2012 (Year 5)
Habitat Monitoring Report
Village Creek Restoration Project
(University Village Albany Step 2, #12810A)
University of California, Berkeley

Prepared for:
University of California, Berkeley
Office of Environment, Heath, and Safety
University of California, Berkeley
University Hall #1150
Berkeley, CA 94720
(510) 642-0359
Contacts: David Scrimger

Prepared by:
May & Associates, Inc.
182 Seal Rock Drive
San Francisco, CA 94121
415-391-1000
Contact: Loran May

November 2012

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

2.0 INTRODUCTION
- **2.1 Project Location**
- **2.2 Project Background**

3.0 MONITORING METHODS
- **3.1. Plant Survival**
- **3.2 Vegetative Cover**
- **3.3 Plant Height**
- **3.4 General Site Observations**

4.0 MONITORING RESULTS
- **4.1. Plant Survival**
- **4.2 Vegetative Cover**
- **4.3 Plant Height**
- **4.4 General Site Observations**

5.0 CONCLUSIONS AND RECOMENDATIONS

6.0 REFERENCES
- **6.1 Printed References**
- **6.2 Personal Communications**

TABLES AND FIGURES
- **Figure 1. Project Location**
- **Figure 2. Planting Plan and Photo Monitoring Locations**

- **Table 1. Approved Site Planting List**
- **Table 2. Results of Plant Survivorship Monitoring (2007, 2008, 2009)**
- **Table 3. Summary of Year 2 Performance (2009)**
- **Table 4. Recommended Replacement Plantings, Year 2 (2009)**

APPENDICES
- **Appendix A. Site Photographs**

1.0 EXECUTIVE SUMMARY

This report documents the 2012 (Year 5) monitoring for the University of California, Berkeley's Village Creek restoration project located in Albany, California. The project is located near the University of California, Berkeley's University Village student housing complex located at 1125 Jackson Street in Albany California, bounded on the east by San Pablo Avenue, on the north by Buchanan Street, on the south by Harrison Street, and on the west by the Union Pacific Railroad tracks (Figure 1). The Creek Day-lighting project area encompasses 22,500 square feet of restored creel channel (approximately 0.52 acres).

The project is subject to the following environmental permits and agreements:

- California Regional Water Quality Control Board, Water Quality Certification (File No. 01-02-C0829);
- U.S. Army Corps of Engineers Section 404 Clean Water Act, Nationwide Permit 7 (File No. 29071S); and
- Department of Fish and Game, Lake and Streambed Alteration Agreement (Notification No. 1600-2004-0664-3).

These permits and agreements require UC Berkeley to conduct plantings described above, in conformance to Village Creek Planting Sheet L7.02, included in the construction design drawings dated September 9, 2004 (Figure 2). The creek restoration site was graded and irrigation installed in September and early October 2007. The site was planted in early October 2007, with plantings completed by October 10, 2007(T. Nowack, pers. comm.). Restoration plantings included tree and shrub planting and hydroseeding, as described in project design drawings and specifications. Following the baseline site assessment in January 2008, replacement plantings were installed to replace diseased or damaged plants. A total of 51 replacement plantings were installed in early 2008, another 67 willow stakes and 151 rooted plants were installed in April and May 2010, and another 91 plants installed in October 2011.

The following performance criteria were established for the project:

> "All plantings shall have a minimum of 80% survival at the end of 5 years and shrubs shall attain 70% cover after 3 years and 75% cover after 5 years. If the… (*Sic* project is not attaining) …the stated percentage survival and/or cover requirements, the Applicant is responsible for replacement plantings, additional watering, weeding, invasive exotic eradication, or any other practice, to achieve these performance goals. Replacement plantings shall be monitored with the same percents survival and growth requirements for five years after planting as the original plantings."

