H. T. HARVEY & ASSOCIATES

Ecological Consultants

Wrigley Creek Improvement Project
Milpitas, California

Year 5 (2015) Monitoring Report

Project #2995-04

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September 2015

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Executive Summary

Permit Numbers

The following permits apply to the Wrigley Creek Improvement Project:

- U. S. Army Corps of Engineers Section 404 Permit File No. 26644S
- California Department of Fish & Game Streambed Alteration Notification No.1600-2008-0266-3
- Regional Water Quality Control Board Site No. 02-43-C0589

Background

The Santa Clara Valley Transportation Authority's (VTA) Freight Railroad Relocation/Lower Berryessa Creek (FRR/LBC) project is located within the Union Pacific Railroad (UPRR) corridor from the UPRR Milpitas yard, just south of Calaveras Boulevard in Milpitas, to an unnamed creek in Fremont (designated as Line B by the Alameda County Flood Control and Water Conservation District). The project includes track relocation and construction, modifications to roadway crossings, drainage improvements, and culvert replacement and/or extension where the rail line crosses Line B, Scott Creek, Calera Creek, Berryessa Creek, and Wrigley Creek. The project's Mitigation and Monitoring Plan (MMP) describes FRR/LBC project related impacts, which include 0.48 acre (ac) of permanent impacts to wetlands, 288 linear feet (ln ft) of permanent impacts to other State and Federal waters, and permanent removal of approximately 100 Congdon's tarplant (*Centromadia parryi* ssp. *congdonii*) individuals (ICF Jones & Stokes 2009). All FRR/LBC impacts are mitigated within the Wrigley Creek Improvement Project site, which was completed in February 2011 and included the installation of a total of 1.04 ac of seasonal floodplain wetlands, 1.96 ac of riparian woodland habitat, 1985 ln ft of channel (including channel meanders and backwater alcoves) and seeding of 0.23 ac with Congdon's tarplant (H. T. Harvey & Associates 2011).

The MMP includes native grassland percent cover performance criteria and a final success criterion, although the project did not impact native grassland habitat. Following Year 1 (2011) monitoring, a memorandum was produced that describes changes to the original native grassland percent cover success criterion (H. T. Harvey & Associates 2012a). Specifically, it broadens the interpretation of native grasses to include all native grasses and forbs both naturally recruiting as well as those species included in the original native seed mix installed at the site. Prior to Year 5 monitoring, H. T. Harvey & Associates and VTA met with representatives from CDFW at the site on 29 April 2015 to further discuss the native grassland percent cover success criterion. Following this meeting, the locations of some of the grassland monitoring transects were modified to better represent the current distribution of herbaceous vegetation cover at the site because of the maturation of planted and naturally recruited native woody vegetation (H. T. Harvey & Associates 2015).

Results

The table below presents the Year 5 (2015) monitoring results relative to the project's Year 5 final success criteria. The survival rate of woody plants in good or fair condition was 73%, exceeding the 70% criterion. The site had 44.6% cover of native grassland species, which is above the Year 5 cover criterion of 35% cover. The percent cover of native grassland species on the site is substantially higher than is typically found in local grassland habitats.

The final success criterion for Congdon's tarplant was met in Year 3. Nonetheless, Congdon's tarplant monitoring was conducted in Years 4 and 5 to provide additional information on population dynamics at the site. Two Hundred and Fifty Five (255) Congdon's tarplant individuals were tallied in Year 5, exceeding the minimum 100 individuals. Greater than 100 Congdon's tarplant individuals have been observed in 4 of the 5 monitoring years meeting the MMP's final success criterion of a minimum of 100 individuals in at least 2 of the 5 monitoring years. Hydrologic and geomorphic observations indicate the constructed channel and floodplain are stable. These results indicate that the site has met all of its long-term success criteria.

The project hydrologist estimated that floodplain surface soils were continuously inundated or saturated for at least 40 days between 29 November 2014 and 3 January 2015. This exceeds the minimum requirement of 31 days of continuous inundation or saturation. Due to drought conditions and the flashy hydrology of the drainage, the project hydrologist had few opportunities to observe flow on the floodplain and was not able to make flow measurements in Year 5. However, water level/depth observations from Year 5 continue to support prior observations of backwatering of the channel. It appears that the source of this backwatering is flow modification caused by normal operations of the City of Milpitas Wrigley-Ford Creek pump station located approximately 4500 feet downstream of the project site. During storm events, water likely accumulates within the channel until the station pumps flows into Berryessa Creek. Regardless of this backwatering, the mitigation project is establishing well and sedimentation rates on the floodplain are minimal.

Wrigley Creek Improvement Project Habitat Mitigation Performance and Success Criteria Summary

Indicator	Year 5 Success Criteria	Year 1 Success Criteria Met?	Year 2 Success Criteria Met?	Year 3 Success Criteria Met?	Year 4 Success Criteria Met?	Year 5 Success Criteria Met?	Management Recommendations
Woody Plant Percent Survival	70% in good or fair condition	Yes (97% survival in good or fair condition)	Yes (92% survival in good or fair condition)	Yes (84% survival in good or fair condition)	Yes (81% survival in good or fair condition)	Yes (73% survival in good or fair condition)	None-Final Success Criterion met
Native Grass Average Percent Cover	35% cover of native herbaceous species	No (35% cover of native herbaceous species)	No (21.5% cover of native herbaceous species)	No (16.1% cover of native herbaceous species)	No (23.2% cover of native herbaceous species)	Yes (44.6% cover of native herbaceous species)	None-Final Success Criterion met
Congdon's Tarplant Survival	Final Success Criterion ≥ 100 individuals in ≥2 monitoring years	Yes (5600 individuals)	No (6 individuals)	Yes (150-250 individuals)	Yes (105 individuals)	Yes (255 individuals)	None-Final Success Criterion met
Hydrology and Geomorphology	Stable channel; continuous floodplain soil saturation for 12.5% of growing season (31 days)	Yes (stable channel; at least 31 days continuous saturation)	Yes (stable channel; 39 days continuous saturation)	Yes (stable channel; 81 days continuous saturation)	Yes (stable channel; 68 days continuous saturation)	Yes (stable channel, 40 days continuous saturation)	None-Final Success Criterion met

Management Recommendations

The site has met all of its final success criteria. Upon agency approval that the success criteria have been met and that maintenance may cease, we recommend that the above ground elements of the irrigation system be removed and any below ground elements be cut and capped. We have no further vegetation maintenance recommendations for the Wrigley Creek Improvement Project.

Agency Actions

The VTA requests sign-off from the U. S. Army Corps of Engineers, California Department of Fish and Wildlife, and Regional Water Quality Control Board that the project's final success criteria have been met and that maintenance, monitoring, and reporting may cease.

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List of Preparers

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Section 1.0 Introduction

1.1 Permit Numbers

The following permits apply to the Wrigley Creek Improvement Project:

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- California Department of Fish & Game Streambed Alteration Notification No.1600-2008-0266-3
- Regional Water Quality Control Board Site No. 02-43-C0589

1.2 Overview

The Santa Clara Valley Transportation Authority's (VTA) Freight Railroad Relocation/Lower Berryessa Creek Project (FRR/LBC) is located within the Union Pacific Railroad (UPRR) corridor from the UPRR Milpitas yard, just south of Calaveras Boulevard in Milpitas, to an unnamed creek in Fremont (designated as Line B by the Alameda County Flood Control and Water Conservation District) (Figure 1). The project includes track relocation and construction, modifications to roadway crossings, drainage improvements, and culvert replacement and/or extension where the rail line crosses Line B, Scott Creek, Calera Creek, Berryessa Creek, and Wrigley Creek. The FRR/LBC project resulted in 0.48 acre (ac) of permanent impacts to wetlands, 288 linear feet (ln ft) of permanent impacts to other State and Federal waters, and permanent removal of approximately 100 Congdon's tarplant (*Centromadia parryi* ssp. *congdonii*) individuals (ICF Jones & Stokes 2009).

All FRR/LBC impacts are mitigated within the Wrigley Creek Improvement Project (mitigation project) in accordance with the project's regulatory agency permits and associated Mitigation and Monitoring Plan (MMP) (ICF Jones & Stokes 2009). The Wrigley Creek Improvement Project site is located within the larger FRR/LBC project area, on a reach of Wrigley Creek between Yosemite Drive and Calaveras Boulevard in Milpitas, California (Figure 1). Construction of the Wrigley Creek Improvement Project began in August 2010 and was completed in February 2011. The mitigation project included the construction of 1.04 ac of seasonal floodplain wetlands, 1.96 ac of riparian woodland habitat, 1985 ln ft of channel (including channel meanders and backwater alcoves), and seeding of 0.23 ac with Congdon's tarplant. The project meets the habitat mitigation requirements in the regulatory agency permits and includes an additional 60 ln ft of channel restoration and 0.04 ac of floodplain wetland habitat (H. T. Harvey & Associates 2011).

The MMP includes quantifiable performance and final success criteria and calls for a minimum 5-year monitoring period (Years 1-5). Results of quantitative annual monitoring of the mitigation site are used to determine if the project has met the MMP's performance and final success criteria. This report presents the results of Year 5 monitoring. These results are compared to the MMP's final success criteria to determine whether the restored riparian ecosystem is likely to eventually achieve the long-term habitat mitigation goals with little chance of failure.

