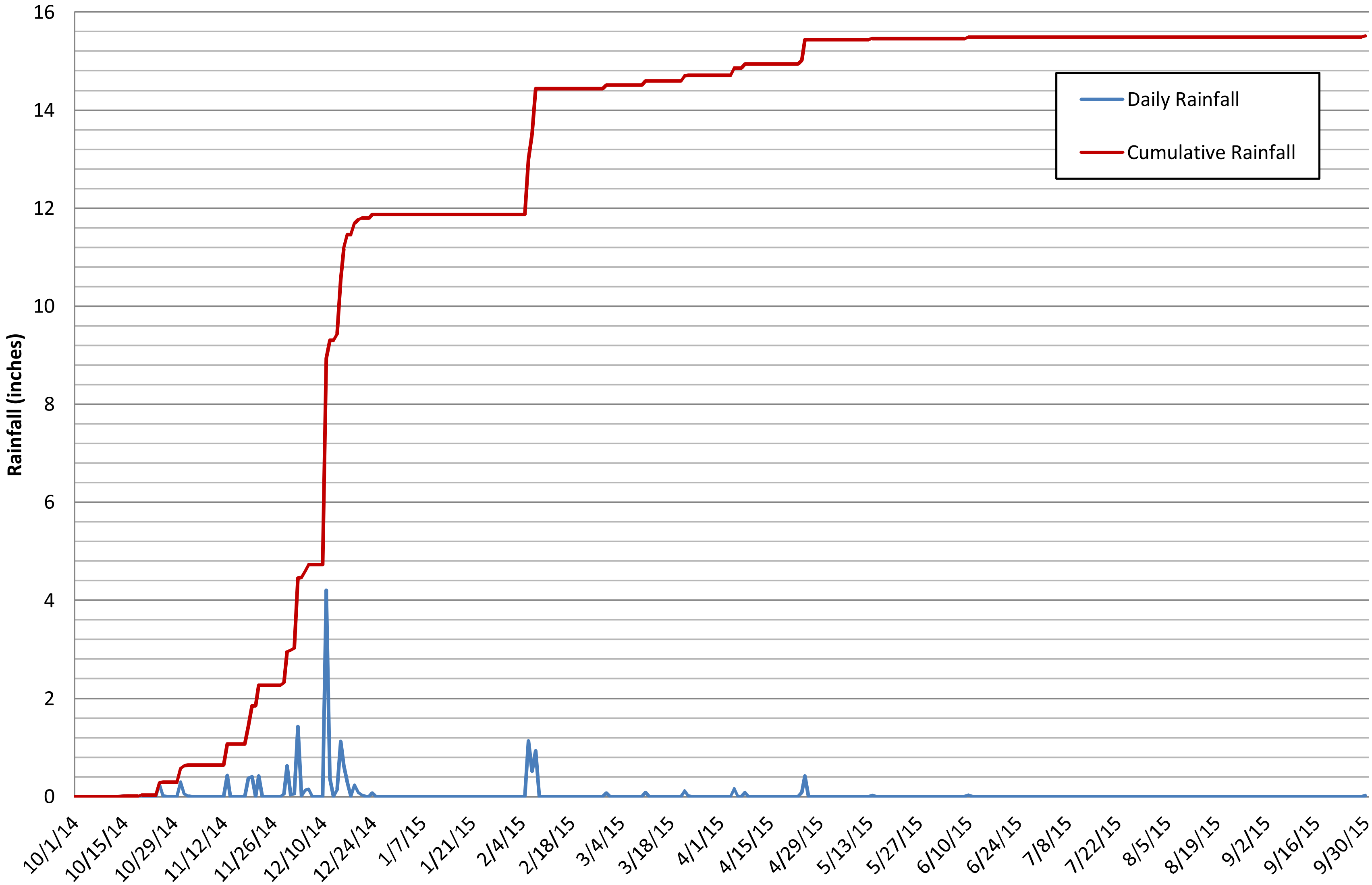


Source: Weather Underground

Balance Hydrologics, Inc.

Figure 3. Daily Rainfall and Cumulative Rainfall, Berryessa, California (Weather Underground Station KCANSANJO17). Alum Rock Monitoring, WY2015, Santa Clara County, California.

Rainfall_WY2015.xls



Source: CIMIS

Balance Hydrologics, Inc.

Figure 4. **Daily Rainfall and Cumulative Rainfall, Union City (CIMIS 171). Alum Rock Monitoring, WY2015, Santa Clara County, California.**

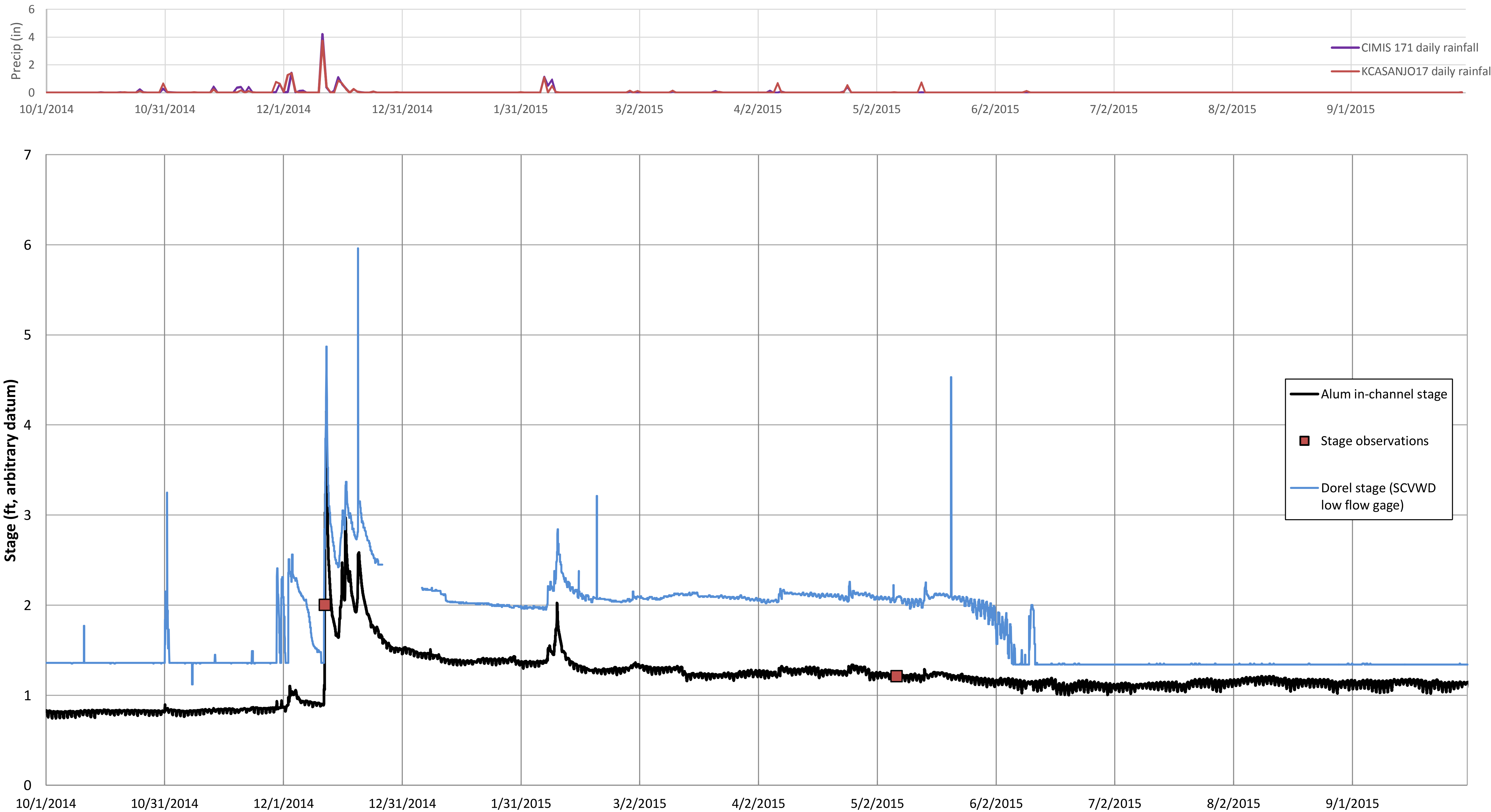


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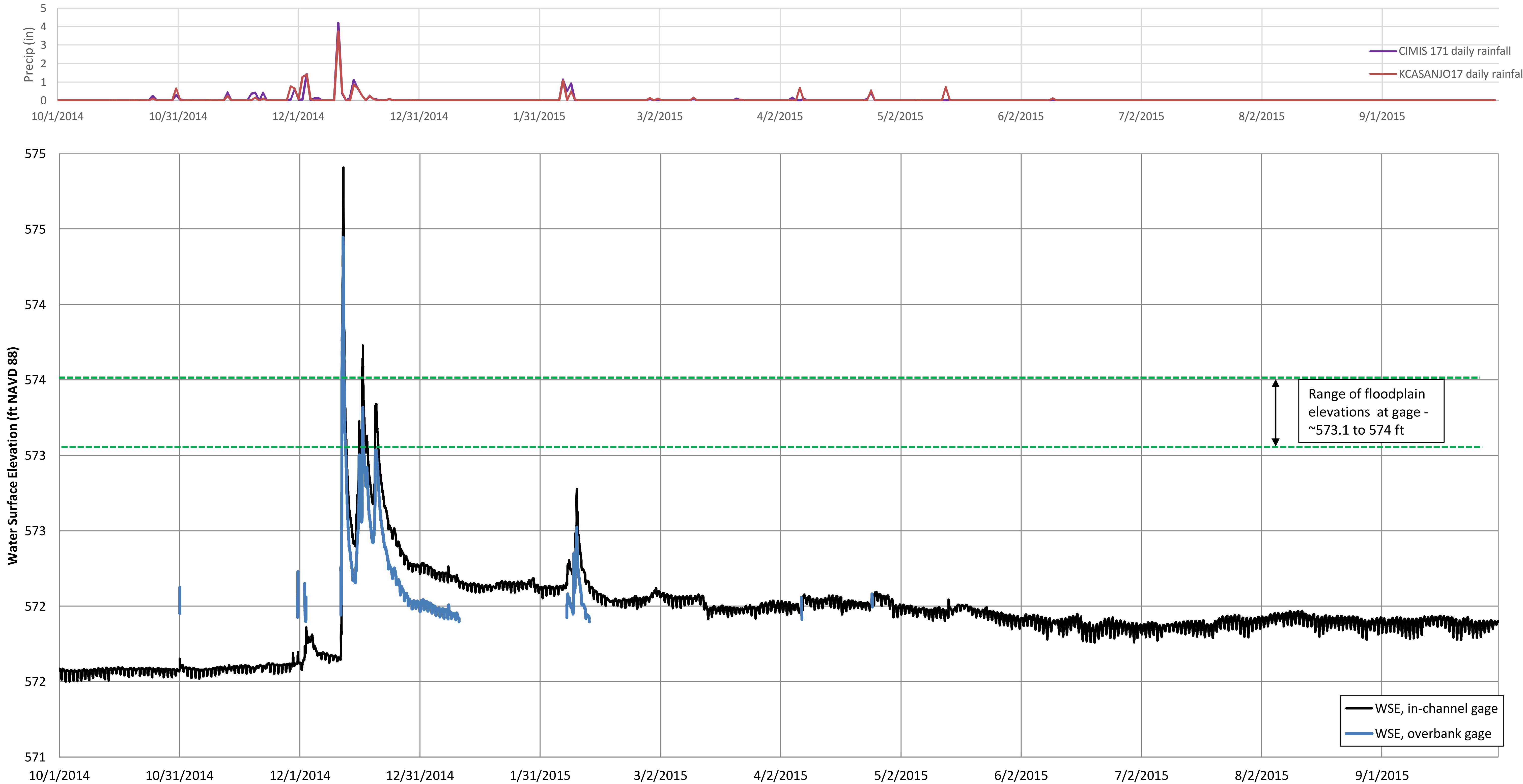
Figure 5 . **Alum Rock 15 minute stage record from upstream channel-bottom pressure transducer, WY2015, Alum Rock monitoring, Santa Clara County, California.** Red squares mark manual readings from the upstream staff plate. These data are compared with hourly stage data from the Dorel gage, located approximately 2.5 km downstream from project sites 10 and 13. Precipitation from nearby gages (KCASANJ17, CIMIS171) are shown above.

Sources: Balance Hydrologics and http://alert.valleywater.org/sgi.php,



Balance Hydrologics, Inc.

Figure 6. Alum Rock water surface elevations measured within the channel and on the floodplain, WY2015, Alum Rock monitoring, Santa Clara County, California. In-channel water surface elevation (WSE) is calculated from surveys of the staff plate at the upstream datalogger. Floodplain WSE is approximated by adjusting stage records to match flooding peaks in the in-channel record. Floodplain stage records are only plotted during times of inundation. According to discharge records for the SCVWD Dorel gage, a flow of approximately 2.3 cfs is needed to see a response at the overbank gage, and a flow of approximately 50 cfs is needed to inundate the floodplain. Dorel discharge has been scaled for watershed size to estimate Alum Rock discharge.

Sources: Balance Hydrologics and http://alert.valleywater.org/sgi.php,

Balance Hydrologics, Inc.

Figure 7. **Photo point 1, Site 13, Years 0-2. Alum Rock Monitoring, Upper Penitencia Creek, Santa Clara County, California .** Photo point 1 photographs taken from pedestrian bridge, looking downstream at the first rock band structure and chute of the fish passage project. Note the large log that has moved up the left bank. Refer to Figure 1 of this report for photo point locations.

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Figure 8. **Photo point 2, Site 13, Years 0-2. Alum Rock Monitoring, Upper Penitencia Creek, Santa Clara County, California .** Photo point 2 photographs looking upstream to bridge below first rock band structure and chute of the fish passage project. Note the scour of gravels in the pools and along the banks, Refer to Figure 1 of this report for photo point locations.

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Figure 9. **Photo point 3, Site 13, Years 0-2. Alum Rock Monitoring, Upper Penitencia Creek, Santa Clara County, California .** Photo point 3 photographs looking upstream across pool 1 at the modified concrete grade control structure and pedestrian bridge in the fish passage project. Refer to Figure 1 of this report for photo point locations.

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Figure 10. **Photo point 4, Site 13, Years 0-2. Alum Rock Monitoring, Upper Penitencia Creek, Santa Clara County, California .** Photo point 4 photographs taken on right bank from top of the modified concrete grade control structure wall looking downstream across chute 2 along the fish passage project. Refer to Figure 1 of this report for photo point locations.

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Figure 11. **Photo point 5, Site 13, Years 0-2. Alum Rock Monitoring, Upper Penitencia Creek, Santa Clara County, California .** Photo point 5 photographs looking upstream across chute 2 to modified concrete grade control structure and bridge in the fish passage project. Note the scour of vegetation and algal mats. Refer to Figure 1 of this report for photo point locations.

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Figure 12. **Photo point 6, Site 13, Years 0-2. Alum Rock Monitoring, Upper Penitencia Creek, Santa Clara County, California .** Photo point 6 photographs looking upstream across pool 2 and chute 2 in the fish passage project. Refer to Figure 1 of this report for photo point locations.

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Figure 13. **Photo point 7, Site 13, Years 0-2. Alum Rock Monitoring, Upper Penitencia Creek, Santa Clara County, California .** Photo point 7 panoramic photographs looking downstream at rock band structure and chute 3 in the fish passage project. Note forming erosion line on right bank downstream of rock band. Refer to Figure 1 of this report for photo point locations.

November 2013

September 2014

October 2015

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Figure 14. **Photo point 8, Site 13, Years 0-2. Alum Rock Monitoring, Upper Penitencia Creek, Santa Clara County, California .** Photo point 8 photographs looking upstream across rock band structure and pool 3 in the fish passage project. Refer to Figure 1 of this report for photo point locations.

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Figure 15. **Photo point 9, Site 13, Years 0-2. Alum Rock Monitoring, Upper Penitencia Creek, Santa Clara County, California .** Photo point 9 photographs looking upstream across rock band structure and pool 4 in the fish passage project. Refer to Figure 1 of this report for photo point locations.