Following plant installation, a 5 year monitoring and plant maintenance program is required by project permits to help ensure the project is successful. This 5-year monitoring period was extended to 2014 to account for replacement plantings that were installed as a result of insufficient performance reported in 2009-2010. Loran May, Senior Biologist with May &

Associates, Inc. has performed all necessary monitoring to date. Baseline monitoring was performed on January 4, 2008; Year 1 monitoring was performed on October 1, 2008; Year 2 monitoring was performed on September 24, 2009; Year 3 monitoring was performed on September 30, 2010, Year 4 monitoring was performed on October 19, 2011, and Year 5 monitoring was performed on October 10, 2012. The following summarizes the Year 5 results.

Plant Survivorship: A total of 107 trees were live as of the October 2012 monitoring site visit (Table 3), a survivorship rate of 116% (due to installation of replacement trees in April and May 2010). Additional monitoring of the replacement trees to 2014 is required to ensure trees have established properly and meet the 80% survivorship requirement for the entire project. A total of 74 trees (i.e. 80% of the original 92 trees installed onsite) will be required to be live at the end of the extended monitoring period in 2014.

Shrub survivorship (if natural regenerating species are included in the survivorship counts) was estimated at 350% in October 2012, well above Year 5 performance standards. This better-than-anticipated result is due to the natural spread of just two species, marsh baccharis *(Baccharis douglasii)* and coyote bush (*Baccharis pilularis* and *Baccharis pilularis* var *pilularis*- dwarf form) as well as 2010 and 2011 replacement shrub plantings. If volunteer marsh baccharis and coyote bush plants are excluded from survivorship counts, this represents a survivorship rate of 107%, well in excess of the 80% performance standard for Year 5.

The observed high shrub survivorship recorded in 2011 and 2012 is due in part to the replacement planting of 138 shrubs installed in April and May 2010 and 91 replacement plants in October 2010; these additional shrubs will have to monitored for additional years to help ensure project conditions are met. A total of 225 shrubs (i.e. 80% of the original 281 shrubs installed onsite) will be required to be live at the end of the extended monitoring period in 2014.

Vegetation Cover: Overall, hydroseeded areas had good grass and forb establishment, estimated at 90-95% cover all years, including 95% in Year 5 (October 10, 2012), 95% in Year 4 (October 19, 2011); 90-95% in Year 3 (September 30, 2010); 90-95% in Year 2 (September 24, 2009) and 90% in Year 1 (October 2008). This is an increase over baseline site conditions of 90% cover that was recorded in January 2008. The 2012 Year 5 observed vegetation cover exceeds Year 5 performance standards for the project. Vegetation cover of grasses and forbs is so thick that some weeding around shrub planting sites was recommended in early 2010 to reduce competition. Mulch (bark) was added around many planting basins in 2011 to reduce competition from annual grasses and forbs.

Plant Height: The 2012 Year 5 observed plant height had increased every year as compared with the January 2008 (Baseline) plant height, and is within the acceptable range at this time for the project.

To date, the project has met Year 5 performance requirements for all plantings except replacement plantings installed in 2010. Therefore, starting in 2013, only replacement plantings will be monitored. Replacement planting will continue to be monitored for 5 years, until 2014. Supplemental water to original plantings can now be tapered off, and discontinued.

The following remedial actions are recommended for planted tree and shrub species to keep the project on track to meet Year 5 performance criteria, as described below in Section 5.0.

> ***Remedial Action 1: Continue to Monitor Replacement Plants.*** As per project permit requirements, the replacement plantings installed in April and May 2010 will be monitored for a period of 5 years, beginning in 2010 and ending in 2014. **Starting in 2013, only replacement plantings will be monitored.**
>
> ***Additional Recommendation: Continue to Control Invasive Plants.*** As part of remedial actions, invasive plants that are encountered during weeding and replanting efforts should be treated. If herbicide application is selected, a qualified certified herbicide applicator is required to perform this activity.