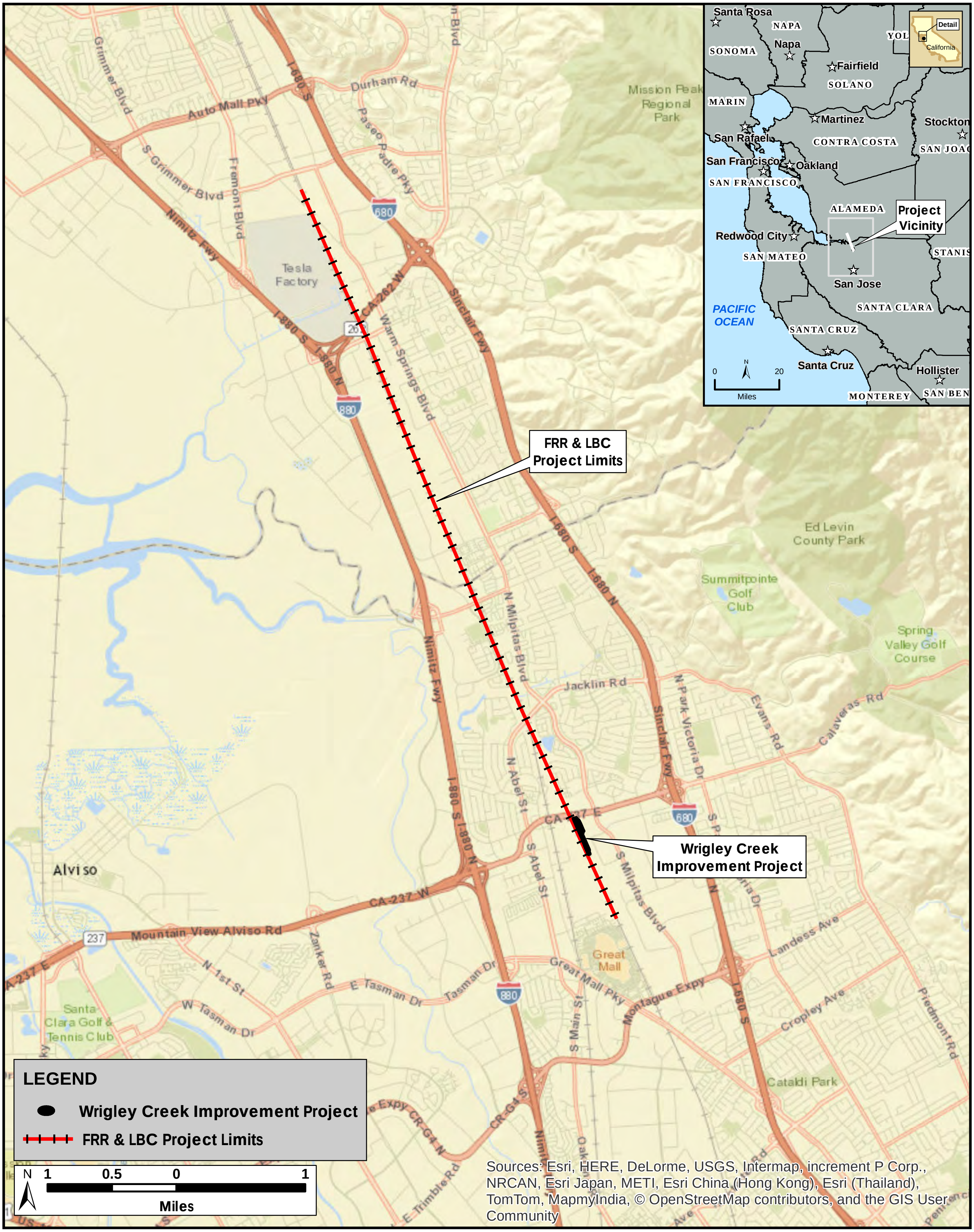

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Figure 1: Vicinity Map
Wrigley Creek Improvement Project (2995-04)
September 2015

Section 2.0 Methods

H. T. Harvey & Associates' restoration ecologists Will Spangler, B.A., Kaitlin Schott, M.S., and Patrick Furtado, M.S., conducted vegetation surveys at the Wrigley Creek mitigation site on 6 May 2015 and 2 July 2015. Vegetation surveys were conducted in accordance with the methods outlined in the MMP (ICF Jones & Stokes 2009). Vegetation characteristics measured in the field included woody plant survival, percent cover of native grassland species, Congdon's tarplant abundance, woody plant health and vigor, and woody plant natural recruitment. In addition, vegetation maintenance observations were noted and photographs were taken from fixed locations to document habitat establishment. The following is a description of the methods employed during these field surveys and the methods used to analyze the data. The methods employed by Balance Hydrologics, Inc. to assess on-site hydrology and geomorphology and detailed results of their assessment are provided in Appendix A. The VTA's landscape contractor, Confluence, performed vegetation maintenance activities in 2015.

2.1 Vegetation Maintenance Monitoring

The VTA's landscape contractor (Confluence Restoration) performed vegetation maintenance activities in 2015. H. T. Harvey & Associates restoration ecologists conducted two site visits in 2015 to inspect vegetation maintenance work and also reviewed Confluence Restoration's maintenance logs. A summary of vegetation maintenance work is provided in the below results section.

2.2 Woody Plant Survival

Plant survivorship was determined on 2 July 2015 by counting 100% of the installed woody plants. The total number of living and dead individuals of each planted species was counted in the field. The percent survival of individuals in good or fair condition was calculated and the percent survival for each species was calculated as follows:

Percent Survival Species A = (Total Number Alive in Good or Fair Condition in 2014/Total Number Required per the MMP) * 100

The success criterion for woody plant survival in Year 5 is 70% in good or fair condition. The methods for assessing the condition of the woody plantings are described in the Plant Health and Vigor section below.

2.3 Percent Cover of Native Grassland Species

Native grassland species percent cover was estimated on 6 May 2015 by conducting a survey along nine transects (ICF Jones & Stokes 2009; H. T. Harvey & Associates 2012a). During the course of the 5 year monitoring period, the increasing shade cast by maturing native woody vegetation altered the distribution of herbaceous vegetation. Therefore, prior to Year 5 monitoring, the locations of eight of the grassland monitoring transects were modified to better represent the current distribution of herbaceous vegetation cover at the site (H. T. Harvey & Associates 2015). One transect was located in the Congdon's Tarplant Mitigation Area and eight transects were located throughout the Floodplain Planting Zone, Streamside Planting Zone, and the Upland Planting Zone (Figures 2-1 & 2-2). Each transect is 100 feet in length and endpoints of each transect were mapped using GPS. Percent cover of herbaceous species was estimated using the quadrat method (Bonham 1989). Cover data were collected in five randomly located 1 m^2 quadrats along each of the nine transects. Within each quadrat, all species were identified and percent cover was estimated to the nearest 1 percent. Plant species were identified in accordance with the Jepson Manual (Baldwin et al. 2012). Average percent cover was calculated for each species, native species, nonnative species, and total average cover of all species. Sample size was determined adequate (H. T. Harvey & Associates 2012b) by graphing the cumulative average percent native grass cover as a function of sample size to determine whether the variability in average cover declined to an acceptable level (Elzinga et al. 1998).

The average percent cover of native grasses and forbs in 2015 was compared to results from previous years and the Year 5 performance criterion of 35% cover (ICF Jones & Stokes 2009).

2.4 Congdon's Tarplant Survival

The abundance of Congdon's tarplant was determined by surveying the entire site and counting each live individual encountered. The survey was conducted on 2 July 2015 during the flowering period for this species. The performance criterion for survival of Congdon's tarplant is a minimum of 100 individuals in 2 of 5 years (ICF Jones & Stokes 2009).

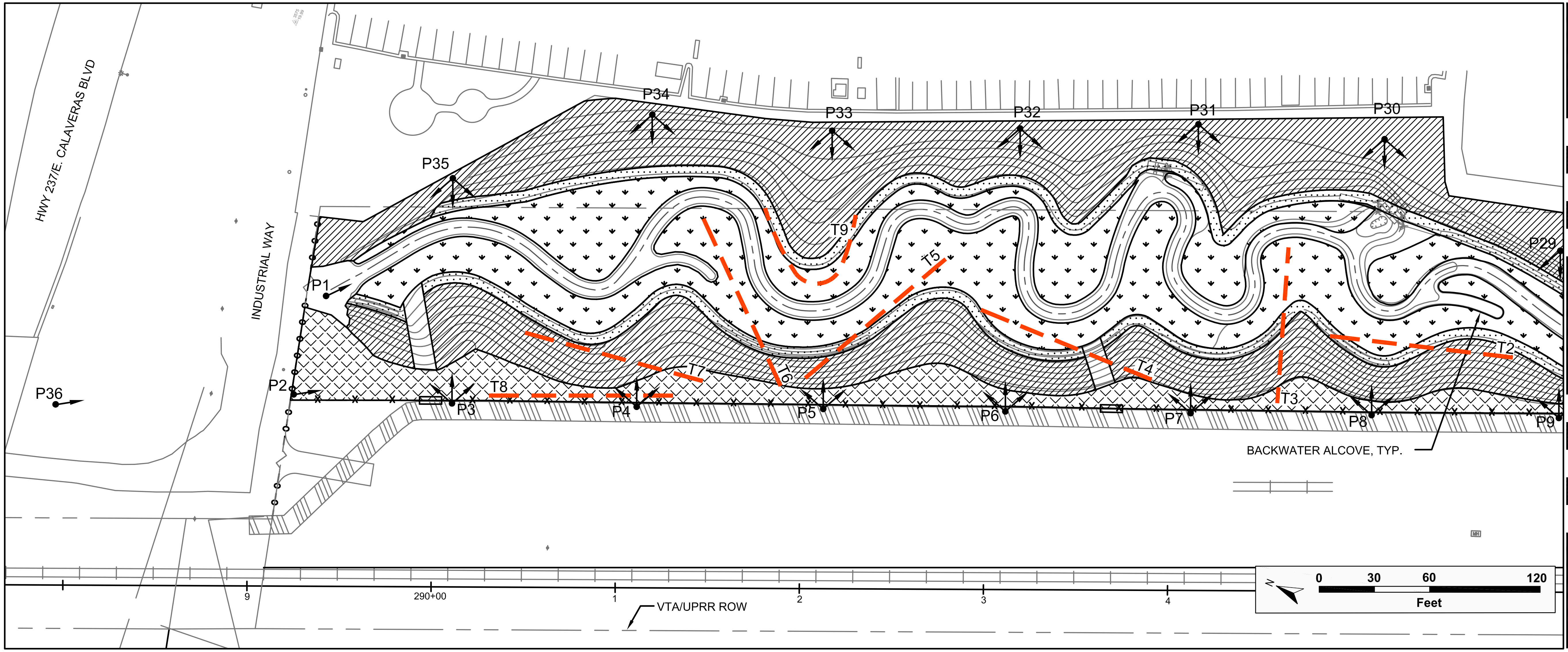
2.5 Woody Plant Health and Vigor

The health and vigor of all of the woody plantings was assessed on 2 July 2015 by considering such factors as internode length, leaf color, leaf size, presence of browse damage, disease symptoms, and insect infestation. Numerical health and vigor ratings were assigned to each woody planting as described in Table 1.

Mean health and vigor ratings were calculated for each planted woody species by dividing the total health and vigor points by the number of living individuals of that species sampled. The percentage of individuals who fall into the three general health and vigor categories was calculated by dividing the number of individuals within each category by the total number of living individuals.

Table 1. Plant Health and Vigor Categories

Categories	Numerical Values	Observations
Good Condition	1	Plant has relatively long internode lengths and most or all leaves show healthy color and size, and/or <25% of plant's aboveground growth is affected by browse damage, disease, or insect infestation.
Fair Condition	2	Plant has medium to long internode lengths and most leaves show healthy color and size, and/or 25-50% of plant's aboveground growth is affected by browse damage, disease, or insect infestation.
Poor Condition	3	Plant has short internode lengths and few or some leaves show healthy color and size, and/or >75% of plant's aboveground growth is affected by browse damage, disease, or insect infestation.