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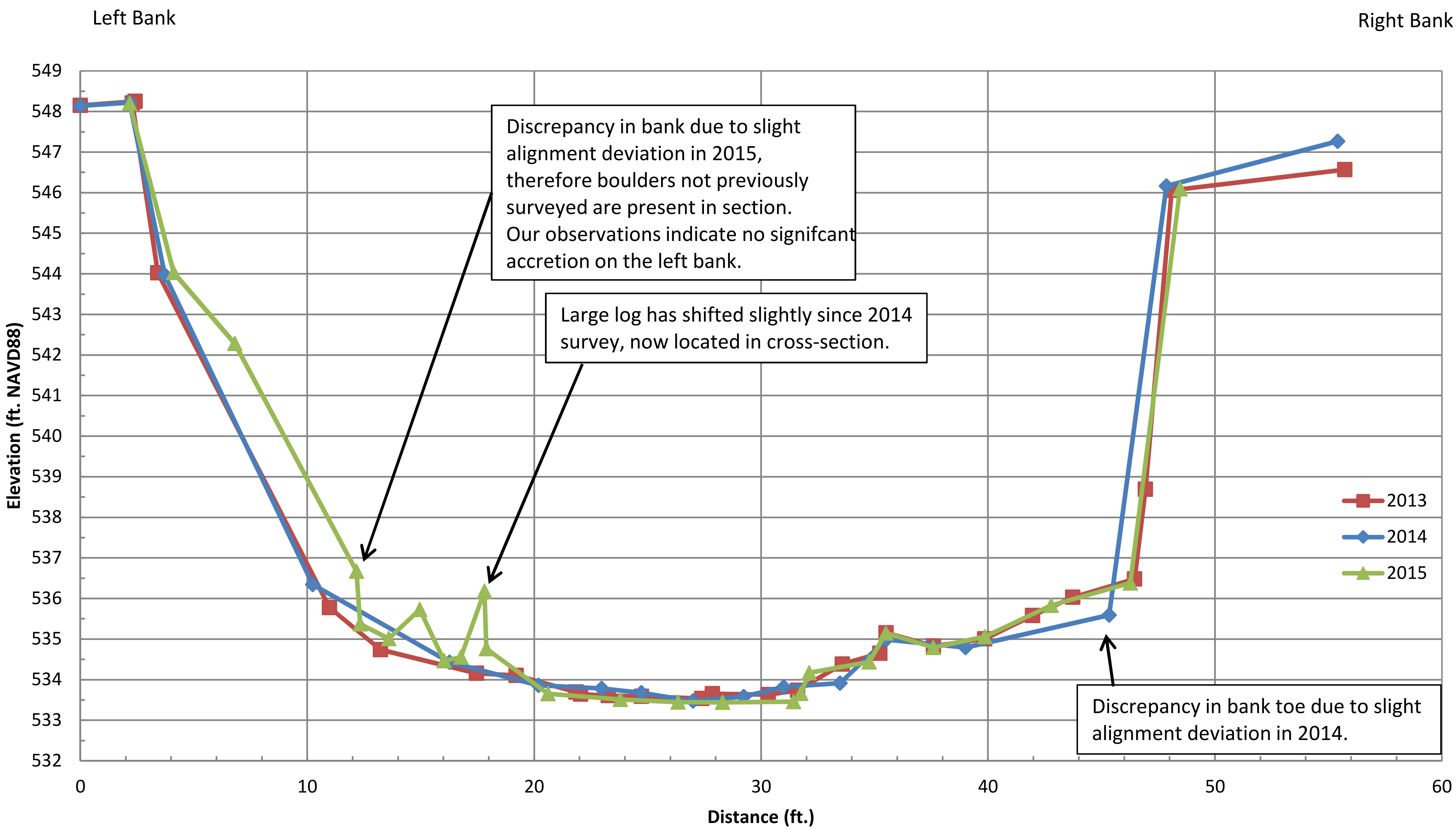
Figure 16. **Photo point 10, Site 13, Years 0-2. Alum Rock Monitoring, Upper Penitencia Creek, Santa Clara County, California .** Photo point 10 looking upstream from bottom of fish passage project. Refer to Figure 1 of this report for photo point locations.



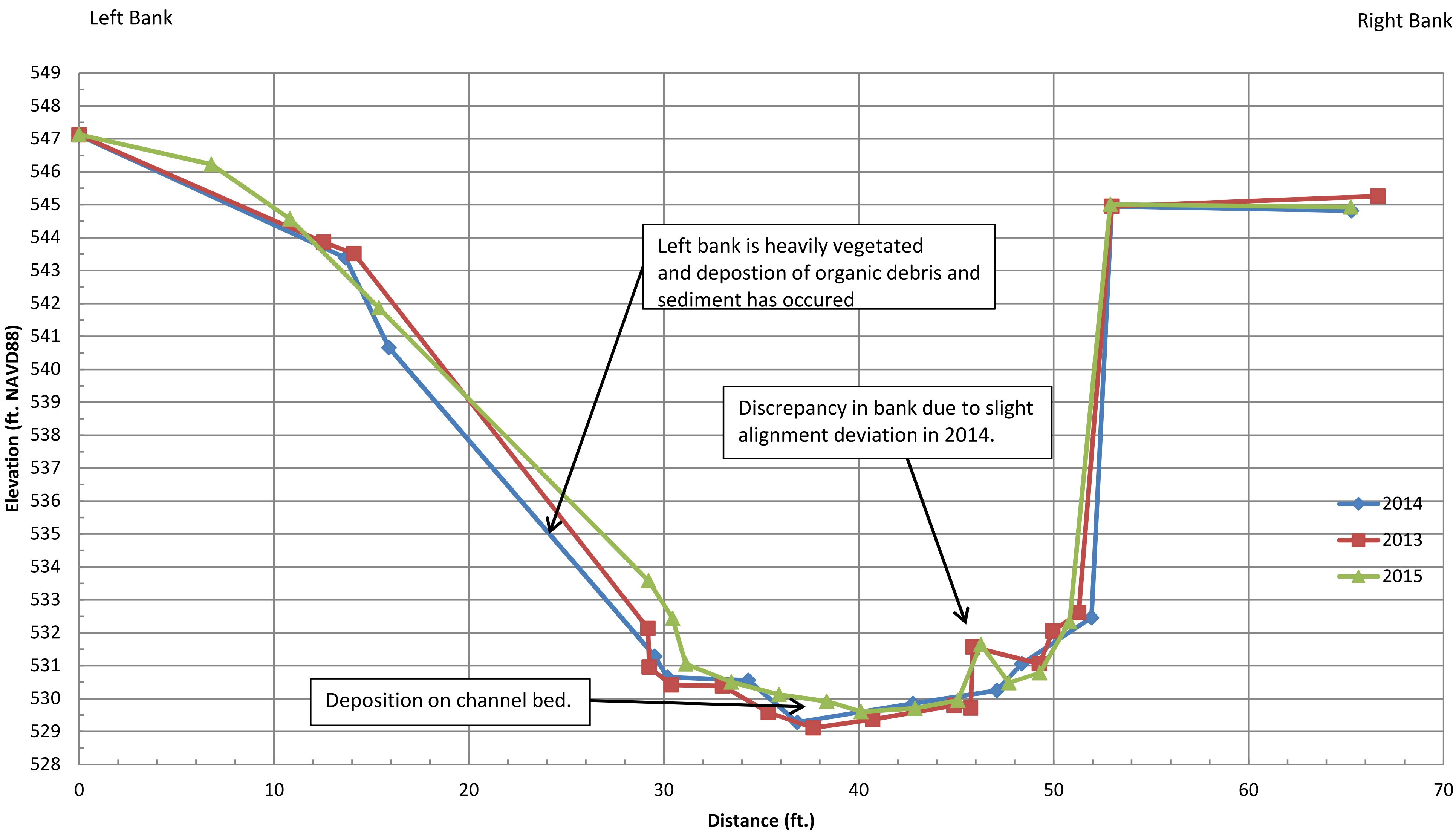
Horizontal and vertical scales do not match.

Source: Balance Hydrologics survey

Balance Hydrologics, Inc.

Figure 17 . Cross section 1, Alum Rock WY2015 monitoring, Santa Clara County, California.

213017 Alum_WY2015_survey master working.xlsx



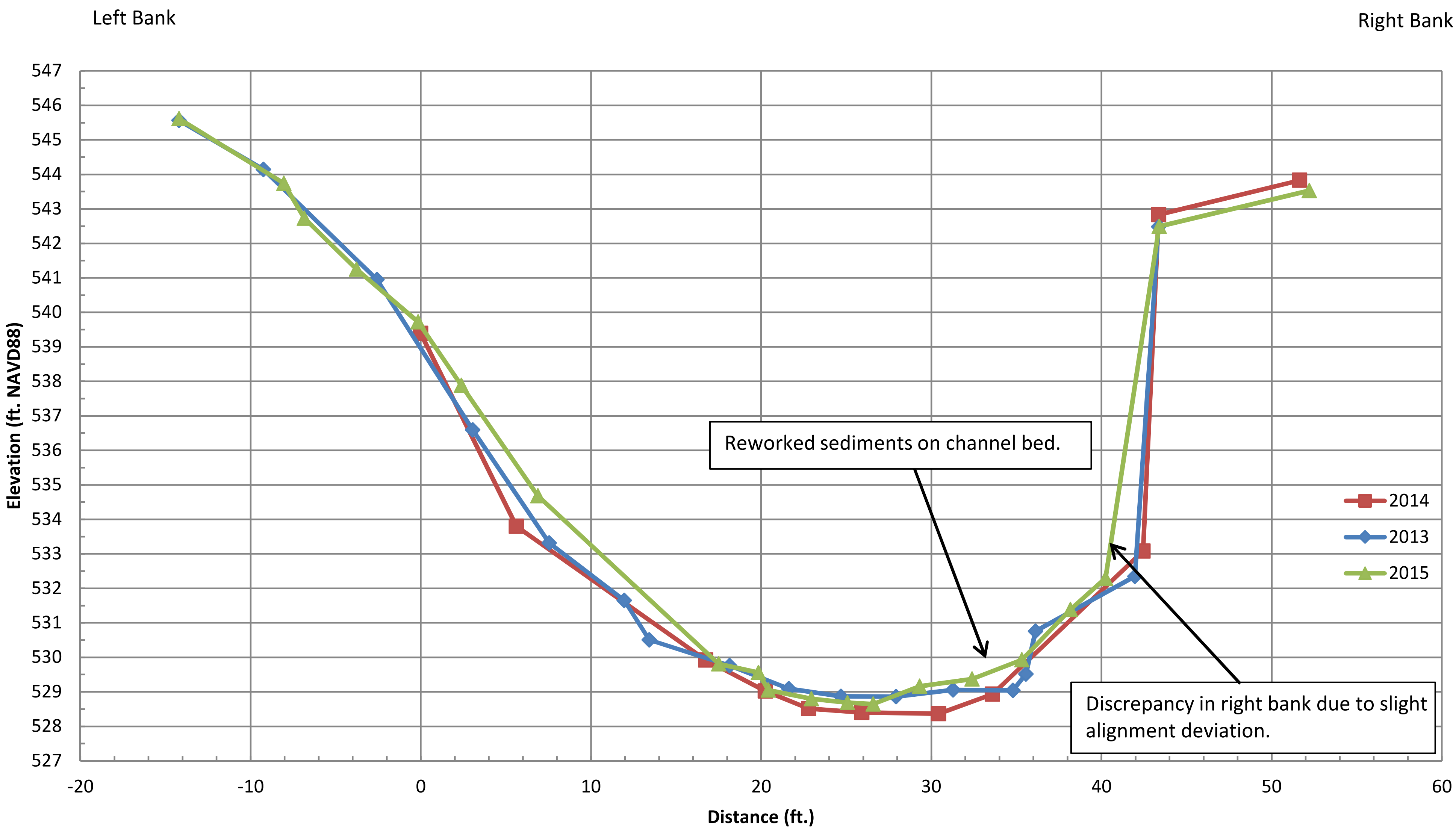
Horizontal and vertical scales do not match.

Source: Balance Hydrologics survey

Balance Hydrologics, Inc.

Figure 18 . Cross section 2, Alum Rock WY2015 monitoring, Santa Clara County, California.

213017 Alum_WY2015_survey master working.xlsx



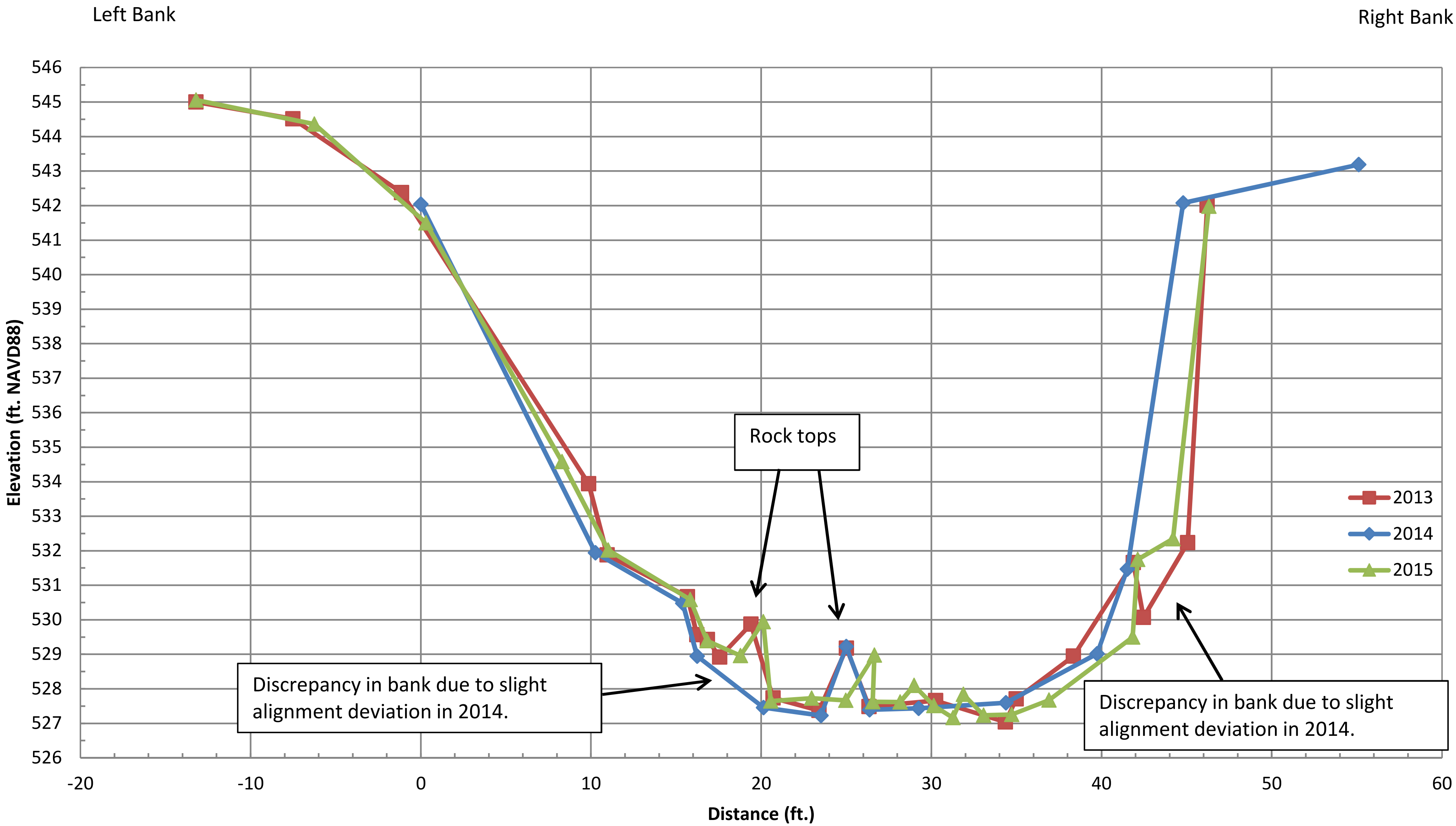
Horizontal and vertical scales do not match.

Source: Balance Hydrologics survey

Balance Hydrologics, Inc.

Figure 19 . Cross section 3, Alum Rock WY2015 monitoring, Santa Clara County, California.