2.0 INTRODUCTION

This report documents the results of the October 10, 2012 (Year 5) vegetation monitoring for the University of California, Berkeley's Village Creek restoration project located in Albany, California. The Creek Day-lighting project area encompasses approximately 750 linear feet of Village Creek that used to run through a culvert.

2.1 Project Location

The project is located near the University of California, Berkeley's University Village student housing complex located at 1125 Jackson Street in Albany California, bounded on the east by San Pablo Avenue, on the north by Buchanan Street, on the south by Harrison Street, and on the west by the Union Pacific Railroad tracks (Figure 1).

2.2 Project Background

The creek restoration project is part of a larger housing construction project. The project goal is to replace student housing that has surpassed its design lifetime. The project has been designed to provide treatment of stormwater runoff and to improve the habitat value and flood conveyance capacity of Codornices and Village Creeks.

Step 1 of the University Village student housing project was completed in 1999 included restoration of the section of Village Creek between Jackson Street and 6th Street to an open channel. At the downstream end of the restored channel, a box culvert was installed to provide conveyance for Village Creek, and access for emergency equipment.

The Step 2 University Village student housing project encompasses about 19 acres and includes demolition of old housing units, and construction of apartments, streets and parking areas. Step 2 of the project also includes day-lighting, and restoring approximately 750 linear feet of Village Creek that used to run through a culvert. The creek was constructed by removing the concrete culvert, and excavating a new channel consisting of a stepped floodplain (i.e. low flow and high flow creek channels sized for a 100-year flood event). Several outfall structures including rock energy dissipater structures were constructed in the restored creek channel. The low and high flow creek channels were revegetated with riparian vegetation, and biodegradable erosion control matting was placed in the steep banks to prevent erosion while plants are establishing, The restored creek channel, when completely restored, will create approximately 0.52 acre of riparian habitat.

The project is subject to the following environmental permits and agreements:

- California Regional Water Quality Control Board, Water Quality Certification (File No. 01-02-C0829);
- U.S. Army Corps of Engineers Section 404 Clean Water Act, Nationwide Permit 7 (File No. 29071S); and
- Department of Fish and Game, Lake and Streambed Alteration Agreement (Notification No. 1600-2004-0664-3).

These permits and agreements require UC Berkeley to conduct creek restoration activities, in conformance with Village Creek Planting Sheet L7.02, included in the construction design drawings prepared by J.R. Roberts Corporation dated September 9, 2004 (J.R. Roberts Corporation, 2004) (Figure 2). Approved creek restoration activities included tree and shrub planting and hydroseeding both the upper and lower creek banks. Plantings that were installed in the restored creek channel are presented in Table 1. The upper creek banks were required to be hydroseeded with 50 lbs per acre of an approved mixture of upland grasses and forbs, as shown in Table 1. The lower creek banks were to be hydroseeded with 49 lbs of a mixture of floodplain grass and forb species (Table 1). (J.R. Roberts Corporation. 2007).