Legend

FLOODPLAIN PLANTING ZONE	PHOTO DOCUMENTATION POINT (P1)
STREAMSIDE PLANTING ZONE	SPLIT RAIL FENCE
UPLAND PLANTING ZONE	SPLIT RAIL GATE
CONGDON'S TARPLANT MITIGATION AREA	CHAIN LINK FENCE
CHEVRON PIPELINE PROTECTION ZONE (NO PLANTING)	CHANNEL CENTERLINE
BIOENGINEERED OUTFALL STRUCTURE	TRANSECT LOCATION (T1)

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Figure 2-1: Site Map

Wrigley Creek Improvement Project (2995-04)
September 2015

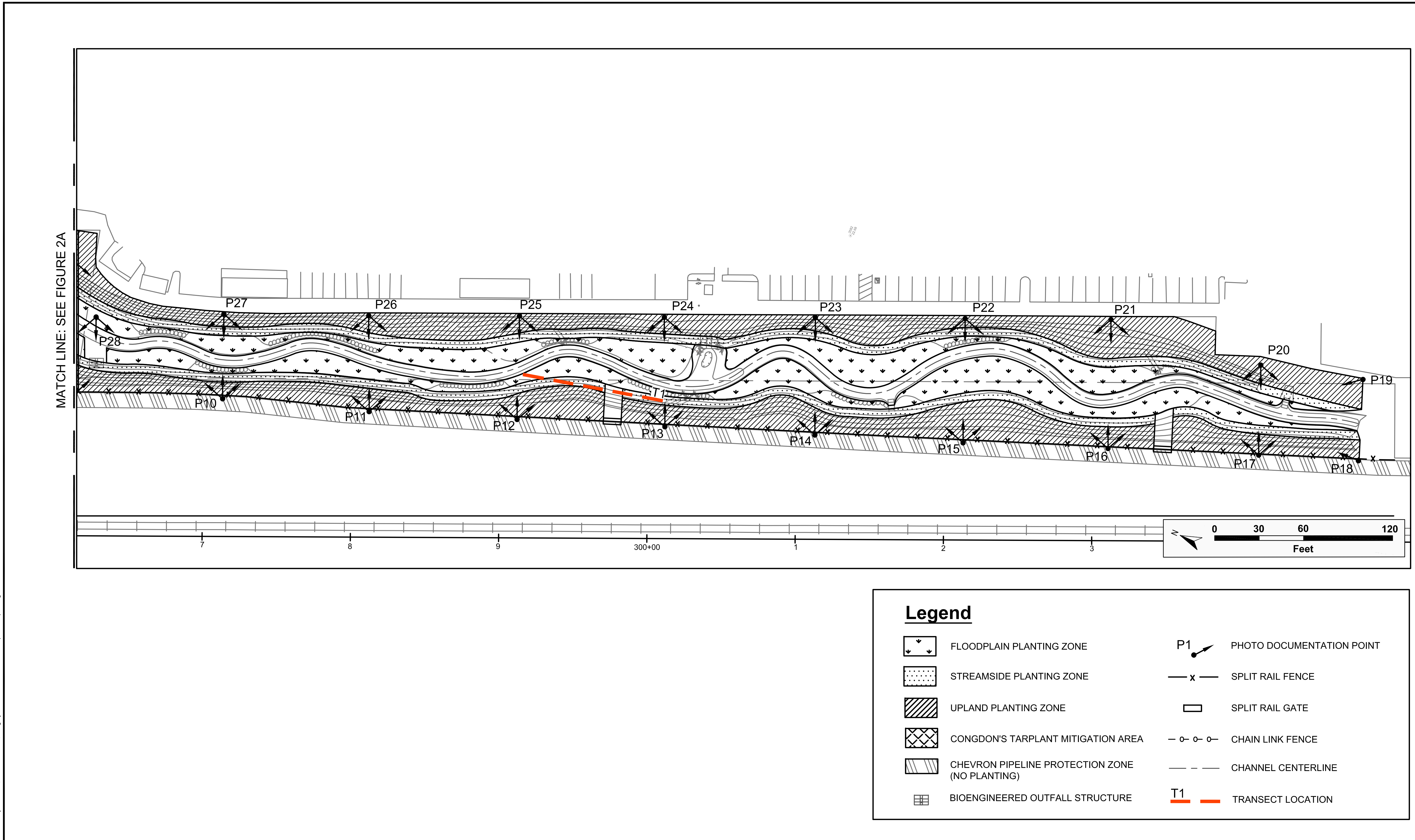

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Figure 2-2: Site Map

Wrigley Creek Improvement Project (2995-04)
September 2015

2.6 Natural Recruitment

The number of stems of naturally recruiting native and nonnative woody plant species within 5 feet on each side of the nine native grassland cover monitoring transects was recorded on 6 May 2015. Recruitment densities were compared between each monitoring year.

2.7 Hydrology and Geomorphology

The project hydrologist (Balance Hydrologics Inc.) conducted hydrology and geomorphology monitoring. Monitoring included visual observations of stormflows and geomorphic stability, floodplain sedimentation using sedimentation plates, floodplain soil moisture monitoring using water level data loggers and graduated staff plates, and photo-documentation. A more detailed description of monitoring methods is presented in the Year 5 (water year 2015) Hydrologic and Geomorphic Monitoring Letter Report by Balance Hydrologics, Inc. (Appendix A).

2.8 Photo-documentation

Photographs of the mitigation site were taken at 36 fixed photo-documentation points on 2 July 2015. These photo-documentation point locations are indicated on Figures 2-1 and 2-2. Photographs from additional locations were also taken to document general site conditions.

Section 3.0 Results and Discussion

3.1 Vegetation Maintenance Monitoring

Confluence Restoration conducted regular weed control activities throughout 2015 including targeted mowing and hand weeding of planting basins. Woody plantings, with the exception of willows, were irrigated starting in July 2015.

3.2 Woody Plant Survival

The overall survival rate of woody riparian plantings in good or fair condition decreased from 81% in Year 4 to 73% in Year 5 (Table 2). Percent survival ranged from 47% for blue elderberry (*Sambucus nigra* ssp. *caerulea*) to 109% for coyote brush (*Baccharis pilularis*).

Table 2. Percent Survival of Planted Woody Species in Good or Fair Condition

Scientific Name	Common Name	No. of Plants Specified in MMP Planting Plan	% Survival				
			Year 1	Year 2	Year 3	Year 4	Year 5
Acer negundo	box elder	176	101%	97%	92%	88%	55%
Baccharis pilularis	coyote brush	129	97%	105%	104%	102%	109%
Quercus agrifolia	coast live oak	89	89%	83%	82%	76%	81%
Rosa californica	California rose	343	96%	91%	85%	80%	79%
Salix laevigata	red willow	154	104%	95%	90%	94%	79%
Salix lasiolepis	arroyo willow	254	101%	98%	87%	86%	74%
Sambucus nigra ssp. *caerulea*	blue elderberry	206	88%	78%	54%	50%	47%
	Total[1]	**1351**	**97%**	**92%**	**84%**	**81%**	**73%**

[1] The total average cover values vary slightly from the sum of average cover values across species due to rounding assumptions.
Note: Percent survival is occasionally greater than 100% or increases between years because either additional plants were installed in excess of the number required by the MMP, or individuals that were dead aboveground resprouted in subsequent years.

The 73% survival rate in Year 5 exceeds the success criterion of 70% (Table 3).

Table 3. Comparison of Woody Plant Survival to the Success Criteria

Year	MMP Success Criterion	Results
1	90% survival in good or fair condition	97% in good or fair condition
2	80% survival in good or fair condition	92% in good or fair condition
3	75% survival in good or fair condition	84% in good or fair condition
4	70% survival in good or fair condition	81% in good or fair condition
5	70% survival in good or fair condition	73% in good or fair condition

3.3 Percent Cover of Native Grassland Species

Following Year 1 (2011) monitoring, a memorandum was produced that describes changes to the MMP's native grassland percent cover success criterion based upon guidance from the California Department of Fish and Wildlife (CDFW) and Regional Water Quality Control Board (RWQCB) staff (H. T. Harvey & Associates 2012a). It broadens the interpretation of native grasses to include all native grasses and forbs both naturally recruiting, as well as those species included in the original native seed mix installed at the site. Therefore, we calculated the average percent cover of native grassland species, including all native grasses and forbs, and compared this metric to the MMP final success criterion of 35% cover.

The average percent cover of native grassland species increased from 23.2 % in 2014 to 44.6% in 2015 (Table 4). The increased percent cover from 2014 to 2015 was due primarily to substantial increases in the percent cover of meadow barley (*Hordeum brachyantherum*) and purple needlegrass (*Stipa pulchra*). The most abundant native species were meadow barley (25.1%), purple needlegrass (11.5%), and blue eyed grass (*Sisyrinchium bellum*) (1.9%). All three species were included in the original native seed mix installed at the mitigation site (H. T. Harvey & Associates 2011).