213017 Alum_WY2015_survey master working.xlsx



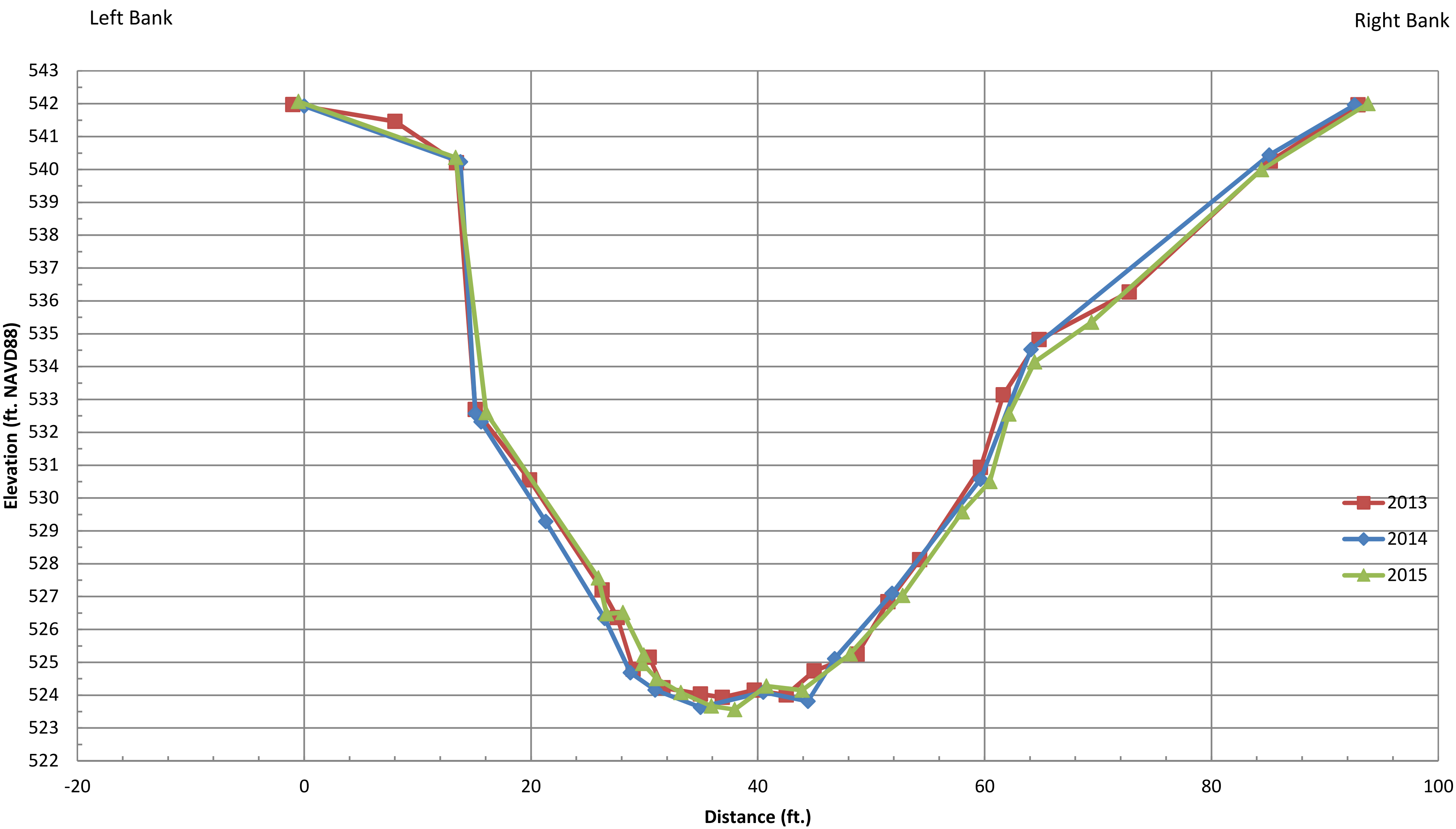
Horizontal and vertical scales do not match.

Source: Balance Hydrologics survey

Balance Hydrologics, Inc.

Figure 20 . Cross section 4, Alum Rock WY2015 monitoring, Santa Clara County, California.

213017 Alum_WY2015_survey master working.xlsx



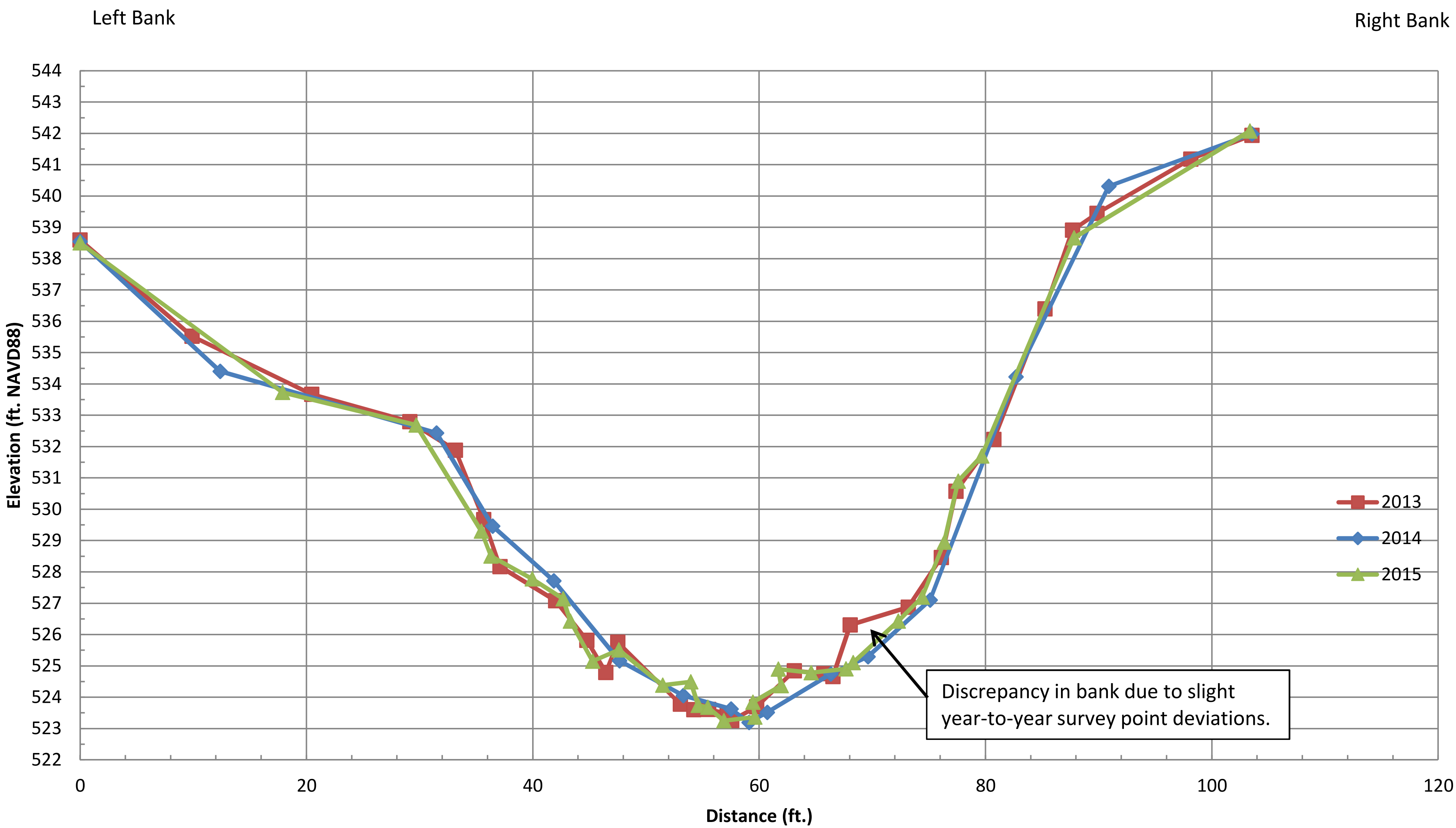
Horizontal and vertical scales do not match.

Source: Balance Hydrologics survey

Balance Hydrologics, Inc.

Figure 21 . Cross section 5, Alum Rock WY2015 monitoring, Santa Clara County, California.

213017 Alum_WY2015_survey master working.xlsx



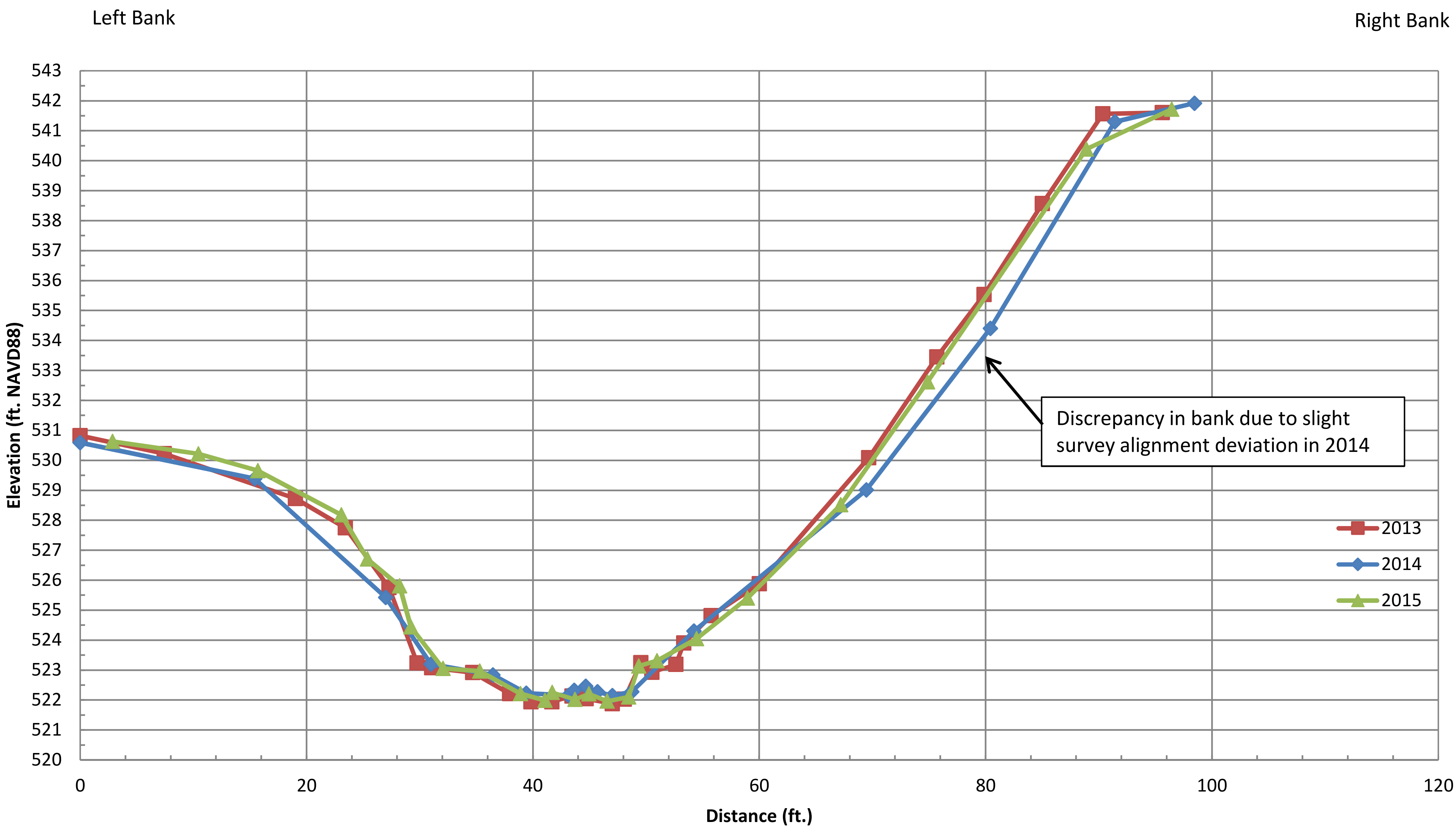
Horizontal and vertical scales do not match.

Source: Balance Hydrologics survey

Balance Hydrologics, Inc.

Figure 22 . Cross section 6, Alum Rock WY2015 monitoring, Santa Clara County, California.

213017 Alum_WY2015_survey master working.xlsx



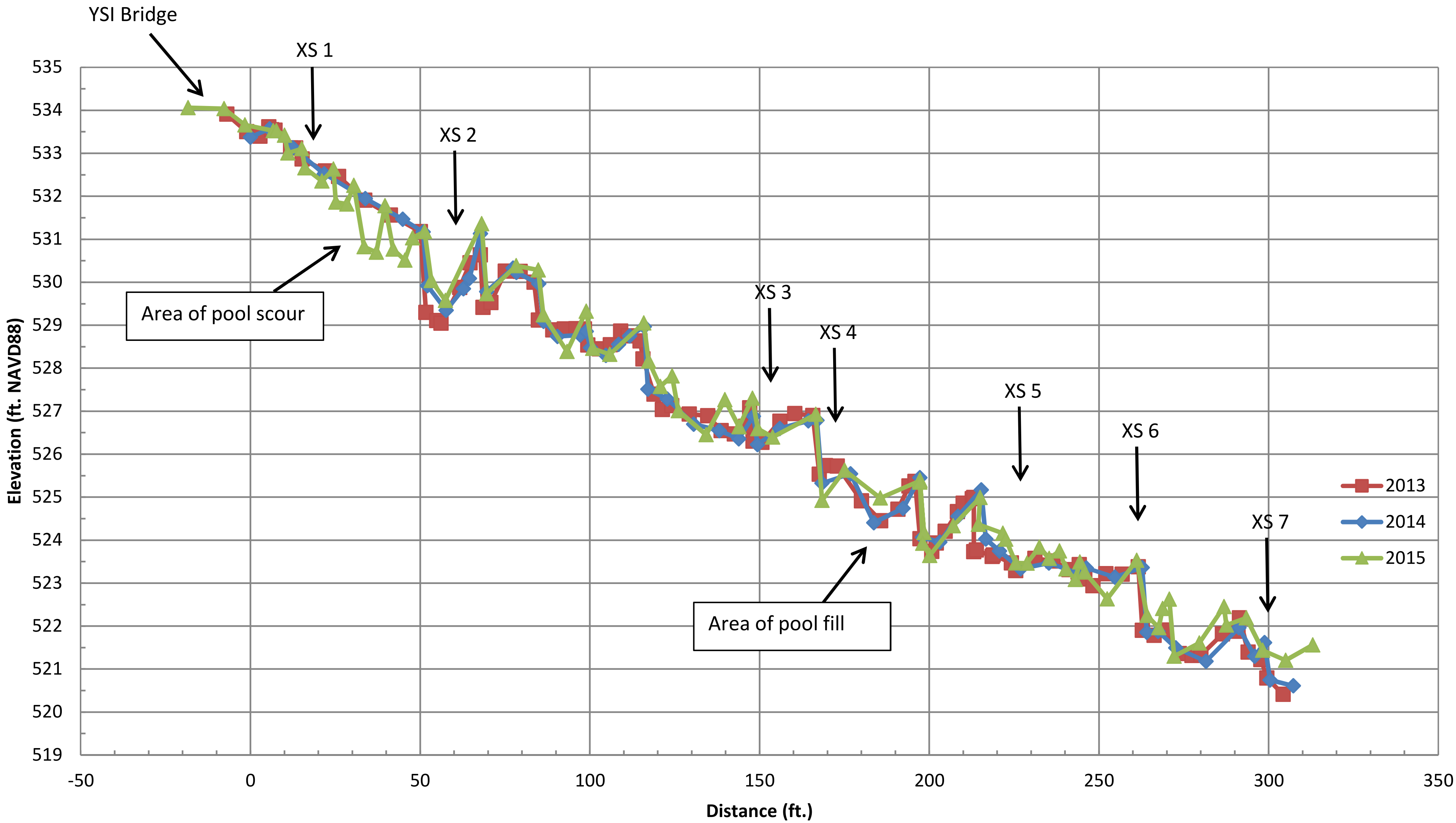
Horizontal and vertical scales do not match.

Source: Balance Hydrologics survey

Balance Hydrologics, Inc.

Figure 23 . Cross section 7, Alum Rock WY2015 monitoring, Santa Clara County, California.

213017 Alum_WY2015_survey master working.xlsx



Horizontal and vertical scales do not match.

Source: Balance Hydrologics survey

Balance Hydrologics, Inc.

Figure 24 . **Thalweg longitudinal profile, Site 13 (Fish Passage), Alum Rock WY2015 monitoring, Santa Clara County, California.**

213017 Alum_WY2015_survey master working.xlsx

Figure 25. **Photo point 11, Site 10, Years 0-2. Alum Rock Monitoring, Upper Penitencia Creek, Santa Clara County, California .** Photo point 11 looking upstream at Site 10 floodplain toward foot bridge. Refer to Figure 2 of this report for photo point locations.

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Figure 26. **Photo point 12, Site 10, Years 0-2. Alum Rock Monitoring, Upper Penitencia Creek, Santa Clara County, California .** Photo point 12 looking upslope at the downstream edge of the Site 10 floodplain. Refer to Figure 2 of this report for photo point locations.