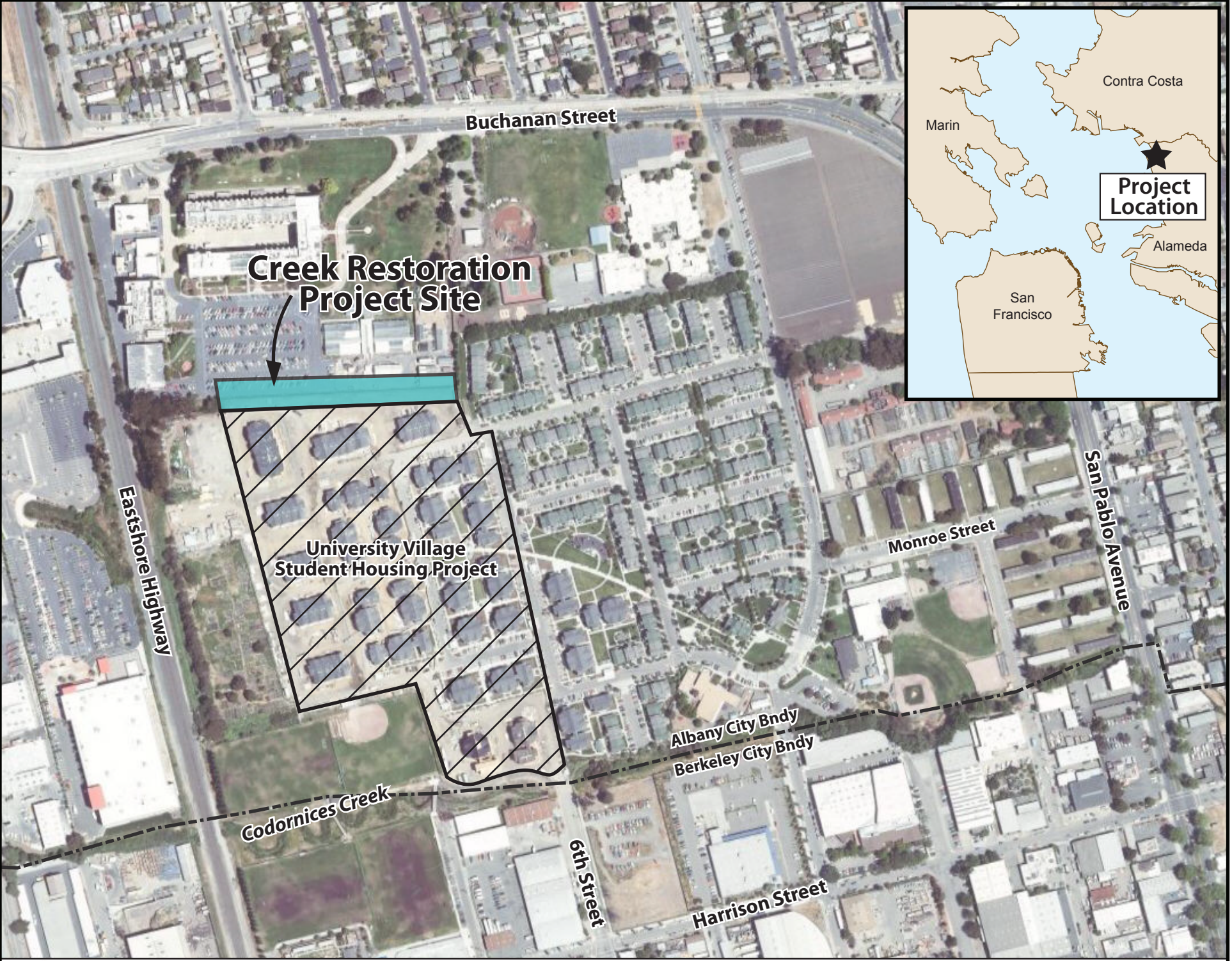
The creek restoration site was constructed in 2007 according to specifications (J.R. Roberts Corporation, 2004) (Figure 2). The site was prepared for planting in late September and early October 2007, and plant installation was completed by October 10, 2007 (T. Nowack, pers. comm.). The site was also hydroseeded in October 2007. In early 2008 following completion of baseline site assessment, replacement plantings were installed to replace diseased or damaged plants. A total of 51 replacement plantings were installed in early 2008. An additional 67 willow stakes and 151 rooted plants were installed in April and May 2010; and 91 replacement shrubs were installed in October 2011 to offset ongoing plant mortality.