Table 4. Average Percent Cover of Herbaceous Vegetation

Native/Nonnative Status	Scientific Name	Common Name	Average % Cover				
			Year 1	Year 2	Year 3	Year 4	Year 5
Native	*Achillea millefolium*[1]	yarrow	1.6	8.3	5.9	3.8	<0.1
	*Artemisia douglasiana**	mugwort	0.2	1.5	1.6	2.7	1.1
	Bolboschoenus robustus	sturdy bulrush	0.0	0.1	1.1	0.5	0.3

Native/Nonnative Status	Scientific Name	Common Name	Average % Cover				
			Year 1	Year 2	Year 3	Year 4	Year 5
	Centromadia parryi ssp. *congdonii*[1]	Congdon's tarplant	17.0	<0.1	1.1	0.0	0.2
	Cressa truxillensis	spreading alkaliweed	0.3	0.1	0.0	0.2	0.3
	Cyperus eragrostis	tall flatsedge	0.2	0.1	0.1	<0.1	0.5
	Distichlis spicata	saltgrass	0.0	0.5	<0.1	0.1	0.0
	Eleocharis macrostachya	common spikerush	0.0	0.0	0.8	0.0	1.6
	Elymus triticoides[1]	beardless wildrye	0.0	0.3	0.0	0.0	0.5
	Eschscholzia californica[1]	California poppy	0.1	<0.1	0.1	0.2	0.0
	Festuca microstachys[1]	small fescue	0.5	1.4	0.0	<0.1	0.0
	Hordeum brachyantherum[1]	meadow barley	14.8	7.0	0.4	10.9	25.1
	Lythrum californicum	California loosestrife	0.4	0.3	0.4	<0.1	0.1
	Malvella leprosa	alkali mallow	0.0	0.0	0.0	0.0	0.5
	Persicaria amphibia	water smartweed	0.0	0.0	0.4	0.2	0.4
	Sisyrinchium bellum[1]	blue eyed grass	0.0	0.0	0.0	0.0	1.9
	Stipa pulchra[1]	purple needle grass	0.0	0.4	0.2	0.8	11.5
	Typha latifolia	broadleaf cattail	0.0	<0.1	0.7	1.5	0.3
	Symphyotrichum subulatum	eastern annual saltmarsh aster	0.0	1.4	3.3	1.5	0.2
Nonnative	*Anagallis arvensis*	scarlet pimpernel	0.0	0.0	0.0	0.0	0.2
	Atriplex prostrata	fat-hen	11.6	2.9	1.1	0.8	0.1

Native/Nonnative Status	Scientific Name	Common Name	Average % Cover				
			Year 1	Year 2	Year 3	Year 4	Year 5
	Avena fatua	common wild oats	0.3	1.0	3.1	5.5	4.1
	Beta vulgaris	common beet	4.1	<0.1	0.2	0.3	1.2
	Bromus diandrus	ripgut brome	0.0	0.0	0.0	0.1	0.1
	Crypsis schoenoides	swamp grass	0.1	0.0	0.0	0.0	0.0
	Dittrichia graveolens	stinkwort	0.6	0.0	0.0	0.0	0.0
	Echinochloa crus-galli	barnyard grass	0.8	0.2	0.0	0.1	0.0
	Festuca myuros	six weeks grass	0.0	0.0	0.0	0.0	<0.1
	Festuca perennis	Italian rye grass	14.3	22.9	26.4	8.5	16.9
	Foeniculum vulgare	sweet fennel	0.0	<0.1	0.1	0.0	0.3
	Geranium dissectum	cutleaf geranium	0.0	0.0	0.0	0.0	2.8
	Helminthotheca echioides	bristly ox-tongue	2.1	1.6	2.7	3.5	0.3
	Hordeum sp.[3]	barley	0.0	0.0	12.3	<0.1	0.0
	Hordeum marinum	seaside barley	0.0	0.0	0.0	0.0	<0.1
	Hordeum murinum	foxtail barley	0.0	0.0	0.0	0.0	0.6
	Lactuca serriola	prickly lettuce	0.2	0.9	0.8	8.2	2.3
	Ludwigia peploides ssp. *peploides*	floating water primrose	0.0	7.8	6.9	7.4	0.8
	Malva parviflora	cheeseweed	0.0	<0.1	<0.1	0.1	0.0
	Medicago polymorpha	bur clover	0.0	<0.1	0.3	0.0	1.9
	Melilotus indicus	annual yellow sweetclover	0.0	<0.1	0.0	0.0	0.8

Native/Nonnative Status	Scientific Name	Common Name	Average % Cover				
			Year 1	Year 2	Year 3	Year 4	Year 5
	Paspalum dilatatum	dallis grass	0.0	0.0	1.9	0.0	0.0
	Plantago coronopus	cut leaf plantain	0.0	0.0	<0.1	0.1	0.0
	Polypogon monspeliensis	rabbitsfoot grass	0.1	0.1	0.0	2.2	0.0
	Raphanus sativus	wild radish	0.0	<0.1	<0.1	0.0	0.6
	Rumex crispus	curly leaved dock	0.1	0.7	0.2	1.0	0.3
	Salsola tragus	Russian thistle	0.0	1.0	0.0	0.0	0.0
	Sonchus asper ssp. *asper*	prickly sow thistle	0.0	<0.1	0.0	0.0	0.5
	Stipa miliacea var. *miliacea*	smilo grass	0.0	<0.1	0.2	<0.1	0.0
	Taraxacum officinale	common dandelion	0.0	0.0	0.0	<0.1	0.0
	Tragopogon porrifolius	salsify	0.0	0.0	0.0	0.0	<0.1
	Trifolium repens	white clover	0.0	0.0	0.0	0.2	0.0
	Vicia sativa ssp. *nigra*	common vetch	0.0	0.0	<0.1	<0.1	1.2
		Total Average Percent Native Species Cover[2]	**35.0**	**21.5**	**16.1**	**23.2**	**44.6**
		Total Average Percent Nonnative Species Cover[2]	**34.7**	**40.2**	**56.3**	**38.2**	**35.0**
		Total Average Percent Cover	**69.7**	**61.7**	**72.4**	**61.4**	**79.6**

[1] Indicates species that were included in the original native grassland seed mix.
[2] The total average cover values vary slightly from the sum of average cover values across species due to rounding assumptions.
[3] Plant was not positively identified to species level due to a lack of flowering parts in all years.
Note: Table 4 only includes native species found along monitoring transects. Congdon's tarplant was encountered elsewhere on the site and was not exclusively found along the transects.

The average percent cover of native grassland species in Year 5 is 44.6% (Table 5, Figure 3). The percent cover of native grassland species on the site is substantially higher than is typically found in local grassland habitats. In addition to the populations encountered along the sampling transects, dense stands of native purple needlegrass (*Stipa pulchra*) were observed on the upper slopes of the west creek bank and dense stands of native meadow barley (*Hordeum brachyantherum*) were observed throughout the floodplain (Photos 21 and 22). The Year 5 percent cover of native grassland species exceeds the Year 5 success criterion of 35%.

Nonnative, invasive weeds have been controlled throughout the five year monitoring period, which has likely contributed to the increase in native grassland cover over time.

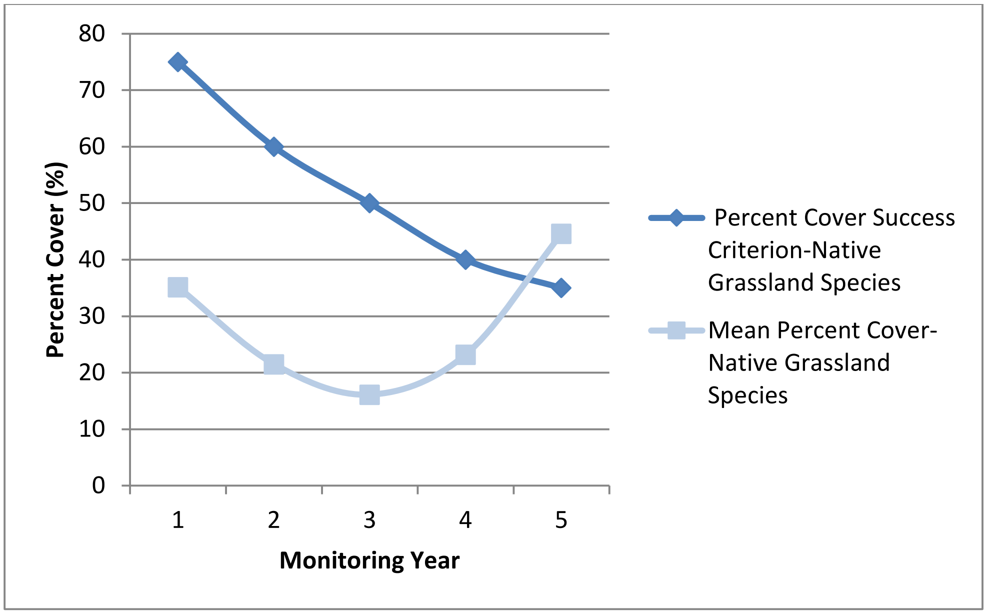

Figure 3. Mean Percent Cover of Native Grassland Species Compared to Success Criterion.

Table 5. Comparison of Percent Cover of Native Grassland Species to the Success Criterion

Year	Success Criterion[1]	Results
1	75% cover of native grassland species	35.0% cover of native grassland species[2]
2	60% cover of native grassland species	21.5% cover of native grassland species
3	50% cover of native grassland species	16.1% cover of native grassland species
4	40% cover of native grassland species	23.2% cover of native grassland species
5	35% cover of native grassland species	44.6% cover of native grassland species

[1] The interpretation of "native grassland species" was broadened, with CDFW and RWQCB approval, to include all native grassland species (grasses and forbs), not just those native grasses that were included in the seed mix.
[2] The Year 1 percent cover result was re-calculated to account for the broadened interpretation of the success criterion.

3.4 Congdon's Tarplant Survival

The MMP performance criterion requires a minimum of 100 Congdon's tarplant individuals in 2 of 5 monitoring years. Two hundred and fifty-five (255) Congdon's tarplant individuals were counted throughout the mitigation area in Year 5 (Table 6) (Photo 23). Congdon's tarplant individuals were observed in the seeding area as well as the in the adjacent upland planting area and the floodplain area. The population size of Congdon's tarplant has exceeded 100 individuals in 4 of the 5 years of monitoring and has therefore met the final success criterion.

Table 6. Comparison of Congdon's Tarplant Survival to the Success Criteria

Year	Success Criterion	Results
1	not applicable	5600 individuals
2	Minimum 100 individuals in 2 of 5 years	6 individuals
3	Minimum 100 individuals in 2 of 5 years	150-250
4	Minimum 100 individuals in 2 of 5 years	105
5	Minimum 100 individuals in 2 of 5 years	255

3.5 Woody Plant Health and Vigor

Despite ongoing drought conditions in the region, nearly every planted tree and shrub displayed good health and vigor (Photo 24; Tables 7 and 8). Moreover, a greater percentage of individuals were in good condition in Year 5 relative to previous years (Table 8). The overall average health and vigor of the woody plantings was 1.0 (good) in Year 5 (Table 7). The average health and vigor rating for each species was 1.0 (good). Table 8 lists the percentage of individuals that fall into the three general health and vigor categories by monitoring year. The percentage of individuals in good condition increased from 72.6% in Year 4 to 98.5% in Year 5. The percentage of individuals in fair condition decreased from 23.9% in Year 4 to 1.2% in Year 5. The percentage of individuals in poor condition decreased from 3.5% in Year 4 to 0.3% in Year 5.