November 2013

September 2014

October 2015

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Figure 27. **Photo point 13, Site 10, Years 0-2. Alum Rock Monitoring, Upper Penitencia Creek, Santa Clara County, California .** Photo point 13 looking downstream from foot bridge at Site 10 floodplain. Refer to Figure 2 of this report for photo point locations.

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Figure 28. **Photo point 14, Site 10, Years 0-2. Alum Rock Monitoring, Upper Penitencia Creek, Santa Clara County, California .** Photo point 14 looking from upslope across XS 101 at Site 10 floodplain. Refer to Figure 2 of this report for photo point locations.

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Figure 29. **Photo point 15, Site 10, Years 0-2. Alum Rock Monitoring, Upper Penitencia Creek, Santa Clara County, California .** Photo point 15 looking from upslope across XS 102 at Site 10 floodplain. Refer to Figure 2 of this report for photo point locations.

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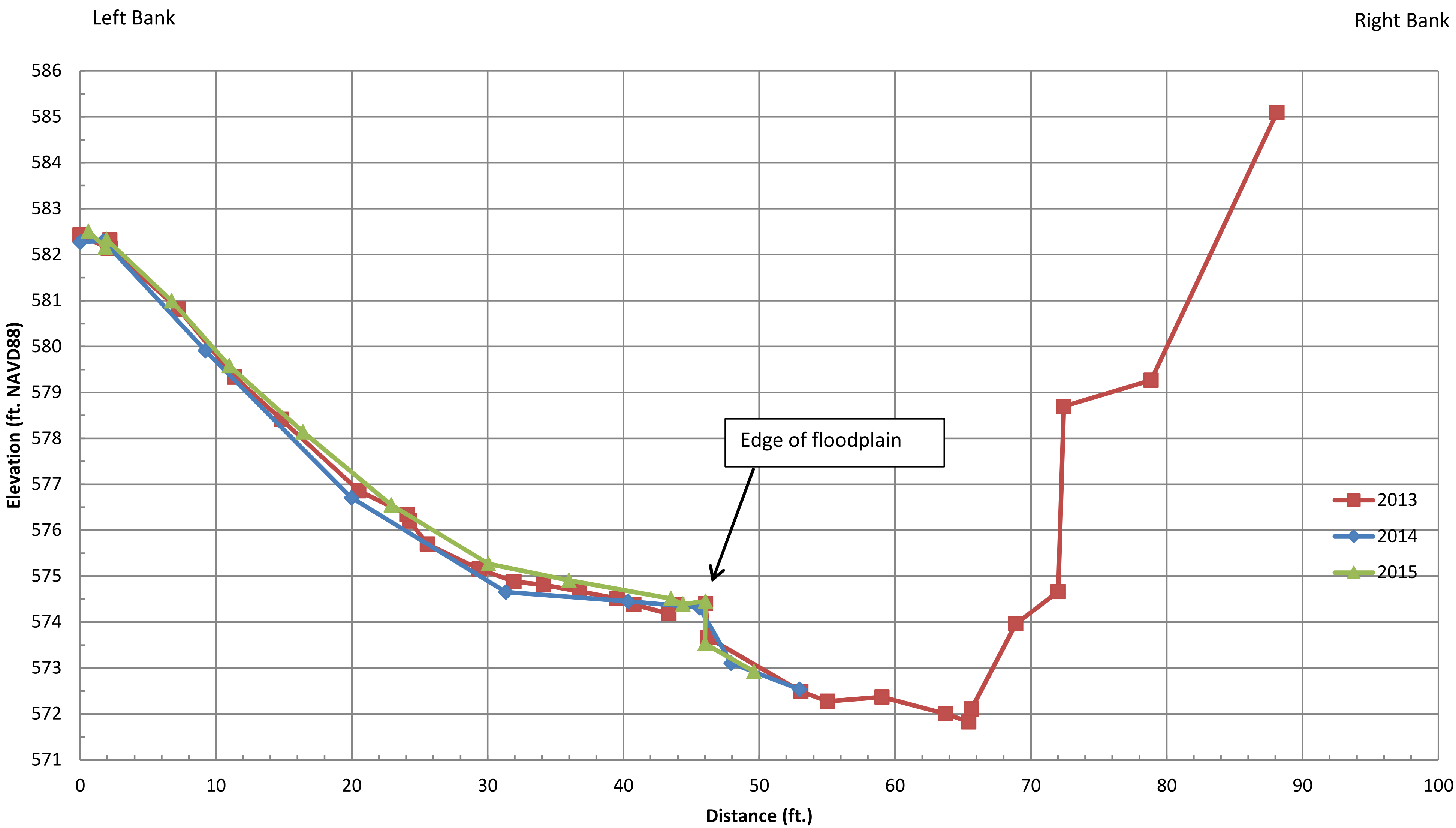
Figure 30. **Photo point 16, Site 10, Years 0-2. Alum Rock Monitoring, Upper Penitencia Creek, Santa Clara County, California .** Photo point 16 looking from upslope to the footbridge at Site 10 floodplain. Refer to Figure 2 of this report for photo point locations.



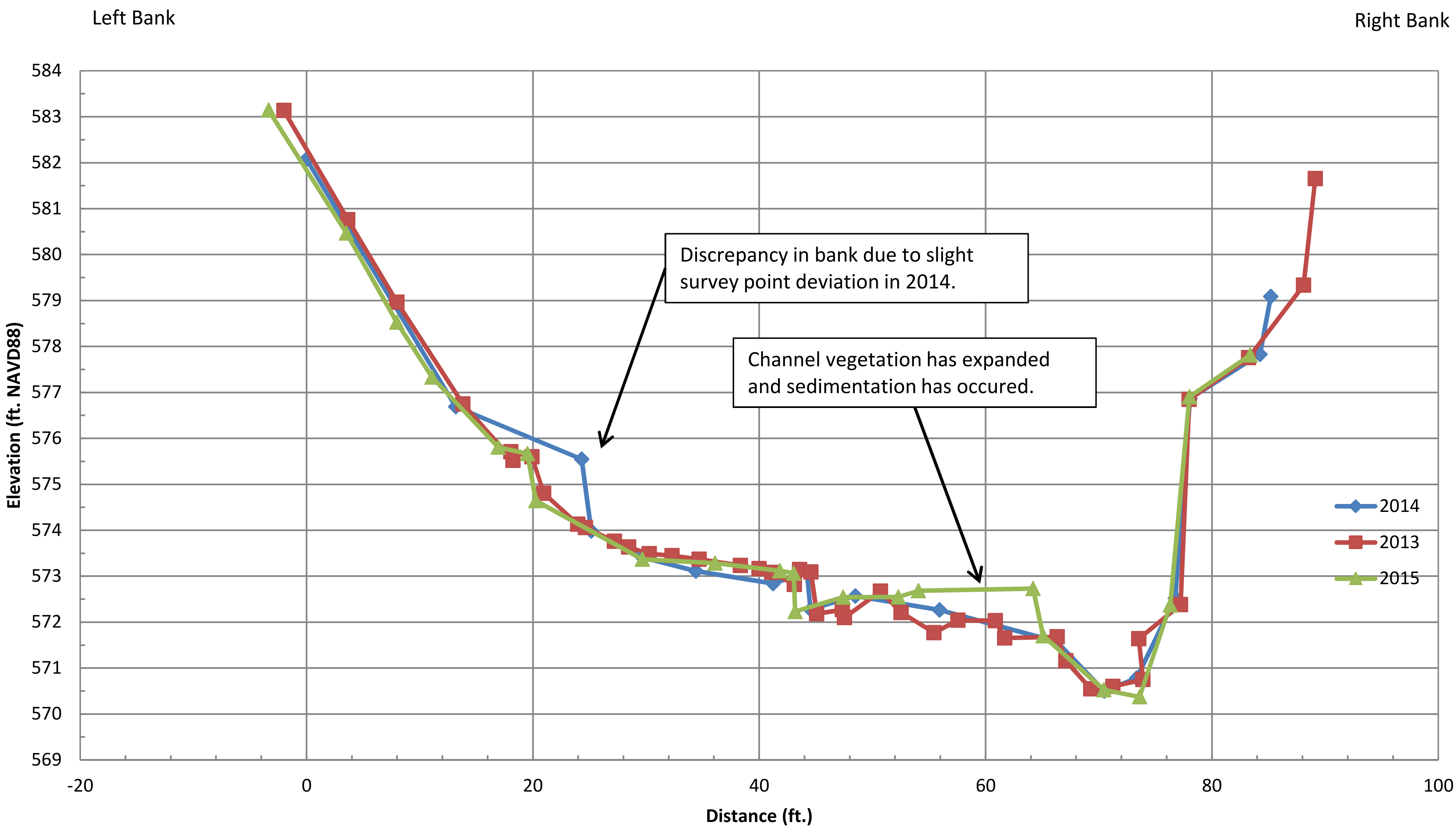
Horizontal and vertical scales do not match.

Source: Balance Hydrologics survey

Balance Hydrologics, Inc.

Figure 31 . **Cross section 101, Alum Rock WY2015 monitoring, Santa Clara County, California.**

213017 Alum_WY2015_survey master working.xlsx



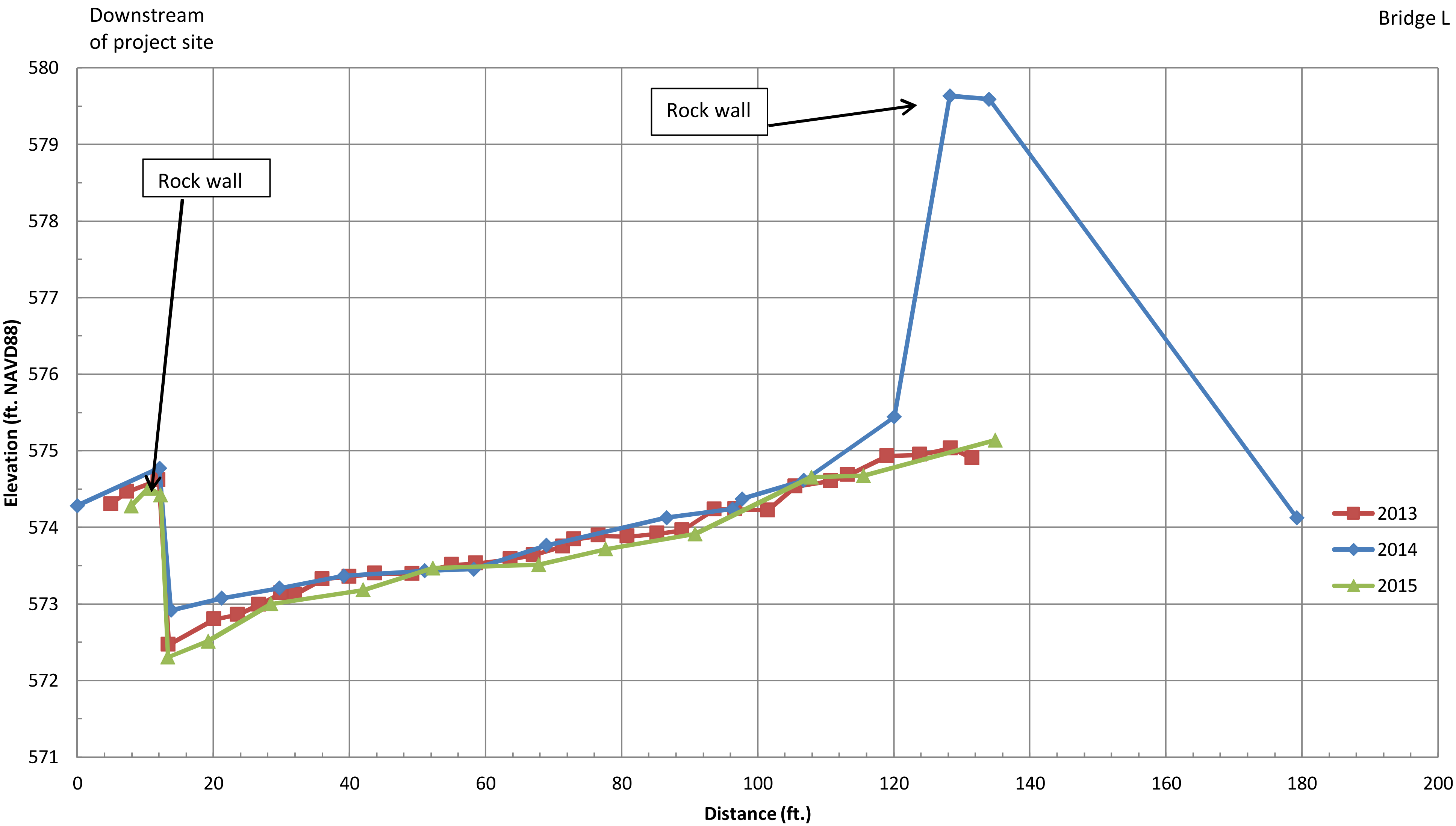
Horizontal and vertical scales do not match.

Source: Balance Hydrologics survey

Balance Hydrologics, Inc.

Figure 32 . **Cross section 102, Alum Rock WY2015 monitoring, Santa Clara County, California.**

213017 Alum_WY2015_survey master working.xlsx



Horizontal and vertical scales do not match.

Source: Balance Hydrologics survey

Balance Hydrologics, Inc.

Figure 33. **Site 10 (Floodplain) elevational profile, Alum Rock WY2015 monitoring, Santa Clara County, California.** Note that due to thick planted vegetation, line-of-sight is difficult. In order prevent damage to plantings, long profile may vary slightly year to year.

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Appendix D

Alum Rock Park Fish Passage Improvement Project: Year 3 Fisheries Monitoring

H. T. HARVEY & ASSOCIATES

Ecological Consultants

Alum Rock Park Fish Passage Improvement Project: Year 3 Fisheries Monitoring

HTH Project No. 3518-02

Prepared for:

Santa Clara Valley Transportation Authority
3331 N. First Street, Bldg. B
San Jose, CA 95134
p (408) 321-5976
f (408) 321-5787

Prepared by:

H. T. Harvey & Associates

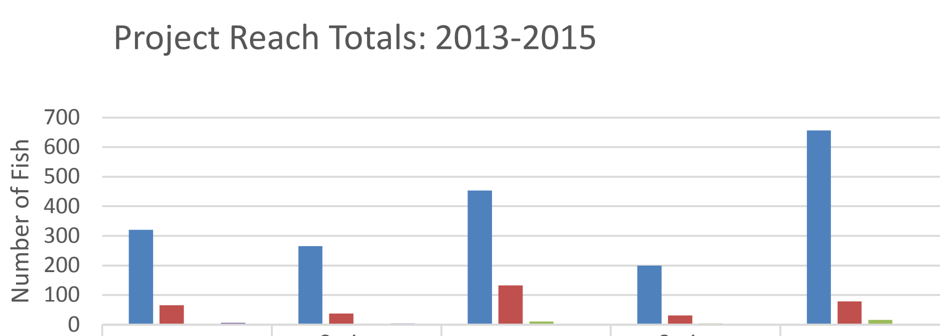
January 2016

1125 16th Street, Suite 209 • Arcata, CA 95521 • Ph: 707.822.4141 • F: 707.822.4848

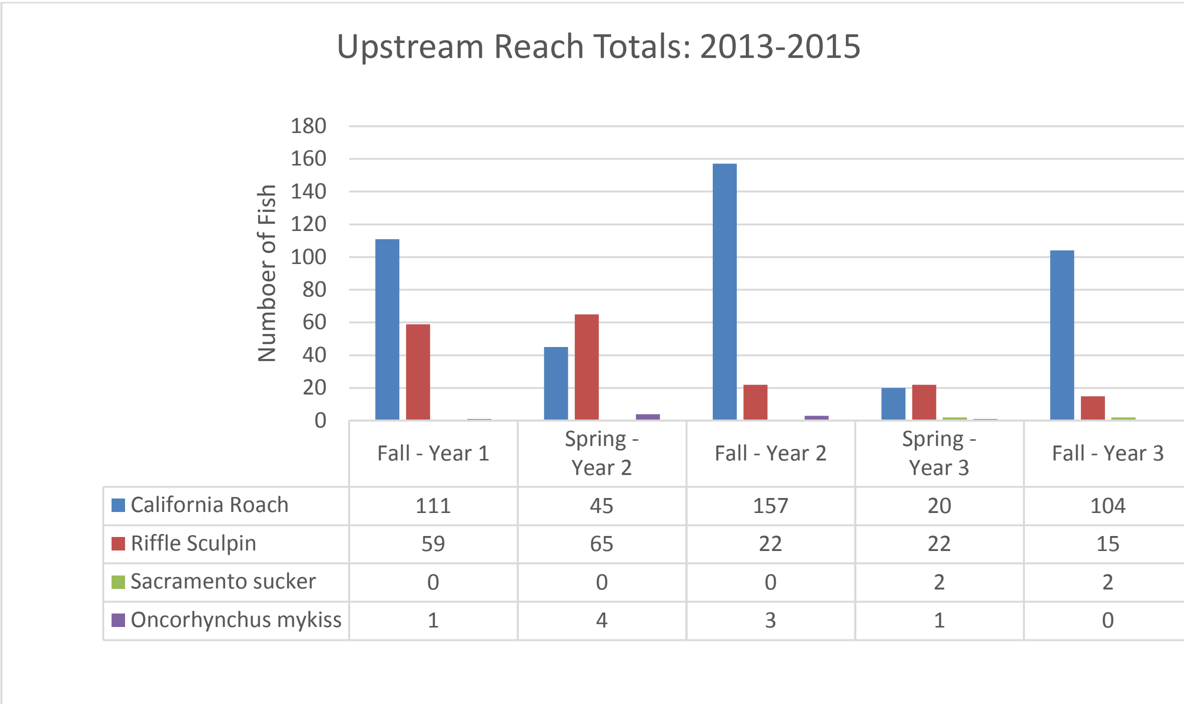
Executive Summary

The Alum Rock Fish Passage Improvement Project (Project) was implemented by the Santa Clara Valley Transportation Authority (VTA) to improve fish passage in Upper Penitencia Creek, a tributary to Coyote Creek in San Jose, Santa Clara County, California. Upper Penitencia Creek is designated as critical habitat for Central California Coast steelhead (*Oncorhynchus mykiss*), a distinct population segment listed as threatened under the Federal Endangered Species Act. In 2012, fish passage was improved by modifying a concrete weir and constructing a roughened channel. On behalf of VTA, H. T. Harvey & Associates (HTH) developed and implemented a fisheries monitoring plan to meet the requirements of the biological opinion prepared by the National Marine Fisheries Service for the Project. Plan goals were to (1) document the fish species occupying the Project reach and (2) document habitat associations in the Project and reference reaches upstream. Year 1 monitoring (fall only) was completed in 2013. Monitoring will continue, as described in the plan (spring and fall), through Year 5 (2017).