The University of California, Berkeley Capital Project retained the service of May & Associates, Inc. to conduct an independent assessment of baseline site conditions and to perform 5 years of performance monitoring for the project, and the additional years of monitoring for the replacement plantings. This report documents the results of the Year 5 performance monitoring that was conducted by May & Associates, Inc. on October 10, 2012

Table 1. Original Approved Site Planting List

Plant Species		Container Size	Quantity
Scientific Name	**Common Name**		
TREES			
Acer macrophyllum	Bigleaf maple	15 gal.	7
Aesculus californica	California buckeye	5 gal.	4
Populus fremontii	Fremont's cottonwood	5 gal.	9
Quercus agrifolia	Coast live oak	15 gal	12
Sambucus caerulea*	Blue elderberry	1 gal	59 (66)*
SHRUBS			
Baccharis douglasii	Marsh baccharis	1 gal	51
Baccharis pilularis	Coyote bush	1 gal	23
Baccharis pilularis ssp. pilularis (dwarf form)	Dwarf coyote bush	1 gal	26
Diplacus aurantiacus	Sticky monkey flower	1 gal	69
Mimulus gutattus	Monkey flower	1 gal	50
Perideridia kelloggii*	Kellogg's yampah	1 gal	46 (39)*
Rosa californica	California wild rose	1 gal	23
Total Shrub And Tree Plantings			**379**
*Note- It appears 7 *Sambucus mexicana* were planted instead of 7 *Perideridea kelloggii*			
UPPER CREEK BANK HYDROSEED MIXTURE (50 LBS/ACRE)			
Bromus carinatus	California brome grass	n/a	8
Elymus glaucus	Blue wildrye	n/a	8
Hordeum brachyantherum ssp. californicum	California barley	n/a	8
Fesctuca idahoensis	Idaho fescue	n/a	4
Nasella pulchra	Purple needlegrass	n/a	4
Poa secunda	Sandberg bluegrass	n/a	3
Eschscholtzia californica	California poppy	n/a	2
Baccharis pilularis ssp. pilularis (dwarf form)	Dwarf coyote bush	n/a	3
Lasthenia glabrata	Goldfields	n/a	1
Lupinus nanus	Sky lupine	n/a	3
Clarkia purpurea	Clarkia	n/a	2
Trifolium wildenovii	Tomcat clover	n/a	4
Total lbs/acre Upper Creek Bank			**50**
LOWER CREEK BANK HYDROSEED MIXTURE (49 LBS/ACRE)			
Agrostis pallens	Seashore bentgrass	n/a	6
Elymus glaucus	Blue wildrye	n/a	8
Hordeum brachyantherum	Meadow barley	n/a	8
Festuca rubra	Red fescue	n/a	6
Deschampsia caespitosa	Tufted hairgrass	n/a	5
Aster chilensis	California aster	n/a	2
Baccharis douglasii	Marsh baccharis	n/a	2
Epilobium cililatum	Fringed willowherb	n/a	4
Cyperus eragrostis	Umbrella sedge	n/a	3
Juncus effusus	Common rush	n/a	1.5
Scirpus maritimus	Alkali bulrush	n/a	3.5
Total lbs/acre Lower Creek Bank			**49**

Figure 1. Project Location



May & Associates, Inc.
182 Seal Rock Drive ~ San Francisco, CA 94121
(415) 391-1000 ~ www.mayandassociatesinc.com
January 2008 ss_villcrk_fig01_01-08

0 250 500 ft
0 100 200 m

North

Figure 1. Project Site

Figure 2. Planting Plan and Permanent Photomonitoring Locations

Figure 2. Planting Plan & Photo Monitoring Locations

SHRUBS Number Scientific Name / *Common Name*

- B DOU 51 (Baccharis douglasii / *Marsh Bacc.)*
- B PIL 23 (Baccharis pilularis / *Coyote Bush)*
- B PIL PIL 26 (Baccharis pilularis ssp. pilularis / *Dwarf Coyote Bush)*
- D AUR 69 (DiplacusI aurantiacus / *Sticky Monkey Flower)*
- M GUT 50 (Mimulus guttatus / *Monkey Flower*)
- P KEL 46 (Perideridea kelloggii / *Keollogg's yampah*)
- R CAL 23 (Rosa californica / *California Wild Rose*)
- S COE 59 (Sambucus caerulea / *Elderberry*)