Table 7. Mean Woody Plant Health and Vigor Ratings

Scientific Name	Common Name	Average Health and Vigor Rating[1]				
		Year 1	Year 2	Year 3	Year 4	Year 5
Acer negundo	box elder	1.2	1.1	1.2	1.3	1.0
Baccharis pilularis	coyote brush	1.0	1.0	1.0	1.1	1.0
Quercus agrifolia	coast live oak	1.2	1.2	1.1	1.3	1.0

Scientific Name	Common Name	Average Health and Vigor Rating[1]				
		Year 1	Year 2	Year 3	Year 4	Year 5
Rosa californica	California rose	1.3	1.2	1.2	1.4	1.0
Salix laevigata	red willow	1.1	1.3	1.2	1.3	1.0
Salix lasiolepis	arroyo willow	1.1	1.1	1.1	1.2	1.0
Sambucus nigra ssp. *caerulea*	blue elderberry	1.6	1.4	1.7	1.6	1.0
	Average	**1.2**	**1.2**	**1.2**	**1.3**	**1.0**

[1] Good Condition = 1.0; Fair Condition = 2.0; Poor Condition = 3.0

Table 8. Percentage of Planted Tree and Shrub Individuals within Each Health and Vigor Category

Plant Health and Vigor Categories	Year 1 % of Individuals	Year 2 % of Individuals	Year 3 % of Individuals	Year 4 % of Individuals	Year 5 % of individuals
Good Condition	80.7%	80.2%	81.5%	72.6%	98.5%
Fair Condition	16.7%	12.1%	15.8%	23.9%	1.2%
Poor Condition	2.6%	2.0%	2.7%	3.5%	0.3%

3.6 Natural Recruitment

Natural recruitment of native woody plant species was observed, with 9 California rose (*Rosa californica*) individuals and 1 coyote brush encountered along the monitoring transects. Additional individuals were qualitatively observed to be recruiting in large numbers throughout the mitigation area outside of the transects.

3.7 Hydrology and Geomorphology

Observations made by Balance Hydrologics indicate that the constructed channel and floodplain are stable. No major or minor erosion was observed.

The MMP's quantitative hydrologic success criterion requires continuous inundation or saturation of floodplain soils for at least 12.5% (31 days) of the annual growing season. The project hydrologist estimated that floodplain soils were continuously inundated or saturated for at least 40 days between 29 November 2014 and 8 January 2015. This exceeds the minimum requirement of 31 days of continuous inundation or saturation.

Due to drought conditions and the flashy hydrology of the drainage, the project hydrologist had few opportunities to observe flow on the floodplain and was not able to make flow measurements in Year 5. However, water level/depth observations from Year 5 continue to support prior observations of backwatering of the channel. It appears that the source of this backwatering is flow modification caused by the City of Milpitas' Wrigley-Ford Creek Pump Station located approximately 4500 feet downstream of the project site. During storm events, water likely accumulates within the channel until the station pumps flows into Berryessa Creek. Regardless of this backwatering, the mitigation project is establishing well and sedimentation rates on the floodplain are minimal. Minor sediment deposition (<0.2 inches) was observed on the floodplain, which was anticipated and poses no threat to the geomorphic functioning of the site.

Balance Hydrologics visited the site on 11 December 2014 during the one of the largest storms to pass through the region over the 5 year monitoring period. They observed that the site was inundated under several feet of water because of backwatering effects and a high volume of runoff. However, no damage was observed following this inundation, which suggests that the site is capable of withstanding extreme hydrologic events (Balance Hydrologics 2015).

Appendix A provides Balance Hydrologics' detailed results.

3.8 Photo-documentation

Photos were taken from the 36 photo-documentation points. A representative selection of these photos is presented in Appendix B.

3.9 Trail Construction Effects on the Mitigation Site

Construction of an adjacent redevelopment project (by others) began in 2013 and affected the VTA's mitigation project. Redevelopment included construction of a trail bordering the eastern side of the mitigation site that resulted in the removal of approximately 20 trees and shrubs including some mitigation plantings within the upland planting zone of the mitigation site (Calnan 2015, pers. comm.). The 20 removed trees and shrubs accounted for no more than 1.4% of the total quantity of installed plants. VTA replaced the plants in December 2014 with 20 native riparian trees and shrubs of the same species as the original planting palette (Table 9). Plantings were installed in gaps in the riparian woodland canopy within the upland planting zone.

Table 9. Trail Construction Replanting Palette

Scientific Name	Common Name	Source County	Container Size	Quantity
Acer negundo	Box elder	Santa Clara	TP4	2
Baccharis pilularis	Coyote brush	Santa Clara	1-Gal	5
Quercus agrifolia	Coast live oak	Santa Clara	5-Gal	4
Rosa californica	California rose	Santa Clara	1-Gal	8
Sambucus nigra ssp. *caerulea*	Blue elderberry	Santa Clara	TP4	1
			Total	**20**

Conclusion

The Year 5 monitoring results indicate that the site is performing well and is on a trajectory to achieve the long-term habitat mitigation goals. The site met or exceeded the final success criteria for woody plant survival, native grassland species cover, Congdon's tarplant survival, continuous floodplain surface soil inundation or saturation, and hydrologic and geomorphic stability. The site has been well maintained and nonnative, invasive weeds do not pose a threat to the continued establishment of riparian habitat at the site. Willow plantings had a high survival rate, displayed significant growth, and retained their leaves long into the summer dry season despite not being irrigated during 2015, indicating that they have reached groundwater and are self-sufficient without supplemental irrigation. The VTA's landscape contractor applied irrigation to woody plantings, with the exception of willow plantings, starting in July 2015 in response to plant stress associated with the ongoing regional drought. It is important to note that the Year 5 vegetation data collection was completed one day after the first irrigation event in 2015. Therefore, these data reflect site conditions in the absence of supplemental irrigation, and thus it is valid to state that the site met or exceeded the final success criteria without supplemental irrigation.

Management Recommendations

The site has met all of its final success criteria. Upon agency approval that the success criteria have been met and that maintenance may cease, we recommend that the above ground elements of the irrigation system be removed and any below ground elements be cut and capped. We have no further vegetation maintenance recommendations for the Wrigley Creek Improvement Project.

Agency Actions

The VTA requests sign-off from the U. S. Army Corps of Engineers, California Department of Fish and Wildlife, and Regional Water Quality Control Board that the project's final success criteria have been met and that maintenance, monitoring, and reporting may cease.

Section 4.0 References

4.1 Literature Cited

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4.2 Personal Communications

Calnan, A. 2015. Phone communications between Max Busnardo (H. T. Harvey & Associates) and Ann Calnan (VTA) regarding trail construction impacts and replacement planting.

Appendix A. Hydrology and Geomorphology Monitoring Memorandum

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September 29, 2015

Mr. Will Spangler
H. T. Harvey and Associates
983 University Avenue, Building D
Los Gatos, California 95032

Submitted Via Email

Year-5 (Water Year 2015) Hydrologic and Geomorphic Monitoring Letter Report, Wrigley Creek, Santa Clara County, California

Dear Mr. Spangler:

We are pleased to furnish you with this letter report for abbreviated Year 5 (Water Year[1] 2015, or WY15, hereafter) post-construction monitoring of the Wrigley Creek Mitigation Project ('project', hereafter). Construction of the mitigation site was completed in the summer and fall of 2010. The geomorphic and hydrologic monitoring program is designed to assess whether the numeric success criterion for soil saturation is met and identify whether the site is functioning as intended hydrologically and geomorphically. We visited the site numerous times during WY15 including storm responses, at other times during the winter months, dry season visits, and most recently during the dry summer season, on July 30, 2015 to perform the geomorphic site walk. The July 30, 2015 site visit concludes 5-year period for physical monitoring of the project. This letter report summarizes the findings of those visits. It should be noted that we have slightly shortened the monitoring duration for WY15 by 2 months in accordance with a request from the Santa Clara Valley Transportation Authority (VTA) (i.e., hydrology monitoring occurred from October 1, 2014 – July 30, 2015, rather than terminating on September 30, 2015). The VTA shortened the monitoring duration in order to submit the last monitoring report for regulatory review prior to the retirement of Dave Johnston, who has been the California Department of Fish and Wildlife contact since the project's inception. We wish him well in his future endeavors.

Per the project Mitigation and Monitoring Plan (MMP), the project has one numeric performance criterion, whereas other measures of success are related to visual assessment of post-construction conditions. The success criterion for inundation/saturation in the MMP mandates that floodplain soils should be inundated or saturated within the uppermost 6 inches of the soil profile continually for 12.5% of the growing season. Utilizing a growing season of 250 days for neighboring Santa Clara County based on data from the NRCS Soil Survey of Santa Clara County (M. Parsons, H. T. Harvey and Associates, pers. comm.), we conclude that to meet the

[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, WY15 occurred from October 1, 2014 through September 30, 2015.

success criterion outlined in the MMP, the site must be continually inundated or saturated for at least 31.25 days.

Figure 1 illustrates the general design features of the site and the location of hydrologic monitoring and photo-documentation points that serve as the basis for our monitoring work. The schedule for monitoring during years 2 through 5 is presented in **Table 1**.

Table 1. Schedule of Hydrologic and Geomorphic Monitoring Activities

		Year 1 (WY2011)	Year 2 (WY2012)	Year 3 (WY2013)	Year 4 (WY2014)	Year 5 (WY2015)
Task 1	Stormflow Observation	n/a	Oct. 2011-June 2012	Oct. 2012-June 2013	Oct. 2013-June 2014	Oct. 2014-June 2015
Task 2	Floodplain Soil Moisture Monitoring	n/a	Oct. 2011-June 2012	Oct. 2012-June 2013	Oct. 2013-June 2014	Oct. 2014-June 2015
Task 3	End of Water Year Geomorphic Monitoring	Oct. 2011	Oct. 2012	Oct. 2013	Oct. 2014	July 2015
Task 4	Photo-documentation Points	Oct. 2011	Oct. 2012	Oct. 2013	Oct. 2014	July 2015

Monitoring Methods

Winter Storm Observations

To assess the fundamental assumptions and basis for channel design, Balance Hydrologics (Balance, hereafter) observed conditions during or immediately after winter storm events and looked for marked headcutting, marked channel incision or downcutting, substantial bank erosion or lateral channel migration, and excessive sedimentation or aggradation, and whether sediment is sourced from within the site or upstream. In addition, we documented floodplain inundation during storm observations to assess project hydraulic performance. We documented floodplain inundation levels via the staff plates and recording water level loggers, which we periodically downloaded.