HTH fish ecologists documented habitat types and characteristics in the Project reach and the upstream reference reaches (Upstream reach) and electrofished all habitat units. The fish community documented during Year 3 was composed of four native species: California roach (*Hesperoleucus symetricus*), riffle sculpin (*Cottus gulosus*), Sacramento sucker (*Catostomus occidentalis*), and *O. mykiss* (see the following figures, which present totals for 2013–2015 for the Project and Upstream reaches). The same four species were documented in Years 1 and 2. Special attention was given to the occurrence of steelhead because of its listing status, but only a single *O. mykiss* was captured during Year 3 (see the figure showing Project reach totals).



	Fall - Year 1	Spring - Year 2	Fall - Year 2	Spring - Year 3	Fall - Year 3
California Roach	321	265	453	199	657
Riffle Sculpin	66	37	133	31	78
Sacramento sucker	1	3	10	4	16
Oncorhynchus mykiss	6	4	2	0	0



	Fall - Year 1	Spring - Year 2	Fall - Year 2	Spring - Year 3	Fall - Year 3
California Roach	111	45	157	20	104
Riffle Sculpin	59	65	22	22	15
Sacramento sucker	0	0	0	2	2
Oncorhynchus mykiss	1	4	3	1	0

This was primarily due to persistent, region-wide, drought conditions in 2015 during which opportunities for adult and juvenile *O. mykiss* migrations through Upper Penitencia Creek were severely limited. As a result, successful spawning by steelhead probably did not occur, and juvenile steelhead were probably unable to complete seaward migrations. One *O. mykiss* was captured in the Upstream reach during spring surveys; no *O. mykiss* were captured during fall surveys. Although only a single *O. mykiss* was captured during Year 3, the number of Sacramento suckers captured in the Upstream reach and the high number of California roach and sculpin captured in both reaches in Year 3 suggest that the fish passage improvements do provide passage and rearing habitat for native fish, likely including *O. mykiss*, and that Project goals regarding these improvements continue to be met.

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List of Preparers

Sharon Kramer, Ph.D., Principal Fish Ecologist
Max Busnardo, M.S., Principal Restoration Ecologist
Pete Nelson, Ph.D., Senior Fish Ecologist, Project Manager
Ken Lindke, M.S., Fish Ecologist
Neil Kalson, B.S., Fish Ecologist

Section 1.0 Introduction

1.1 Project Purpose

The Alum Rock Park Fish Passage Improvement Project (Project) was implemented by the Santa Clara Valley Transportation Authority (VTA) to improve fish passage for native resident and anadromous fishes in Upper Penitencia Creek, a tributary to Coyote Creek. Upper Penitencia Creek provides some of the most important spawning and rearing habitat in the Coyote Creek watershed for the federally threatened Central California Coast steelhead (CCC steelhead) (*Oncorhynchus mykiss*) distinct population segment (Leidy et al. 2005). Upper Penitencia Creek is also designated as critical habitat for CCC steelhead (NMFS 2005). This report describes fish survey results from Year 3 post-construction monitoring surveys and briefly summarizes monitoring results from Years 1 and 2. It is the third of five reports required as part of the Project's long-term post-construction monitoring.

1.2 Background

Fish passage in the Project reach was improved by modifying a 4.5-foot-high concrete weir. The crest of the weir was lowered to the level of the normal pool surface and a 225-foot-long roughened channel was constructed to improve passage for *O. mykiss* and other native fishes (Figures 1 and 2). Post-construction monitoring is required to "assess the biological performance of the fish passage improvement Project and evaluate the ability of the site to pass steelhead" (NMFS 2012). To meet this goal, a 5-year fisheries monitoring plan was developed by H. T. Harvey & Associates (HTH), approved by the National Marine Fisheries Service, and implemented beginning in September 2013 (HTH 2013a, 2014). The plan involves conducting electrofishing surveys and habitat typing to document the fish species and habitat associations in the Project reach. During monitoring, fish ecologists document all the fish species encountered while focusing on CCC steelhead. Both CCC steelhead and resident rainbow trout have been documented in Upper Penitencia Creek, including upstream of the Project reach (Leidy et al. 2005, Leicester 2011, Leicester and Smith 2012, Leicester and Smith 2013a, Leicester and Smith 2013b, Leicester and Smith 2014, Leicester and Smith 2015, HTH 2013b). Because *O. mykiss* may adopt anadromous or resident life history strategies, all anadromous steelhead and resident rainbow trout observed during surveys are referred to as *O. mykiss* in this report. Other Project monitoring components performed by other firms and not summarized in this report include vegetation monitoring and streambed hydrological monitoring, all of which, when combined, will improve understanding of the evolving habitat conditions and species use in the restored channel.

Figure 1. Concrete Weir before Modification, August 8, 2012 (Looking Upstream)

Figure 2. Modified Concrete Weir, October 15, 2015 (Looking Upstream)

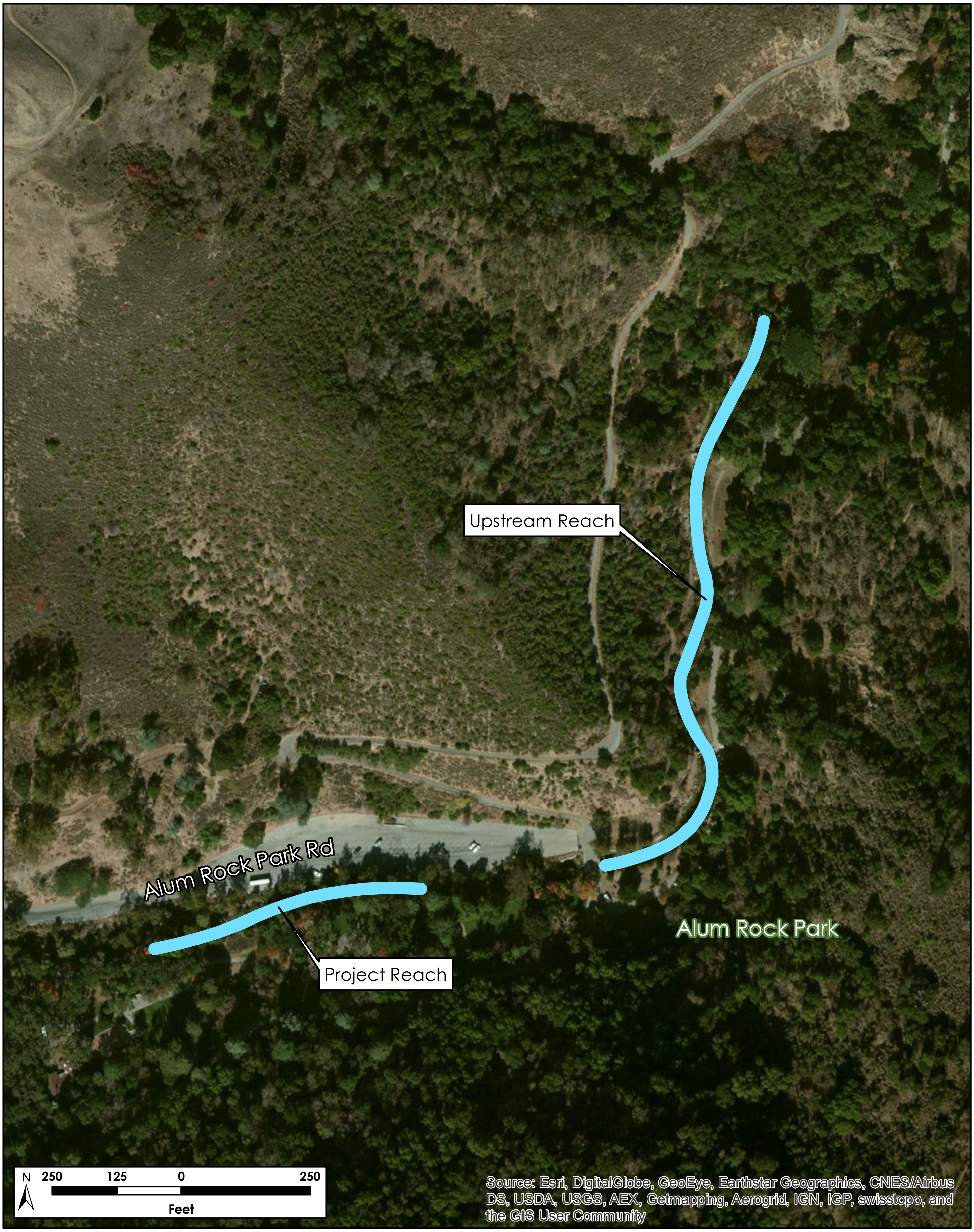
Section 2.0 Methods

2.1 Survey Reach Identification

HTH fish ecologists identified survey reaches in coordination with California Department of Fish and Wildlife (CDFW) regional biologists to avoid duplicating reaches electrofished during annual CDFW surveys. Survey reaches contain individual habitat units concentrated in two areas: the Project reach and a reference reach referred to as the Upstream reach. Habitat units were defined primarily by hydrological and geological features, such as pools, riffles, boulders, and bedrock that characterize the physical environment for fishes and are separable by abrupt changes in depth, flow, or slope. Habitat units were categorized using the Level III (identifies riffle and pool types, e.g., "low gradient riffle") and Level IV (includes subcategories based on cause of formation, e.g., "scour pool—boulder formed") habitat types described in the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 2010). Level IV habitat types are the most descriptive in the classification hierarchy. Each habitat description reflects the cause of formation, channel gradient velocity, depth, and particle size in each unit. For the purpose of describing apparent trends in fish habitat association in this report, such as when describing whether fish(es) were found in functionally equivalent units such as main channel pools versus scour pools, Level III habitat types were used.

The Project reach is approximately 400 feet long and contains all habitat units in the installed roughened channel and additional contiguous habitat units immediately upstream of the limits of construction (Figure 3). During both spring and fall Year 3 surveys, HTH fish ecologists surveyed 17 contiguous habitat units in the Project reach. All habitat units in the Project reach were categorized by habitat type, measured, and electrofished. The Upstream reach is approximately 1,200 feet long. In the Upstream reach (spring and fall), HTH fish ecologists surveyed 10 non-contiguous habitat units spread throughout the reach; these units were categorized by habitat type, measured, and electrofished. The combined length of the 10 habitat units electrofished in the Upstream reach was approximately 200 feet for the Year 3 spring survey and 300 feet for the Year 3 fall survey. The units in the Upstream reach were located between the Alum Rock Falls Road bridge in Alum Rock Park (37.396944; -121.798121) and the Sycamore Grove picnic area in Alum Rock Park (37.400026, -121.796802) (Figure 3).

The number, type, and combined length of the habitat units may vary depending on the units chosen for survey, ambient flow, and changes to the stream channel. Changes in the number and type of habitat units surveyed in different years are attributable primarily to natural fluvial processes and the ambient flow. To minimize variability in descriptions of the habitat units, the same HTH fish ecologist was tasked with describing the units in both reaches.



N:\Projects3500\3518-01\02\Reports\November 2015\Fig 3 Survey Reach Map_Revision.mxd

H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 3: Survey Reach Map
Alum Rock Park Fish Passage Improvement Project
November 2015

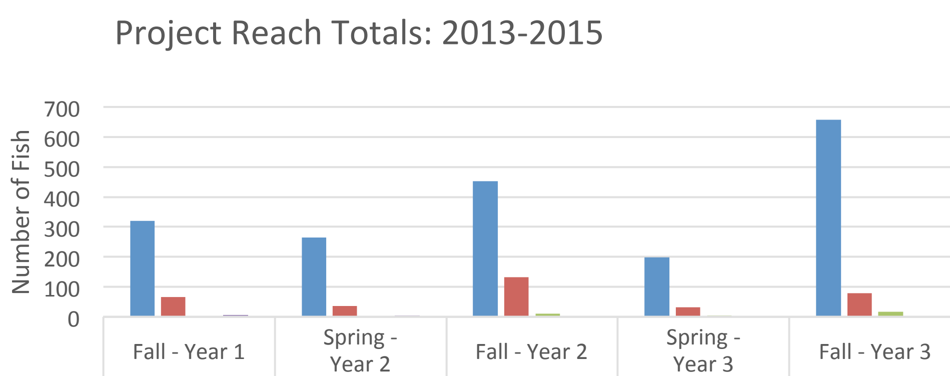
2.2 Electrofishing

Each unit was electrofished, using a single-pass approach (Flosi et al. 2010), once in spring and once in fall, to document fish-habitat associations. Year 3 spring electrofishing surveys were conducted on May 13, 2015; fall electrofishing surveys were conducted on November 15 and 16, 2015. HTH fish ecologists conducted the electrofishing surveys using a Smith-Root LR-24 backpack electrofishing unit, following National Marine Fisheries Service (2000) guidelines. Ambient conductivity and temperature were measured to generate power correction factors to serve as starting points for determining safe and effective electrofishing settings (Appendix A, Table A-1). HTH fish ecologists also followed CDFW techniques (Leicester pers. comm. 2012) developed specifically for electrofishing in the high-conductivity waters found in portions of Upper Penitencia Creek. Final electrofishing unit settings were determined by observing the threshold response behavior of target species. Electrofishing surveys were suspended when measured water temperatures reached 18 °C (Appendix A, Table A-1).

Before electrofishing, HTH fish ecologists isolated target units from other units by using block seines or natural features, such as falls or dams, or by using a combination of both. Fish captured during electrofishing were placed in a plastic bucket containing cool, clean, shaded, aerated stream water. The first 20 fish of each species captured were identified, weighed and measured (total length [TL]), and returned to the unit from which they were captured. The remaining fish were identified, tallied, and released to the unit from which they were captured. All *O. mykiss* captured were examined for features associated with smoltification (e.g., silver color, faded parr marks), which would indicate that the fish were preparing to emigrate and that they were the anadromous, rather than resident, form of *O. mykiss*.

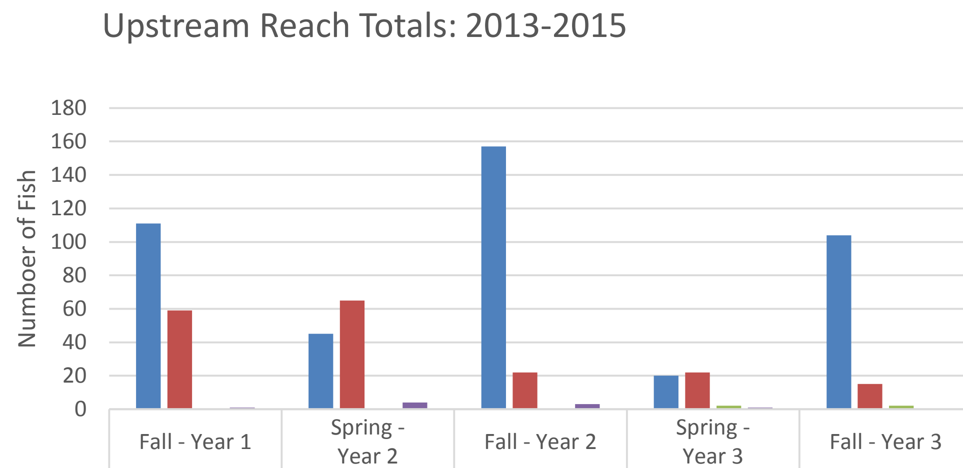
Section 3.0 Electrofishing Survey Results

The fish community documented during Year 3 surveys was composed of four native species: California roach (*Hesperoleucus symetricus*), riffle sculpin (*Cottus gulosus*), Sacramento sucker (*Catostomus occidentalis*), and *O.mykiss*. In total, 281 fishes were captured during spring, and 872 fishes were captured during fall (Figure 4 and 5). California roach were the most abundant by far, followed by riffle sculpin. Both species were found in the Project reach and Upstream reach in nearly all the habitat types surveyed (Table 1, Appendix A [Tables A-2, A-3]). Sacramento suckers were scarce but more abundant in the Project reach. One *O. mykiss* was captured in the Upstream Reach during the spring.



	Fall - Year 1	Spring - Year 2	Fall - Year 2	Spring - Year 3	Fall - Year 3
California Roach	321	265	453	199	657
Riffle Sculpin	66	37	133	31	78
Sacramento sucker	1	3	10	4	16
Oncorhynchus mykiss	6	4	2	0	0

Figure 4. Project Reach Fish Totals: 2013–2015



	Fall - Year 1	Spring - Year 2	Fall - Year 2	Spring - Year 3	Fall - Year 3
California Roach	111	45	157	20	104
Riffle Sculpin	59	65	22	22	15
Sacramento sucker	0	0	0	2	2
Oncorhynchus mykiss	1	4	3	1	0

Figure 5. Upstream Reach Totals: 2013–2015

The species captured in Year 3 were the same as those captured in Years 1 and 2. During the first 3 years of monitoring, in the Project reach, all four species were captured most often in pool habitat types (Figures 6–9), which were the most common habitat types identified in the Project reach (Table 1, Appendix A [Table A-2]). In the Upstream reach, electrofishing was targeted toward pool habitat that would most likely contain *O. mykiss*. As a result, during the first 3 years of monitoring, nearly all fishes in the Upstream reach were captured in pool habitat types.

Table 1. Species Distribution in the Project Reach and the Upstream Reach—Spring and Fall 2015

	Habitat Type (Level IV)		California Roach		Unidentified *Cottus spp.*		Sacramento Sucker		Steelhead		Subtotal	
Unit	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring Subtotal**	**Fall Subtotal**
Project Reach												
Y3-PR Unit 1	Boulder Formed Pool	Bedrock Formed Pool	15	47	2	2					17	49
Y3-PR Unit 2	Run	Low Gradient Riffle	12		4						16	0
Y3-PR Unit 3	Pocket Water	Boulder Formed Pool	18	42	3	4					21	46
Y3-PR Unit 4	Trench Pool	Boulder Formed Pool	13	47	1	4					14	51
Y3-PR Unit 5	Pocket Water	Plunge Pool	9	6	2	8					11	14
Y3-PR Unit 6	Boulder Formed Pool	Mid Channel Pool	27	28	4	4	6				37	32
Y3-PR Unit 7	Pocket Water	Low Gradient Riffle	23	25	4	3					27	28
Y3-PR Unit 8	Mid Channel Pool	Boulder Formed Pool	1	16		5					1	21
Y3-PR Unit 9	Pocket Water	Plunge Pool	14	37	1	4					15	41
Y3-PR Unit 10	Mid Channel Pool	Pocket Water	1	49		11					1	60
Y3-PR Unit 11	Pocket Water	Mid Channel Pool	8	20	1						9	20
Y3-PR Unit 12	Plunge Pool	Pocket Water	3	89	5	7		3			8	99
Y3-PR Unit 13	Mid Channel Pool	Mid Channel Pool	44	52	2	3		3			46	58
Y3-PR Unit 14	Pocket Water	Plunge Pool	11	42		1		1			11	44
Y3-PR Unit 15	Low Gradient Riffle	Mid Channel Pool		48		11		4			0	63
Y3-PR Unit 16	Mid Channel Pool	Pocket Water		20	2	1		3			2	24
Y3-PR Unit 17	Low Gradient Riffle	Low Gradient Riffle		89		10		2			0	101
		Project Reach Subtotal	*199*	*657*	*31*	*78*	*6*	*16*	*0*	*0*	*236*	*751*

	Habitat Type (Level IV)		California Roach		Unidentified *Cottus spp.*		Sacramento Sucker		Steelhead		Subtotal	
Unit	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring Subtotal**	**Fall Subtotal**
Upstream Reach												
Y3-UR Unit 1	Mid Channel Pool	Run	4		1						5	0
Y3-UR Unit 2	Mid Channel Pool	Trench Pool		57			2	2			2	59
Y3-UR Unit 3	Bedrock Formed Pool	Bedrock Formed Pool	12	1	1						13	1
Y3-UR Unit 4	Bedrock Formed Pool	Bedrock Formed Pool	4	12	1						5	12
Y3-UR Unit 5	Bedrock Formed Pool	Low Gradient Riffle		27	2	4					2	31
Y3-UR Unit 6	Mid Channel Pool	Dammed Pool			6	1					6	1
Y3-UR Unit 7	Bedrock Formed Pool	Boulder Formed Pool		5	4	4					4	9
Y3-UR Unit 8	Boulder Formed Pool	Pocket Water		1		1			1		1	2
Y3-UR Unit 9	Dammed Pool	Boulder Formed Pool		1	7	2					7	3
Y3-UR Unit 10	Pocket Water	Low Gradient Riffle				3					0	3
		Upper Reach Subtotal	*20*	*104*	*22*	*15*	*2*	*2*	*1*	*0*	*45*	*121*
		Total	*219*	*761*	*53*	*93*	*8*	*18*	*1*	*0*	*281*	*872*

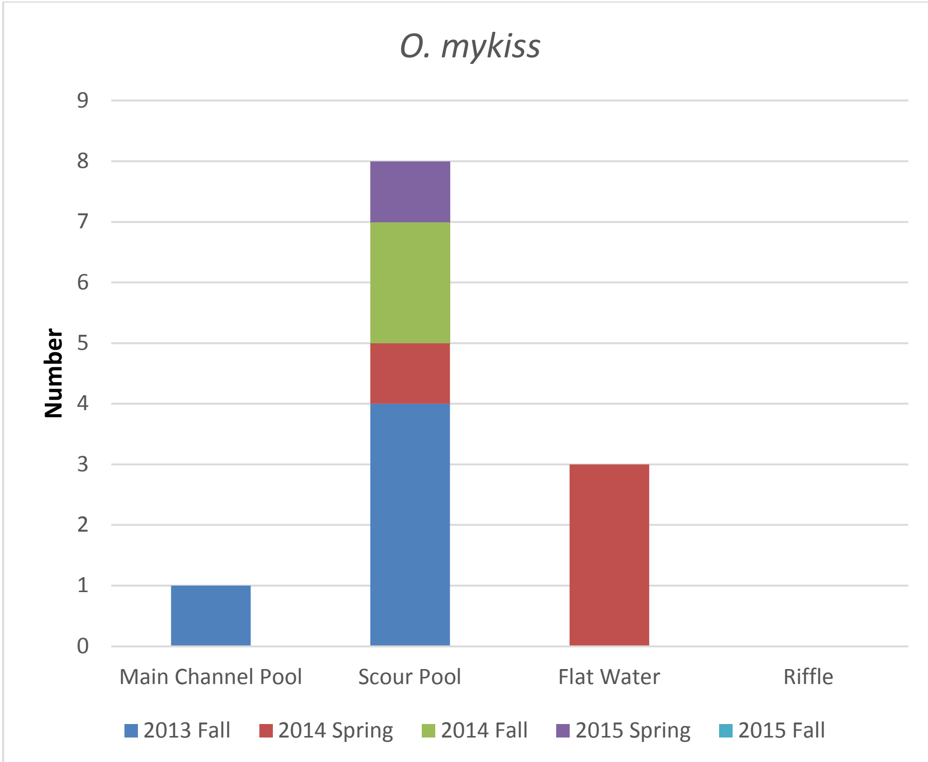


Figure 6. Habitat Associations of *O. mykiss* in the Project Reach, 2013–2015 (no 2013 Spring surveys)

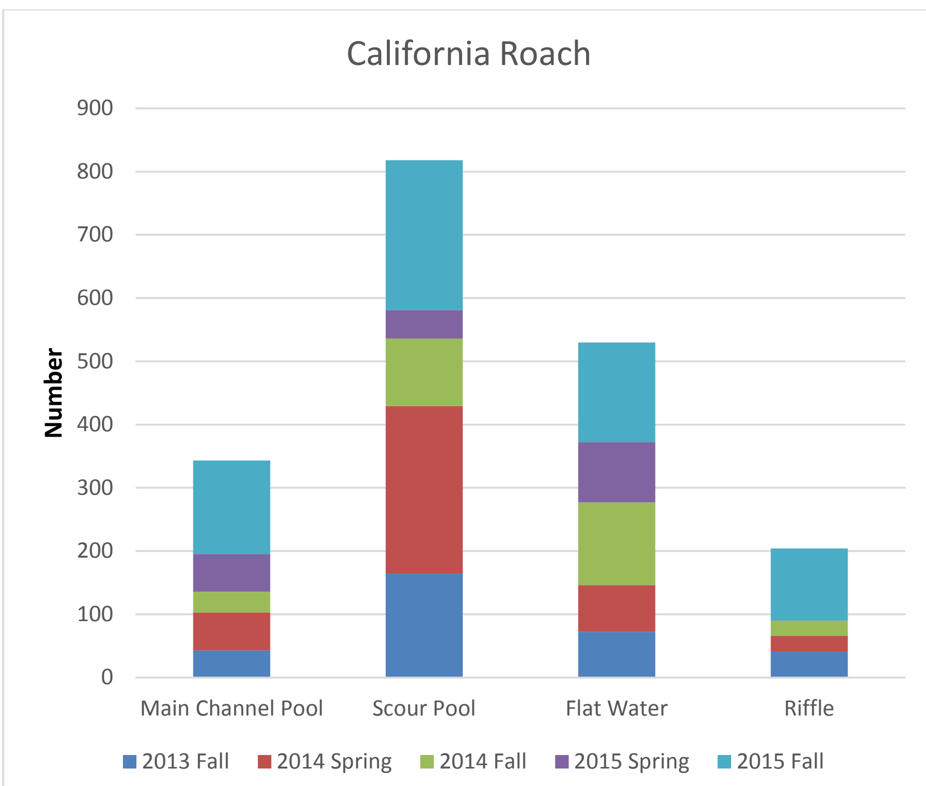


Figure 7. Habitat Associations of California Roach in the Project Reach, 2013–2015 (no 2013 Spring surveys)

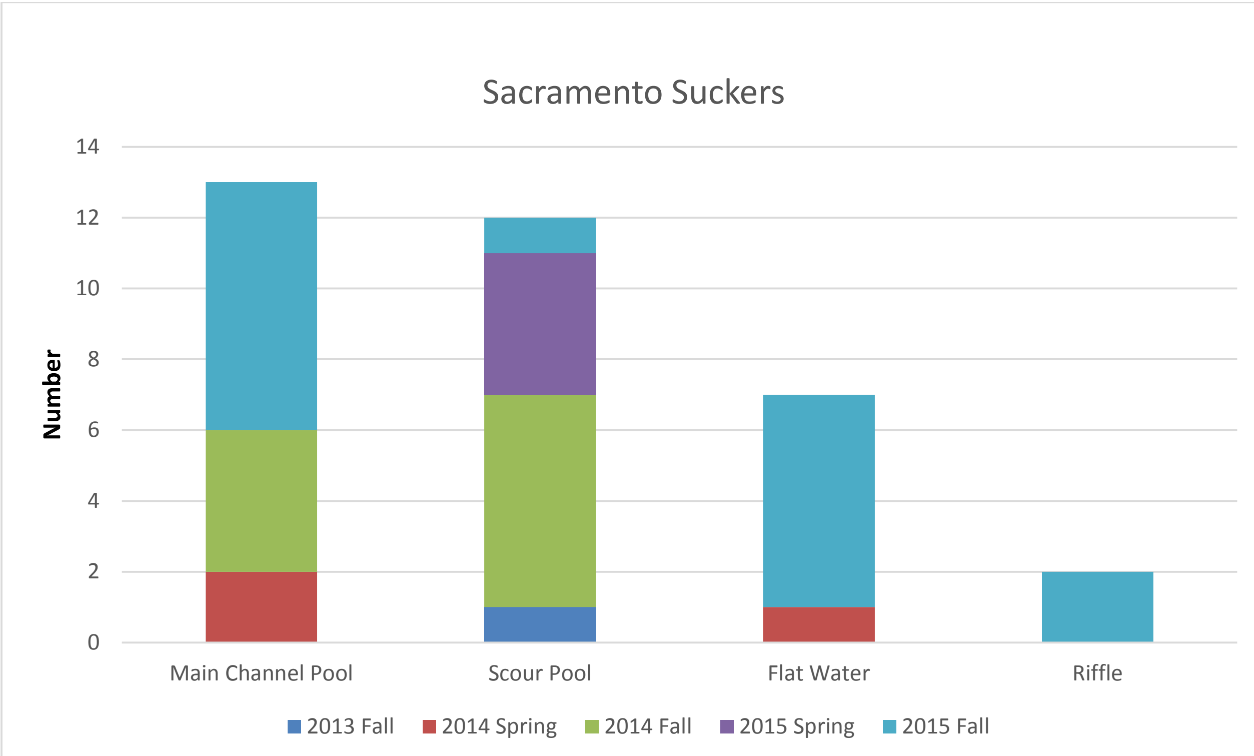


Figure 8. Habitat Associations of Sacramento Suckers in the Project Reach, 2013–2015 (no 2013 Spring surveys)

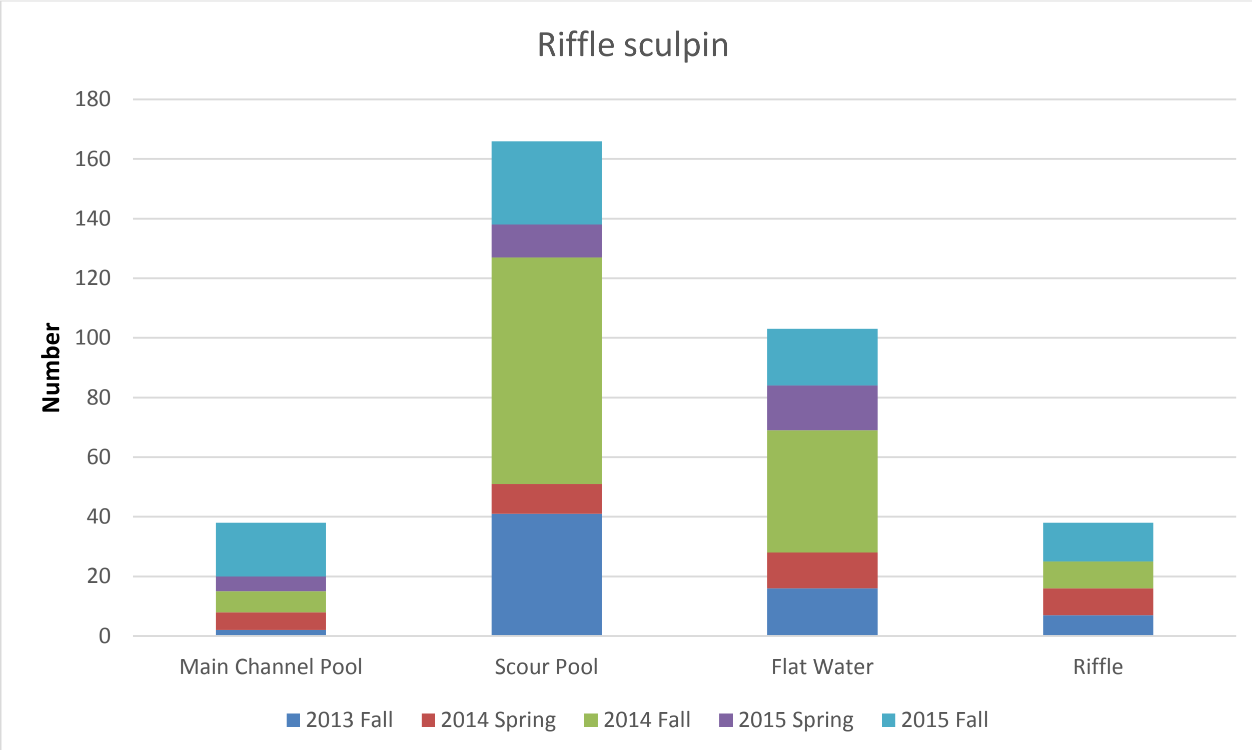


Figure 9. Habitat Associations of Riffle Sculpin in the Project Reach, 2013–2015 (no 2013 Spring surveys)

As in previous years following fish passage improvement work, *O. mykiss* were scarce (see Discussion [section 4.0]). Only one *O. mykiss* (172 millimeters [mm], 64.5 gram) was captured during the spring survey (Upstream reach, Unit 8, lateral scour, boulder-formed pool), and no *O. mykiss* were captured or observed in fall 2015. The Project and Upstream reaches consisted primarily of small pool habitat units (Table 1, Appendix A [Table A-4]) with some flatwater and riffle habitat units.