Floodplain Soil Moisture Monitoring

Our approach provided for the monitoring of surficial hydrologic conditions at two different locations along the project reach (**Figure 1**); monitoring instrumentation included graduated staff plates and water level loggers. At each monitoring location, a staff plate was installed next to a water level logger housing. The water level logger housing consist of a fence post driven into the ground 3 to 4 feet, with a perforated pipe secured to the fence post above ground. The perforated pipe houses the water level logger and is installed in a position with the water level logger slightly beneath the surrounding floodplain in order to document the depth and duration of ponding on the floodplain. Manual monitoring consisted of observations of stage (water depth as measured against the staff plate), soil moisture conditions, and downloading of the water level loggers. We utilized the record of inundation in tandem with visual observations of soil moisture to determine whether or not the soils were saturated for the required 12.5% of the growing season (i.e., at least 31 days, assuming an 8 month growing season.), as outlined in the MMP.

End of Water Year Geomorphic Monitoring

On July 30, 2015 Balance conducted a geomorphic assessment of the channel and floodplain to identify areas of erosion or aggradation within the site over the past year, as specified in the MMP. During the end of water year monitoring visit, Balance supplemented photo-documentation points collected by H. T. Harvey and Associates with five photo-documentation points at places of hydrologic and geomorphic significance (**Figure 1**). On November 30, 2012 Balance staff installed four sedimentation plates (~square-foot plates mounted at the ground surface on a shaft driven into the floodplain) at the site on the floodplain (**Figure 1**). On July 30, 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. The average depth of accumulated sediment for each sedimentation plate location is presented in the results.

Hydrologic Monitoring Results

To provide context for data collected at Wrigley Creek, we present precipitation data from two nearby stations: the California Irrigation Management Information System (CIMIS) station in Union City (Station 171), and Weather Underground Station KCANSANJO17 (Berryessa, hereafter), which we have used since WY12. The Berryessa rainfall station is located approximately 3 miles southeast of the Wrigley Creek mitigation site and the Union City CIMIS station is approximately 14.5 miles northwest of the mitigation site. For all intents and purposes, mean annual rainfall at these sites is similar to that of the project site. Note that the San Jose Airport station (KSJC) has a longer-term record that is more proximal to the project, however we found to have missing values in WY12 and WY13, so only long-term averages are used from this station.

WY15 was characterized by very wet conditions in December 2014 followed by very dry conditions for the rest of the year in the Wrigley Creek area. In the vicinity of the project, approximately 80% of the rain recorded for the entire season fell before January 1st, 2015. The Berryessa station received 16.19 inches of rainfall for the season, (**Figure 2**), 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 1st, 2015. The Union City CIMIS station received 15.49 inches of rainfall (**Figure 3**) or 0.40 inches more than the long-term average for that location. Of that total, 11.87 inches of rain fell before January 1st.

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 indicates that the 12- and 24-hour rainfall duration intensities correlate to approximately a 50-year recurrence interval, while shorter 1-4 hour duration intensities correlate to approximately a 10- to 25- year recurrence[2]. 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 Berryessa, and 2.46 inches recorded at Union City. Watershed conditions were therefore already very wet at the time of the atmospheric river event.

Balance made a total of five site visits during WY15 to take staff plate readings, measure the depth to soil moisture, and download water-level recording instruments. In the discussion that follows, records of water level (stage) and soil moisture (shown in **Figure 4**) are used to deduce the period of inundation/saturation on the floodplain. Precipitation over time is also shown in **Figure 4.**

Criteria for the site are met when the floodplain is either inundated or saturated for a required amount of time. Inundation is defined here as having standing or flowing water on top of the floodplain, and is represented in **Figure 4** as spikes in stage that extend above the ground surface. Floodplain saturation is defined as the presence of moisture a minimum of 2 inches beneath the ground surface, and is represented by points shown in **Figure 4**. Saturation is considered to be achieved whenever these observations confirm it, or when inundation is observed on the floodplain.

As in previous years, at both the north and south gages, we observed that inundation tracked closely to rainfall events. At the beginning of the water year (October 1, 2014), the soils were not saturated within the upper 6 inches of the soil profile, as is reflected in the September 23, 2014 soil moisture observations **(Figure 4).** Continually inundated/saturated conditions begin with the onset of significant precipitation on November 29; inundation was first observed by field staff on December 11, 2014. A series of clustered rainy days, from late November to mid-January, correlate with the longest periods of saturation and inundation. The storms with the highest intensity rainfall yielded the highest stage levels; for example, the season peak in one-day rainfall (December 11, 2014, 4.21 inches) correlates with the highest stage of the year at both the north and south gages, 5.20 and 5.67 feet above the ground surface, respectively. The high water levels rise quickly with the onset of rain, and recede quickly as precipitation ceases, due to the flashy nature of the site. Following the recession of high water, water levels remain elevated a few inches above the floodplain for several days.

Smaller late-season storms produce only brief spikes in stage. For the larger events (February 6 April 7, and May 15, when 1.08, 0.68, and 0.73 inches of rain fell, respectively) the gages show a strong response, recording water levels of around 2 to 3 feet deep on the floodplain. On March 2,

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

when only 0.11 inches of precipitation was recorded, a similarly high water level was recorded on the floodplain. This may be due to saturated conditions persisting through the watershed, or perhaps rainfall was locally higher at the site than at nearby precipitation gages. Other small events (e.g. March 11, 2015, when 0.15 inches of rain fell), produce much lower water levels at the site. The small January 27 spike is not associated with rainfall recorded at either gage.

As discussed in our WY2013 and WY2014 reports, the modeling performed for the site as the basis for design by the Balance design team predicted near bankfull conditions to occur with a discharge of approximately 20 cubic feet per second (cfs), and a 100-year flow of 325 cfs would be required to inundate the floodplain to a depth of 4 feet. This year's multiple stage measurements indicate that the floodplain is inundated more frequently than anticipated, an indication that the site is backwatered, which likely results from flow modifications caused by a pump station located approximately 4500 feet downstream of the project site. Again, pump operations are not understood, but we presume that during storm events, stream flow accumulates within the channel until the station pumps flows up and over the levee into Berryessa Creek.

Throughout the wet season, there were approximately 59 days (discontinuous) during which the north gage site was inundated (**Figure 4**). The longest continuous period of inundation was about 24 days, from December 11, 2014 to January 3, 2015. The stage record and field observations show that between November 29, 2014, when storms inundated the site, and January 8, 2015, when moist soils were observed in the field, soils near the gage were either inundated or saturated at a depth of approximately 2 inches, a period of continuous inundation/saturation lasting 40 days. **Figure 5** shows site photos from the January 8 field visit.

The south gage is located on a section of floodplain that ponds during and after storm events, therefore this site is inundated for a longer duration. According to the stage record **(Figure 4)** there were approximately 78 (discontinuous) during which the south gage site was inundated. The longest period of continuous ponding/inundation lasted 32 days, from November 29, 2014 to January 3, 2015. As at the north gage site, the stage record and field observations show that between November 29, 2014, when storms inundated the site, and January 8, 2015, on which moist soils were observed in the field, soils near the gage were either inundated or saturated at a depth of approximately 2 inches, a period of continuous inundation/saturation lasting 40 days. **Figure 6** shows site photos from the January 8 field visit.

The 40 day period of inundation and soil saturation at the north and south gage sites exceeds the minimum duration of 12.5% of the growing season (i.e., 31 days), stated success criterion outlined in the MMP. Therefore, the site has met the numeric success criterion for inundation/saturation in the MMP, which is particularly notable because rainfall during WY15 was consolidated largely between November 28, and December 27, 2014.

The December 11-12, 2014 atmospheric river event was exceptional in that it was one of the largest storms to pass through the area over the five-year monitoring period. Balance visited the site on December 11, 2014. Due to the backwatering effect of the pump station downstream and the high volume of runoff entering the project site, the channel, staff plates and most of the vegetation was inundated under several feet of water at the time of the visit **(Figure 7**). Discharge measurements were impossible to take with a wading instrument, and difficult to estimate due to turbulent backwater effects. It is encouraging that after an event of this magnitude, no damage was observed following recession of the floodwaters. Due to the dry year and the flashy nature of the site, Balance had few other opportunities to observe flow on the floodplain, and therefore we were not able to measure flow during WY15.

Geomorphic Observations

On July 30, 2015, Balance conducted an end-of-water-year geomorphic walk at the site to make observations. There had been no measurable rain in the area since June 11, 2015. Overall, the site was observed to be in good condition and functioning geomorphically (**Figure 8**).

Table 2 shows the accumulation of sediment on the four sediment plates. Plate 1, located in the upstream portion of the site, showed an accumulation of sediment. We attribute the sediment accumulation to the natural levee that is forming adjacent to the channel. This process does not threaten the long term sustainability of the site, as rates are still quite low, and are expected to slow further with time. At Plate 2, no change was detected. At the downstream sites, Plate 3 saw a slight accumulation when compared to WY14. However, the site experienced scour between WY13 and WY14, so long term trends at this location are difficult to assess. No change was detected at Plate 4. Overall, the transport of sediment on the floodplain is in very small amounts and is not expected to affect the geomorphic or biologic functionality of the site for some time.

Table 2. Summary of Cumulative Annual Sediment Accumulation on Sedimentation Plates 1-4.

	Sedimentation Plate 1 *mm of accumulation*	**Sedimentation Plate 2** *mm of accumulation*	**Sedimentation Plate 3** *mm of accumulation*	**Sedimentation Plate 4** *mm of accumulation*
Year 1 - WY11	n/a	n/a	n/a	n/a
Year 2 - WY12	n/a	n/a	n/a	n/a
Year 3 - WY13*	1	1	5	<1
Year 4 - WY14	3	3	3	3
Year 5 - WY14	15	3	7	3

*Sediment plates installed on November 30, 2012, and therefore the WY13 sediment accumulations do not reflect the complete water year.

During the July 30 site walk, 1.5 feet-deep desiccation cracks were observed on the floodplain adjacent to the downstream (north) gage with moisture at the bottom of these cracks. At the upstream site, flow was estimated at 0.05-0.07 cfs. Soils at the very upstream extent of the site were visibly saturated. Vigorous willow growth was observed here as well.

As noted in our WY14 report, substantial cattail growth continues to expand, and now covers approximately 95% of the low-flow channel length, a condition that remains unchanged in recent visits. It should be noted that successful willows are beginning to shade-out cattail along short portions of that channel. We expect the succession from cattail to willow to continue, and view this succession positively with respect to the hydrologic and geomorphic functions of the site, though it is unlikely that the frequency and duration of inundation will change dramatically. Our observations of water levels (**Figure 4**) and physical bank features suggest these stands of cattail do not currently hinder the ability of the low-flow channel to convey low flows; however they very likely reduce velocities within the channel during high flows. Our observations suggest that elevated water levels are most likely caused by flow modifications from the downstream pump station in combination with the downstream channel conditions, and do not currently threaten the success of the mitigation project.