In the Year 3 spring surveys, there were 0.0 *O. mykiss* per 100 feet of surveyed habitat in the Project reach and 0.4 *O. mykiss* per 100 feet of surveyed habitat in the Upstream reach. In the Year 3 fall surveys, there were 0.0 *O. mykiss* per 100 linear feet in the Project reach and in the Upstream reach (Table 2). The single *O. mykiss* captured during Year 3 surveys displayed the distinct parr marks typical of resident rainbow trout and juvenile *O. mykiss* and did not display features associated with smolting steelhead (e.g., silver coloration, faded parr marks).

Table 2. Density of *O. mykiss* in Upper Penitencia Creek

Location	Survey Year	Survey Date	Length of Survey Reach (feet)	*O. mykiss* Density (number of fish per 100 linear feet)	Surveyor
ARFPIP—Project reach	2015	November 15 and 16	420	0.0	HTH

Location	Survey Year	Survey Date	Length of Survey Reach (feet)	*O. mykiss* Density (number of fish per 100 linear feet)	Surveyor
ARFPIP—Upstream reach	2015	November 15 and 16	250	0.0	HTH
ARFPIP—Project reach	2015	May 13	470	0.0	HTH
ARFPIP— Upstream reach	2015	May 13	230	0.4	HTH
Upstream of King Road	2015	NA	NA	Dry	CDFW
Above and Below Mabury Road	2015	NA	NA	Dry	CDFW
Downstream of Hwy 680	2015	NA	NA	Dry	CDFW
Downstream of Wildlife Center	2015	NA	NA	Dry	CDFW
Downstream of Upper Percolation Ponds	2015	NA	NA	Dry	CDFW
Dorel Drive	2015	NA	NA	Dry	CDFW
1st Bridge in Alum Rock Park	2015	14 November	190	0.0	CDFW
Eagle Rock Picnic Area	2015	14 November	211	0.0	CDFW
Visitor Center in Alum Rock Park	2015	12 November	NA	Present: Observed from bank	CDFW
Upstream of YSI Weir in Alum Rock Park	2015	14 November	259	0.0	CDFW
Trail Halfway from Upper Vehicle Bridge to the Arroy Grande Confluence	2015	NA	NA	Dry	CDFW
ARFPIP—Project reach	2014	November 4	440	0.5	HTH
ARFPIP— Upstream reach	2014	November 5	310	1.0	HTH
ARFPIP—Project reach	2014	May 1	450	0.9	HTH
ARFPIP— Upstream reach	2014	May 1	320	1.25	HTH
Upstream of King Road	2014	NA	NA	Dry	CDFW
Above and Below Mabury Road	2014	NA	NA	Dry	CDFW
Downstream of Hwy 680	2014	NA	NA	Dry	CDFW
Downstream of Wildlife Center	2014	NA	NA	Dry	CDFW
Downstream of Upper Percolation Ponds	2014	NA	NA	Dry	CDFW
Dorel Drive	2014	NA	NA	Dry	CDFW
1st Bridge in Alum Rock Park	2014	28 September	190	0.0	CDFW
Eagle Rock Picnic Area	2014	28 September	211	0.0	CDFW
Visitor Center in Alum Rock Park	2014	28 September	190	0.0	CDFW
Upstream of YSI Weir in Alum Rock Park	2014	28 September	259	0.4	CDFW
Trail Halfway from Upper Vehicle Bridge to the Arroyo Grande Confluence	2014	NA	NA	Dry	CDFW
ARFPIP—Project reach	2013	September 16	384	1.6	HTH
ARFPIP— Upstream reach	2013	September 17	185	0.5	HTH
Upper Penitencia Creek Floodplain Restoration Project	2013	September 18	484	1.0	HTH

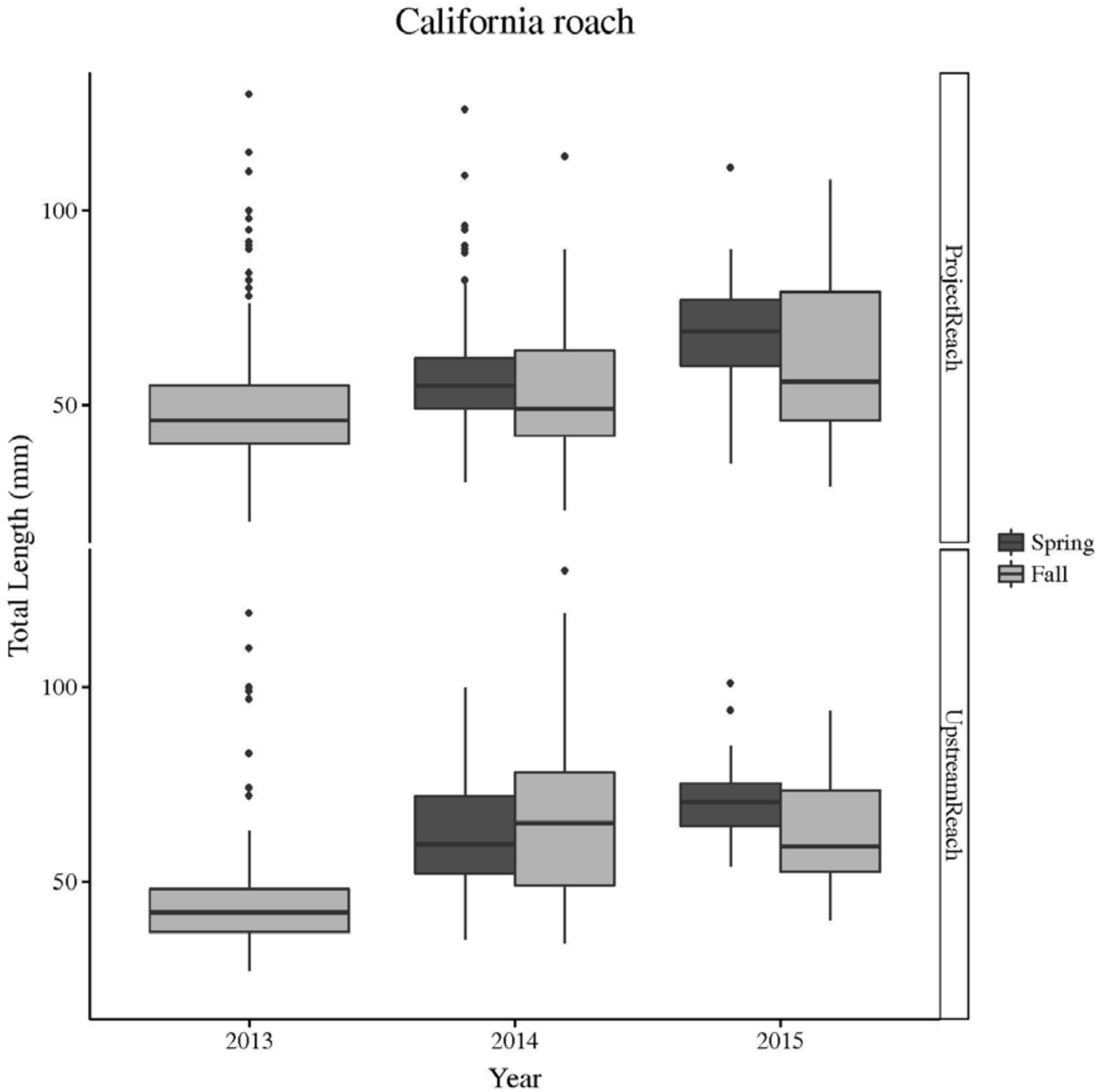
Location	Survey Year	Survey Date	Length of Survey Reach (feet)	*O. mykiss* Density (number of fish per 100 linear feet)	Surveyor
Upstream of King Road	2013	7 October	285	0.4	CDFW
Downstream of Hwy 680	2013	30 August	305	0.0	CDFW
Downstream of Upper Percolation Ponds	2013	30 August	301	0.0	CDFW
1st Bridge in Alum Rock Park	2013	30 August/27 September	218	1.8	CDFW
Eagle Rock Picnic Area	2013	27 September	212	0.9	CDFW
Upstream of YSI Weir in Alum Rock Park	2013	30 August	259	1.2	CDFW
Trail Halfway from Upper Vehicle Bridge to the Arroyo Grande Confluence	2013	27 August	234	10.3	CDFW
Downstream of Hwy 680	2012	16 August	343	1.2	CDFW
Downstream of Wildlife Center	2012	7 October	565	0.5	CDFW
Downstream of Upper Percolation Ponds	2012	16 August	336	0.0	CDFW
Dorel Drive	2012	7 October	55	3.6	CDFW
1st Bridge in Alum Rock Park	2012	5 October	190	2.1	CDFW
Eagle Rock Picnic Area	2012	16 August	188	4.3	CDFW
Visitor Center in Alum Rock Park	2012	5 October	230	3.5	CDFW
Upstream of YSI Weir in Alum Rock Park	2012	5 October	204	4.5	CDFW
Trail Halfway from Upper Vehicle Bridge to the Arroyo Grande Confluence	2012	12 October	348	27.8	CDFW
Trail halfway from upper vehicle bridge to the Arroyo Aguague confluence	2011	December 31	278	13.0	CDFW
Upstream of YSI weir—Alum Rock Park	2011	August 14	258	0.4	CDFW
Visitor center—Alum Rock Park	2011	October 22	308	2.3	CDFW
Eagle Rock Picnic Area—Alum Rock Park	2011	October 22	208	3.4	CDFW
First bridge in Alum Rock Park	2011	August 14	210	2.9	CDFW
Dorel Drive	2011	September 19	235	0.8	CDFW
Downstream of percolation pond outfall	2011	August 14	358	0.0	CDFW
Downstream of wildlife center	2011	September 19	457	0.0	CDFW
Downstream of Interstate 680	2011	August 14	309	0.0	CDFW
Upstream of YSI bridge—Alum Rock Park	2010	August 31	288	0.7	CDFW
Eagle Rock Picnic Area—Alum Rock Park	2010	October 19	215	7.1	CDFW
Near first bridge in Alum Rock Park	2010	August 31	437	4.1	CDFW

Location	Survey Year	Survey Date	Length of Survey Reach (feet)	*O. mykiss* Density (number of fish per 100 linear feet)	Surveyor
Upstream of percolation ponds at Dorel Road	2010	August 30	120	0.0	CDFW
Downstream of percolation pond outflow	2010	August 31	314	4.1	CDFW
Downstream of percolation pond outflow	2010	October 19	354	1.4	CDFW
Piedmont Road	2010	October 19	315	0.3	CDFW
Upstream of Capitol Avenue; downstream of wildlife center	2010	August 30	338	0.0	CDFW
Downstream of Interstate 680	2010	August 30	298	0.0	CDFW

Notes: CDFW = California Department of Fish and Wildlife; HTH = H. T. Harvey & Associates; YSI = Youth Science Institute; ARFPIP = Alum Rock Fish Passage Improvement Project

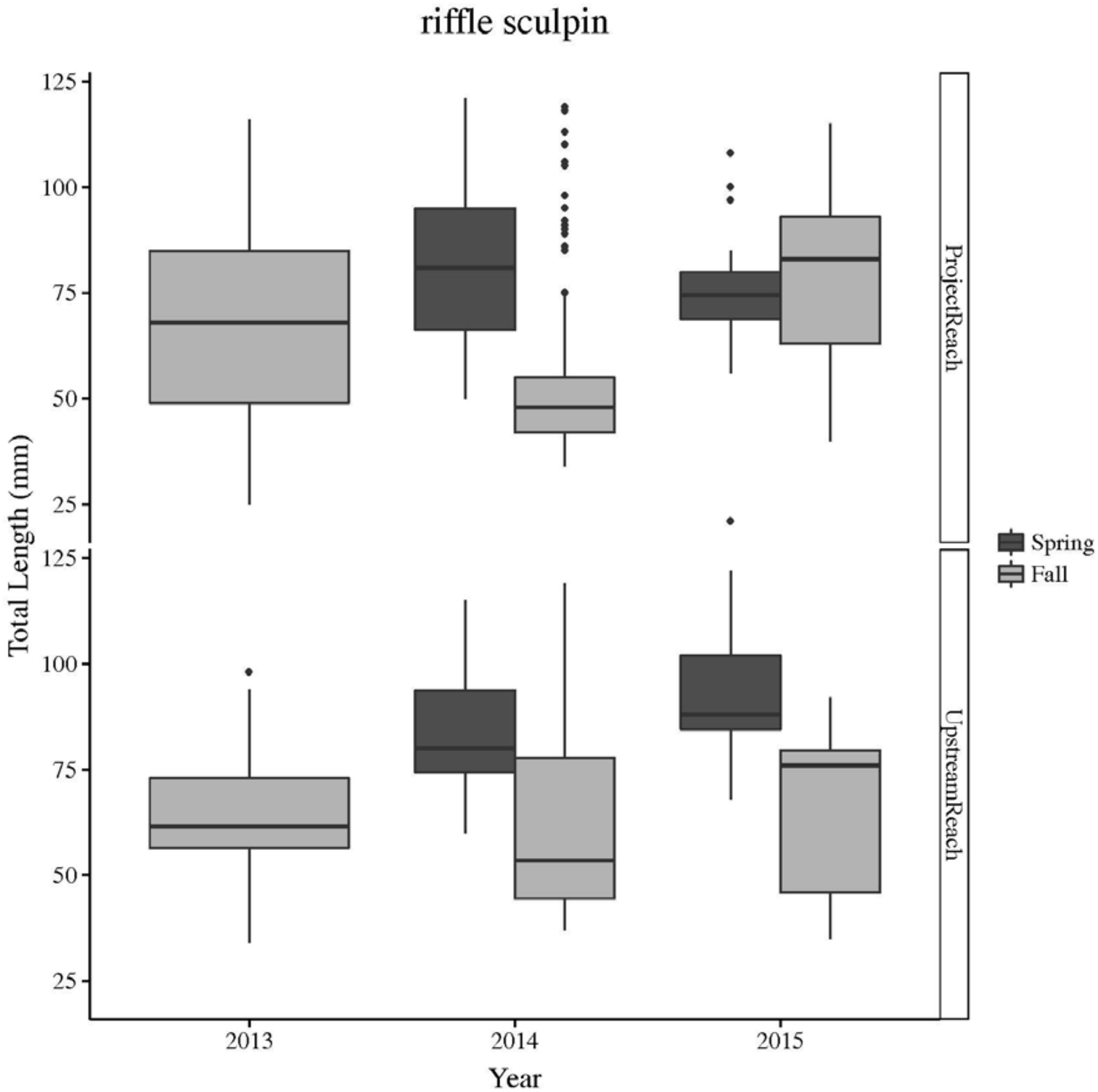
CDFW Data: Leicester 2011, Leicester and Smith 2012, Leicester and Smith 2013a, Leicester and Smith 2013b, Leicester and Smith 2014, Leicester and Smith 2015

Mean lengths for California roach captured in spring and fall were roughly comparable (Figure 10). Riffle sculpin within the Upstream reach were generally larger (greater total length) in spring than in fall (Figure 11). Only 24 Sacramento suckers were captured during Year 3 sampling efforts; they ranged from 10 mm to 99 mm, with a mean length of 35.5-mm.



Note: Box and whisker plots of total length for California roach captured by electrofishing in Alum Rock Park from fall 2013 through fall 2015. Horizontal bars indicate median total length, upper and lower ends of boxes indicate 25th and 75th quartiles, whiskers extend to ±1.5 times the interquartile range, and points indicate outliers.

Figure 10. Box Plot of Mean Lengths for California Roach



Note: Box and whisker plots of total length for riffle sculpin captured by electrofishing in Alum Rock Park from fall 2013 through fall 2015. Horizontal bars indicate median total length, upper and lower ends of boxes indicate 25th and 75th quartiles, whiskers extend to ±1.5 times the interquartile range, and points indicate outliers.

Figure 11. Box Plot of Mean Lengths for Riffle Sculpin

Section 4.0 Discussion

The fish species documented in surveyed reaches were comparable to the species documented in surveys from other reaches in Upper Penitencia Creek (Leicester 2011, Leicester and Smith 2012). In the past, eight native fish species have been documented in different reaches of the Upper Penitencia Creek watershed including: *O. mykiss*, Pacific lamprey (*Entosphenus tridentatus*), California roach, hitch (*Hesperoleucus exilicauda*), Sacramento blackfish (*Orthodon microlepidotus*), Sacramento sucker, prickly sculpin (*Cottus asper*), and riffle sculpin (Buchan et al. 1999, as cited in Stillwater Sciences 2006; Santa Clara Valley Water District 2008). However, these species occupy different habitats in the watershed and are not found in all reaches of Upper Penitencia Creek. Pacific lamprey, hitch, prickly sculpin, and Sacramento blackfish were not observed in the survey reaches during 2015 monitoring (see [section 4.2]).

We observed a large difference between the number of fishes captured in spring and fall in both Year 2 and 3. Although it is possible that there were more fishes present in fall, our surveys are designed to document the presence and relative abundance of fishes in the Project versus Upstream reaches, and across habitat types within a given season. Therefore, the large difference in the number of California roach and riffle sculpin captured may not reflect the true number of fishes present and may be the result of different capture efficiencies associated with environmental conditions.

A greater number of fishes were captured in pools relative to other habitat types. However, the abundance of fish captured in midchannel pool habitat and scour pool habitat reflects the abundance of these habitat types rather than habitat preference. In addition, it is easier to capture fish in pools during electrofishing because the water is deeper and there are typically fewer obstructions to netting fish.

4.1 Native Species Detected

4.1.1 California Central Coast Steelhead

In winter 2014–2015, there was at least one (December 11-12, 2015 – 350 cubic feet per second) streamflow event that probably provided continuous streamflow from Alum Rock Park to Coyote Creek (HTH and Balance Hydrologics 2015). However, it is unknown if continuous streamflow occurred at other times in water year 2015 or if streamflow events were sufficiently long in duration and volume to provide for steelhead passage upstream. There were no reports of adult steelhead in the Coyote Creek watershed in winter 2014–2015 (Leicester pers. comm. 2014). Surveys conducted before the restoration of the Project reach documented the occurrence of *O. mykiss* upstream of the Project reach (Leicester 2011, Leicester and Smith 2012), but since 2011, the density (i.e., number of fish per 100 feet) of *O. mykiss* in the survey reaches has been low, and Year 3 surveys were no exception (Table 2). Poor stream connectivity (i.e., low and intermittent flow) during successive years of drought conditions could affect upstream migration of adults and juveniles, and downstream migration of smolts. Leicester (2011) documented poor *O. mykiss* reproductive success in Upper Penitencia Creek between

2009 and 2011. Fish passage also was impeded by a slide near the upstream end of the Upstream reach that completely blocked the channel in spring and partially blocked the channel in fall (Figure 12). Park staff removed the large branches (date unknown) in the slide due to concerns regarding flooding; sediment from the slide was still present, but flow was continuous over the remnants of the landslide dam as of October 16, 2015. Although we captured one *O. mykiss* upstream of the slide, *O. mykiss* of all age classes may have been prevented from migrating past the slide at least in spring.

O. mykiss captured by HTH in Year 3 had markings indicating that they were likely resident rainbow trout rather than steelhead. We did not observe *O. mykiss* smolts (steelhead) in the Project reach or Upstream reach. If *O. mykiss* smolts had been observed in the Upstream reach, the observation would have suggested that successful steelhead spawning migrations occurred. However, resident *O. mykiss* can produce offspring that become anadromous, making it difficult to determine if juveniles are offspring of the anadromous or resident form (Courter et al. 2013). Although we captured only one *O. mykiss* during Year 3 surveys, greater numbers may be present. During drought conditions, *O. mykiss* may seek refuge in deep pools inaccessible to electrofishing.

Figure 12. Landslide Dam in Upstream Reach

4.1.2 Riffle Sculpin

Riffle sculpin and prickly sculpin occupy similar habitats, and these two sculpin species are difficult to differentiate because their physical characteristics are similar. Riffle sculpin also may hybridize with prickly sculpin, further complicating positive identification, especially in small individuals (Moyle 2002). CDFW reports that riffle sculpin occur in Alum Rock Park (i.e., Project and Upstream reaches) and that prickly sculpin occur in low-elevation reaches downstream of the park (Leicester pers. comm. 2014). We found no clear indication that both species of sculpin were captured during Year 3 surveys and have assumed, based on CDFW reports, that all sculpin captured were riffle sculpin. The riffle sculpin size distribution may be skewed toward smaller individuals because larger riffle sculpin often were not observed exhibiting electrotaxis (fish swimming induced by an electric current) and when shocked they remained on the channel bottom, where they were more difficult to capture. Nonetheless, the presence of riffle sculpin in survey reaches indicates relatively healthy habitat conditions for steelhead because riffle sculpin require cold, highly oxygenated water (Moyle 2002).

4.1.3 Sacramento Sucker

Before the weir modification, Sacramento suckers were abundant in pools and glides below the unmodified grade control weir (HTH 2013b). Leicester and Smith (2012) reported that no Sacramento suckers had ever been captured in Upper Penitencia Creek above this barrier. Following the modifications to the weir as part of the Project restoration, Sacramento suckers have been able to move into reaches upstream of the weir, although they were less abundant than in the Project reach.

4.1.4 California Roach

California roach were the most abundant species in both the Project reach and the Upstream reach and were captured in nearly every habitat unit surveyed during 2015 monitoring. In both reaches, the mean length of California roach captured in Year 3 was greater than in Year 1, and the size distribution contained a wider range of lengths. Aquatic vegetation may have covered a greater portion of the channel during drought conditions (Years 2 and 3), thereby offering greater refuge to small fish during electrofishing and thereby skewing the size distribution toward larger fish in Years 2 and 3. The abundance and wide distribution of California roach during surveys probably were attributable to the ability of California roach to tolerate a variety of water quality conditions and to the low numbers of predatory fishes in the Project and Upstream reaches.

4.2 Absent Species

Several fish species that had been documented previously in the Upper Penitencia Creek watershed and that could distribute into the Project reach, were not observed during monitoring in Year 1 through Year 3: Pacific lamprey, hitch, and Sacramento blackfish.

4.2.1 Pacific Lamprey

As discussed above, past surveys (Leicester 2011, Leicester and Smith 2012) documented lamprey in the low-elevation reaches of Upper Penitencia Creek. Leicester and Smith (2012) indicate that adult or juvenile lamprey have not been reported above the percolation ponds in 35 years. We did not observe lamprey during the Year 3 surveys. Intermittent flow and barriers in Upper Penitencia Creek, including a concrete barrier in the Upstream reach (Figure 13), may create unsuitable conditions for lamprey migration, spawning, and rearing.

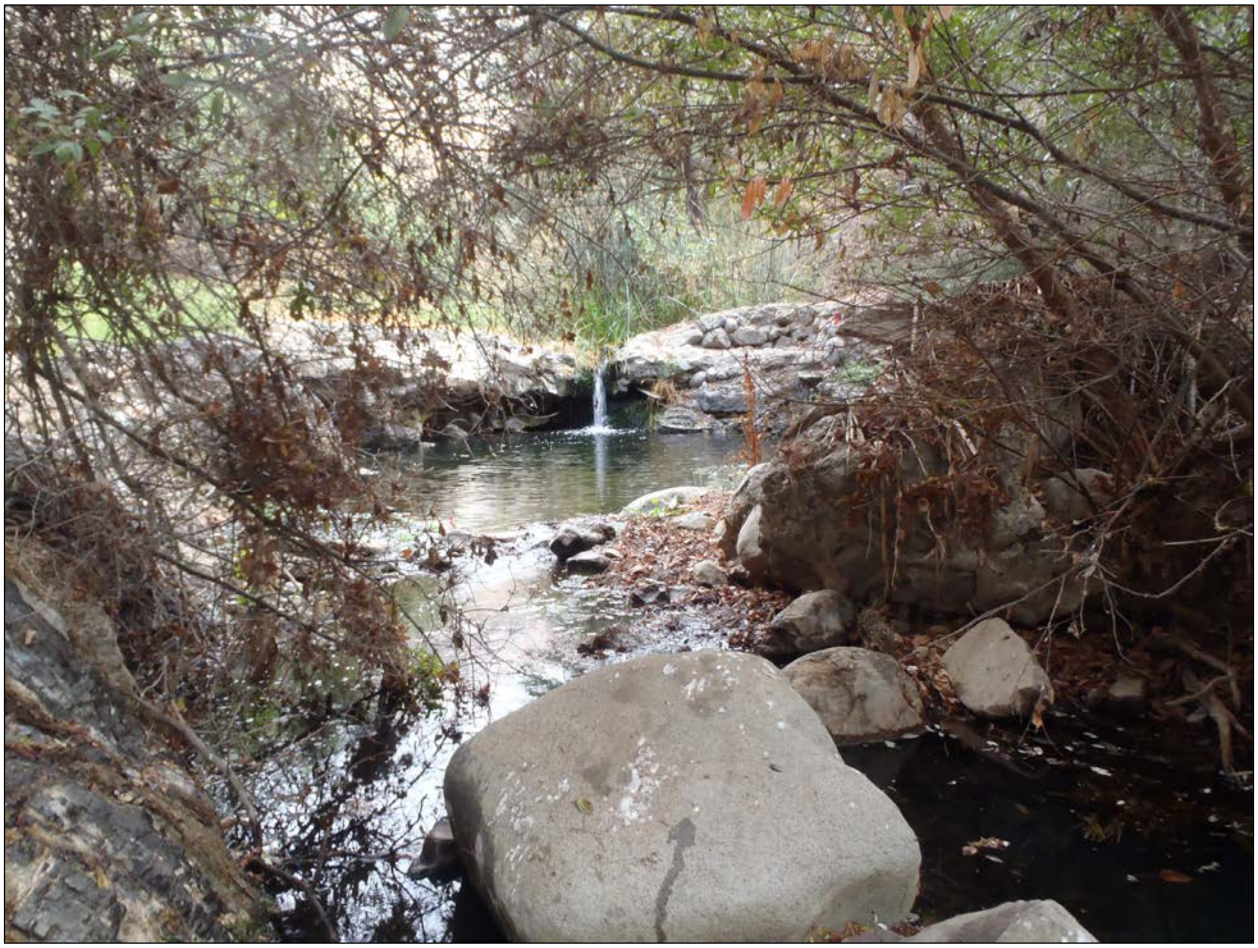


Figure 13. Concrete Barrier in Upstream Reach

4.2.2 Hitch

Although no hitch were captured during Year 3 surveys, hitch are native to Coyote Creek, where they may hybridize with California roach (Moyle 2002). Hitch are typically found in low-gradient, low-elevation streams in quiet water (Moyle 2002), which may explain their absence from the relatively high-gradient reaches present in Alum Rock Park.

4.2.3 Sacramento Blackfish

No Sacramento blackfish were captured during the Year 3 surveys. However, the past occurrence of Sacramento blackfish in Upper Penitencia Creek may have been the result of a temporary introduction from the South Bay Aqueduct (Abel pers. comm. 2005, as cited in Stillwater Sciences 2006.

Section 5.0 Conclusions

The results of the Year 3 surveys indicate that native fishes, including *O. mykiss* and, possibly, CCC steelhead, inhabit the Project reach and the Upstream reach. However, the density (i.e., number of fish per 100 feet) of *O. mykiss* in Upper Penitencia Creek has been low since 2011, which is likely attributable to drought conditions during this timeframe. Although fish passage issues still exist in reaches upstream and downstream of the Project reach, with the ease of access gained through the modification of the concrete weir, native fishes of all life stages can now migrate more easily through the Project reach to upstream habitat when flow conditions allow. Year 3 survey results are consistent with previous monitoring results indicating that Project goals regarding fish passage improvements continue to be met.

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Appendix A. Fish Habitat Summaries

Table A-1. Water Quality and Electrofishing Settings

Date	Time	Temperature (°C)	Ambient Conductivity (uS)	Waveform	Frequency (Hz)	Voltage	Duty Cycle (%)
13 May 2015	0815	14.6	2030	PDC	30	150	25
13 May 2015	1340	17.5	410	PDC	30	150	25
15 Oct 2015	0815	17.3	2766	PDC	30	150	25
15 Oct 2015*	1345	20.0	2806	PDC	30	150	25
16 Oct 2015	0830	16.8	2675	PDC	30	150	25
16 Oct 2015*	1125	18.0	398	PDC	30	150	25

*Electrofishing surveys were suspended due to water temperature

Table A-2. Number of Fish by Species in Level III Habitat Types in the Project Reach

Level III Habitat Type	Year	Season	Number of Units	California Roach	Riffle Sculpin	Sacramento Sucker	*O. mykiss*
Main channel pool	2013	Fall	2	43	2	0	1
	2014	Spring	5	60	6	2	0
		Fall	1	33	7	4	0
	2015	Spring	5	59	5	0	0
		Fall	4	148	18	7	0
Scour pool	2013	Fall	11	164	41	1	4
	2014	Spring	6	107	10	0	1
		Fall	10	265	76	6	2
	2015	Spring	3	45	11	4	0
		Fall	7	237	28	1	0
Flatwater	2013	Fall	5	72	16	0	0
	2014	Spring	7	74	12	1	3
		Fall	5	131	41	0	0
	2015	Spring	7	95	15	0	0
		Fall	3	158	19	6	0
Riffle	2013	Fall	3	42	7	0	1
	2014	Spring	2	24	9	0	0
		Fall	3	24	9	0	0
	2015	Spring	2	0	0	0	0
		Fall	3	114	13	2	0

Table A-3. Number of Fish by Species in Level III Habitat Types in the Upstream Reach

Habitat Type	Year	Season	Number of Units	California Roach	Riffle Sculpin	Sacramento Sucker	*O. mykiss*
Main channel pool	2013	Fall	NA	NA	NA	NA	NA
	2014	Spring	NA	NA	NA	NA	NA
		Fall	2	11	10	0	0
	2015	Spring	3	4	7	2	0
		Fall	1	57	0	2	0
Scour pool	2013	Fall	6	74	31	0	1
	2014	Spring	5	37	17	0	3
		Fall	5	120	8	0	3
	2015	Spring	5	16	8	0	1
		Fall	4	19	6	0	0
Flatwater	2013	Fall	2	16	17	0	0
	2014	Spring	5	8	48	0	1
		Fall	3	26	4	0	0
	2015	Spring	1	0	0	0	0
		Fall	2	1	1	0	0
Riffle	2013	Fall	2	21	11	0	0
	2014	Spring	NA	NA	NA	NA	NA
		Fall	NA	NA	NA	NA	NA
	2015	Spring	NA	NA	NA	NA	NA
		Fall	2	27	7	0	0
Backwater pool	2013	Fall	NA	NA	NA	NA	NA
	2014	Spring	NA	NA	NA	NA	NA
		Fall	NA	NA	NA	NA	NA
	2015	Spring	1	0	7	0	0
		Fall	1	0	1	0	0

Note: NA = not available because this habitat type was not present or was not surveyed in the season shown.

Table A-4. Average Pool Depth and Area, 2015

Season	Reach	Average Pool Depth (meters)	Average Pool Area (meters)
Spring	Project reach	0.37	16.23
Spring	Upstream reach	0.4	14.28
Fall	Project reach	0.36	17.97
Fall	Upstream reach	0.46	11.83