Recommendations for Adaptive Management

We observed no major or minor erosion along the project reach, at the inlet structures, within the backwater channels, the floodplains, or the upland slopes. WY15 was drier than average during the second half of the wet season, however there were major regional runoff events, and the soil moisture criterion from the MMP was met. Therefore, no adaptive management strategies are needed.

It should be noted that the majority of years in which monitoring took place were drier than usual. If downstream conditions that currently cause the backwatering of the site persist in the future, which we expect, it is likely that the site will continue to meet the quantitative soil moisture success criteria, even during severe drought conditions. Additionally, the significant storms of December 11, 2014 caused no detrimental sedimentation or erosion, which suggests the site is geomorphically stable, and capable of withstanding extreme hydrologic events.

Closing

We greatly appreciate the opportunity to assist you with this 5-year geomorphic and hydrologic monitoring effort. If issues arise in the future with regard to the Wrigley Creek Habitat Enhancement Project, or you would like to request any of the archived documentation, we will be happy to assist.

Respectfully submitted,

BALANCE HYDROLOGICS, Inc.

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Project Manager

Krysia Skorko, M.S.
Geomorphologist

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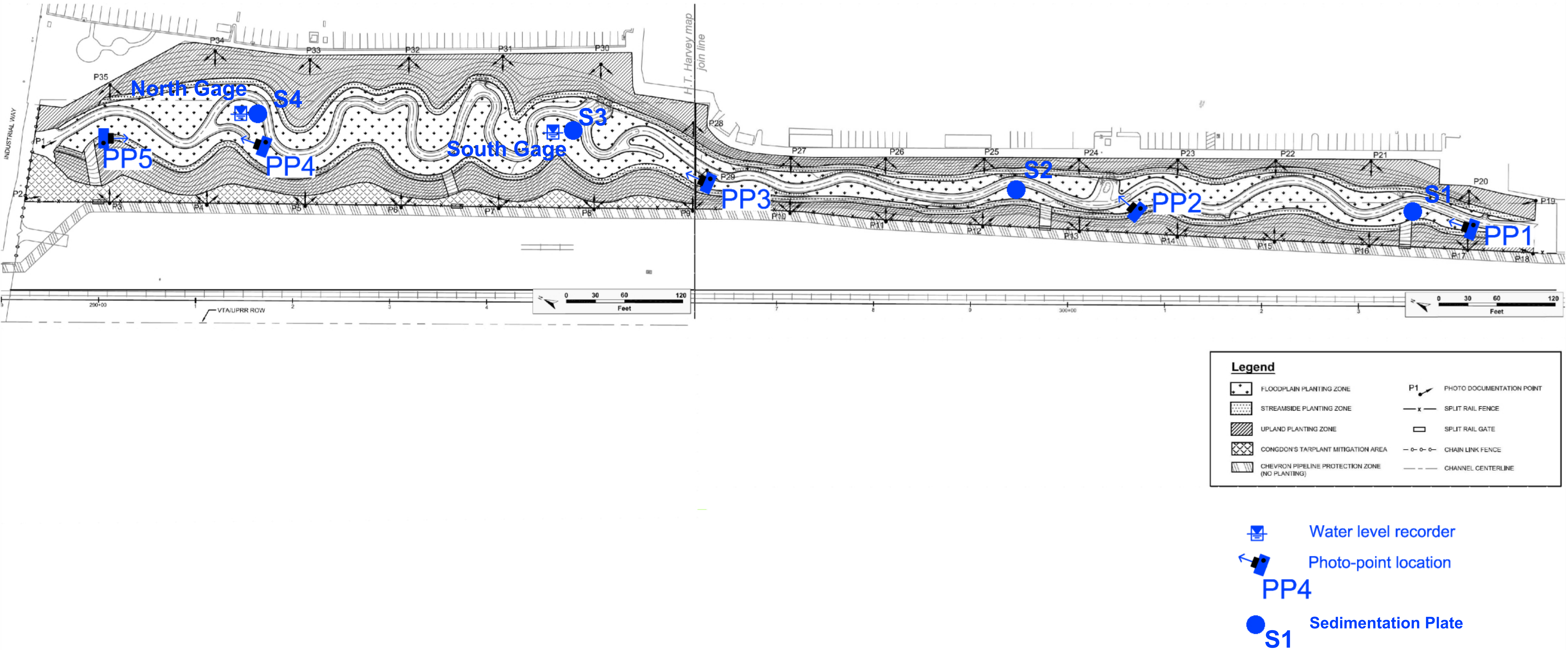
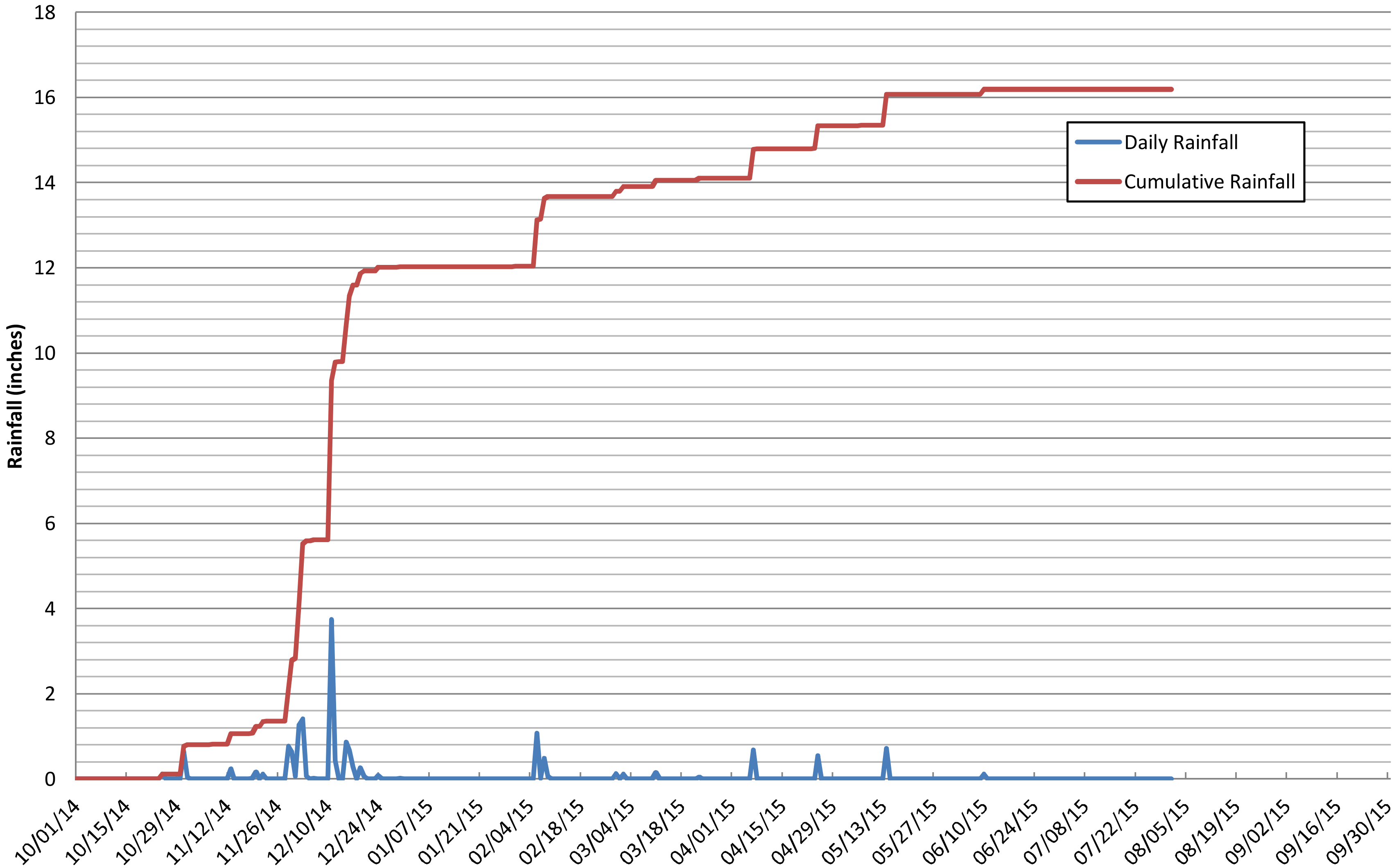
Principal-in-charge

Encl. Figures 1 through 8



Balance Hydrologics, Inc.

Figure 1. Monitoring map.
Basemap Source, H.T. Harvey and Associates, 2011.

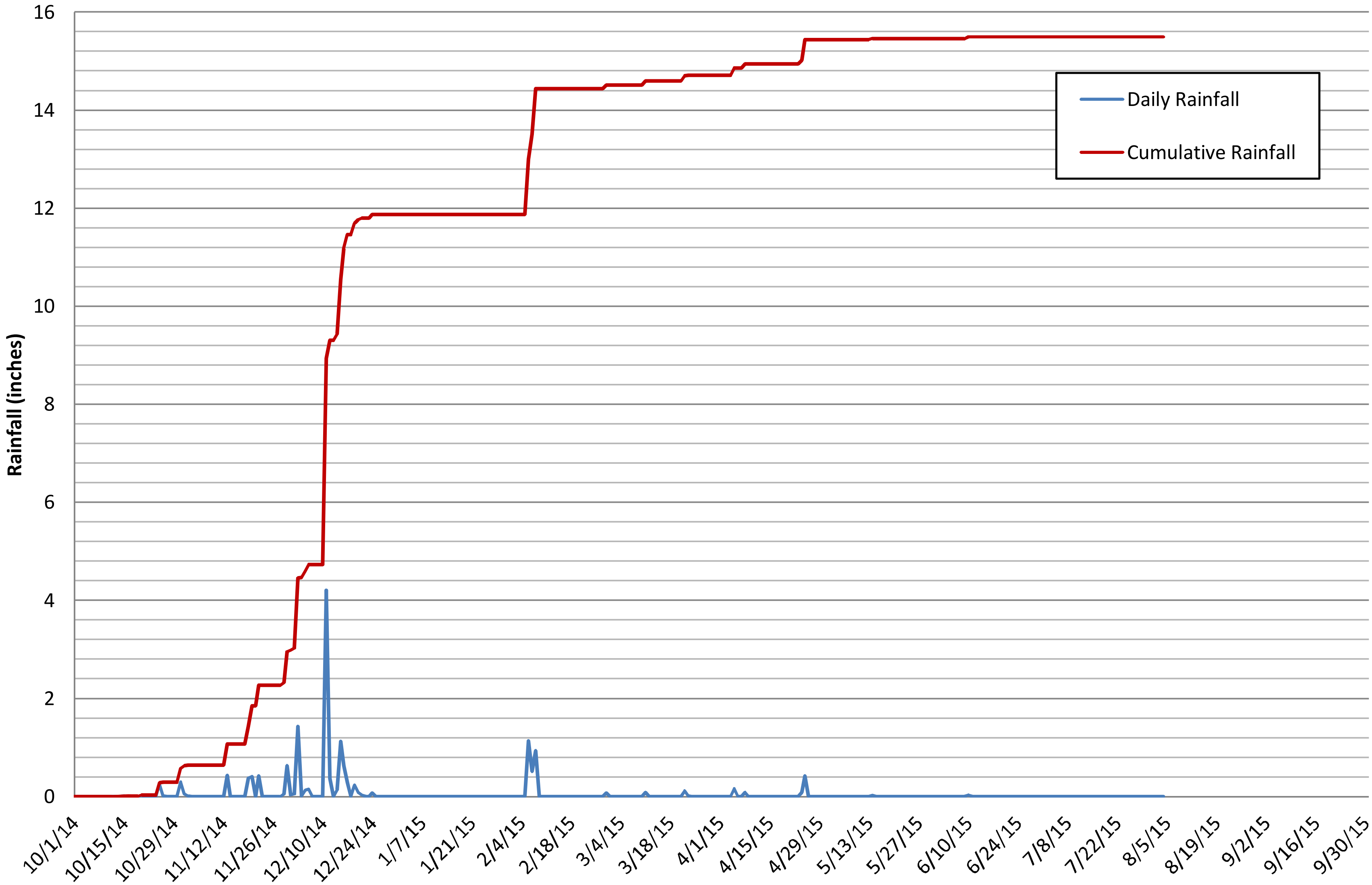


Source: Weather Underground

Balance Hydrologics, Inc.

Figure 2. Daily Rainfall and Cumulative Rainfall, Berryessa, California (Weather Underground Station KCANSANJO17). Wrigley Creek Mitigation Performance Monitoring, Water Year 2015, Milpitas, California.

Rainfall_WY2015.xls

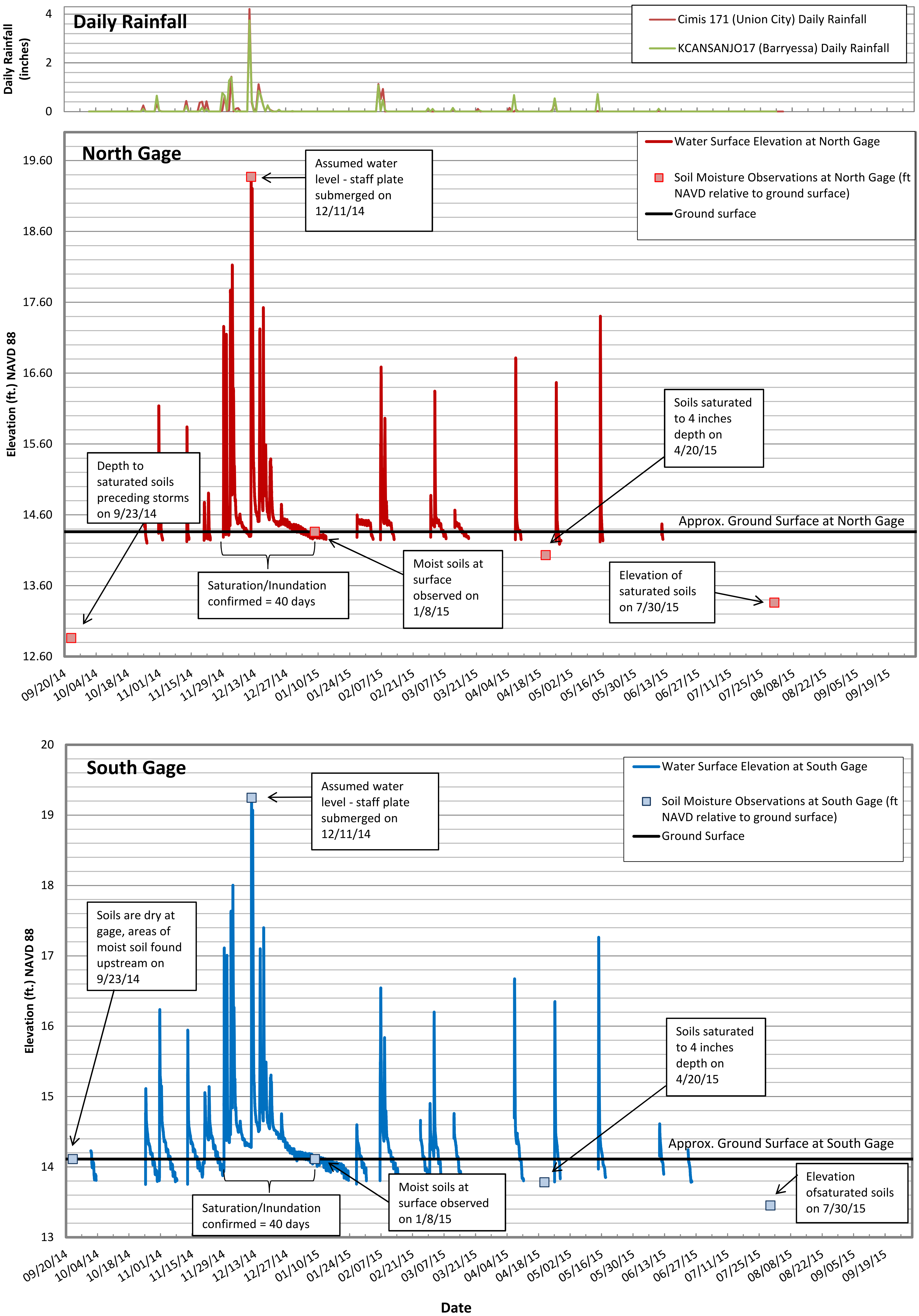


Source: CIMIS

Balance Hydrologics, Inc.

Figure 3. Daily Rainfall and Cumulative Rainfall, Union City (CIMIS 171), Water Year 2015. Wrigley Creek Mitigation Performance Monitoring, Water Year 2015, Milpitas, California.

Rainfall_WY2015



Source: Balance Hydrologics, Inc.

Balance Hydrologics, Inc.

WY15 Water Level Data

Figure 4. Annotated stage record - Wrigley Creek Mitigation Performance Monitoring, Water Year 2015, Milpitas, California Stage record for the north and south stations with storms shown by the steep spikes in stage followed by a gradual decline as the monitoring locations drain. Note that the pressure transducers are installed below the ground surface. Soil moisture observations are elevations in NAVD and should be compared to the adjacent ground surface.

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Figure 5. **January 8, 2015 north gage field photographs. Wrigley Creek Mitigation Performance Monitoring, Santa Clara County, California .** On the day these photos were taken, saturated soils were confirmed at the surface at both the north and south gages. A) North gage on January 8, 2015. B) Soils at the north gage on January 8, 2015.

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Figure 6. **January 8, 2015 south gage field photographs. Wrigley Creek Mitigation Performance Monitoring, Santa Clara County, California .** On the day these photos were taken, saturated soils were confirmed at the surface at both the north and south gages. A) South gage on January 8, 2015. B) The channel about 50 feet upstream of the south gage, January 8, 2015.

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Figure 7. **December 11, 2014 storm flow field photographs. Wrigley Creek Mitigation Performance Monitoring, Santa Clara County, California .** On the day these photos were taken, high flows inundated both staff plates and most vegetation. The tops of the cattail indicate the location of the channel. A) Looking upstream. B) Looking downstream.

Photo Point 1	Photo Point 2	Photo Point 3	Photo Point 4	Photo Point 5
Looking downstream, approx. 0˚ azimuth.	**Looking downstream, approx. 8˚ azimuth.**	**Looking downstream, approx. 0˚ azimuth.**	**Looking downstream, approximately 8˚ azimuth.**	**Looking upstream, approximately 164˚ azimuth.**

November 18, 2011

October 3, 2012

November 5, 2013

September 23, 2014

July 30, 2015

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Year 5 Photodoc

Figure 8. **Photo points 1-5, Years 1-5. Wrigley Creek Mitigation Performance Monitoring, Santa Clara County, California .** Note that vegetation growth at Photo Point 2 obscured the view of the culvert outlet and channel, and in 2013, the photo point was relocated to a location higher on the left bank.

Appendix B. Photo-documentation

Photo 1. Photo-point 1, looking upstream from the culvert at the downstream end of the project site (October 2011)

Photo 2. Photo-point 1, looking upstream from the culvert at the downstream end of the project site (July 2015)

Photo 3. Photo-point 2, looking at Congdon's tarplant Mitigation Area (October 2011)

Photo 4. Photo-point 2, looking at Congdon's tarplant Mitigation Area (July 2015)

Photo 5. Photo-point 7, looking downstream from the west bank. (October 2011)

Photo 6. Photo-point 7, looking downstream from the west bank. (July 2015)

Photo 7. Photo-point 7, looking across the channel from the west bank to the east bank (October 2011)

Photo 8. Photo-point 7, looking across the channel from the west bank to the east bank (July 2015)

Photo 9. Photo-point 7, looking upstream from the west bank (October 2011)

Photo 10. Photo-point 7, looking upstream from the west bank (July 2015)

Photo 11. Photo-point 18, looking downstream from the upstream end of the project site (October 2011)

Photo 12. Photo-point 18, looking downstream from the upstream end of the project site (July 2015)

Photo 13. Photo-point 23, looking upstream from the east bank (October 2011)

Photo 14. Photo-point 23, looking upstream from the east bank (July 2015)

Photo 15. Photo-point 23, looking across the channel from the east bank to the west bank (October 2011)

Photo 16. Photo-point 23, looking across the channel from the east bank to the west bank (July 2015)

Photo 17. Photo-point 23, looking downstream from the east bank (October 2011)

Photo 18. Photo-point 23, looking downstream from the east bank (July 2015)

Photo 19. Photo-point 36, looking over the site from the Hwy 237 embankment located north of the site (October 2011)

Photo 20. Photo-point 36, looking over the site from the Hwy 237 embankment located north of the site (July 2015)

Photo 21. Dense patch of purple needlegrass on the western creek bank slope (May 2015)

Photo 22. Dense patch of meadow barley on the floodplain (May 2015)

Photo 23. Flowering Congdon's tarplant in the Congdon's Tarplant Mitigation Area (July 2015)

Photo 24. Vigorous elderberry planting on the eastern creek bank slope (July 2015)

Photo 25. Mugwort natural recruitment on the western creek bank slope (July 2015)