TREES Number Scientific Name / *Common Name*

- AM 7 (Acer Macrophyllum / *Big Leaf Maple)*
- AC 4 (Aesculus Californica / *California Buckeye*)
- PF 9 (Populus Fremontii / *Fremont's Cottonwood*)
- QA 12 (Quercus Agrifolia / *Coast Live Oak)*

STUDY AREA BOUNDARY

CREEK

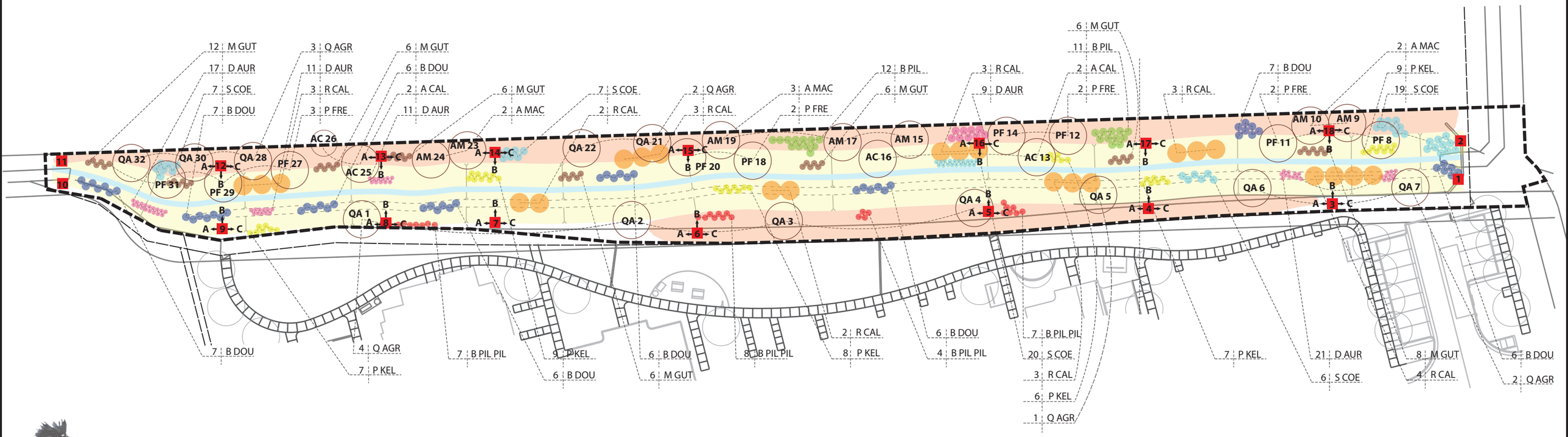
LOW CREEK CHANNEL

HIGH CREEK CHANNEL

(Point Number) A←13→C

(Direction of Shot) B

PHOTO POINT



May & Associates, Inc.
182 Seal Rock Drive ~ San Francisco, CA 94121
(415) 391-1000 ~ www.mayandassociatesinc.com

January 2008 ss_villcrk_fig02_01-08

0 50 100 ft
0 15 30 m

North

3.0 MONITORING METHODS

Vegetation monitoring requirements are stated in the following project permits:

- California Regional Water Quality Control Board, Water Quality Certification (File No. 01-02-C0829);
- U.S. Army Corps of Engineers Section 404 Clean Water Act, Nationwide Permit 7 (File No. 29071S); and
- Department of Fish and Game, Lake and Streambed Alteration Agreement (Notification No. 1600-2004-0664-3).

Specifically, vegetation monitoring includes plant survivorship, vegetative cover, and plant height as three measures of success.

Year 5 Monitoring was performed by Loran May, President and Senior Botanist with May & Associates on October 10, 2012. The entire site was investigated on foot, and a plant count of the entire planting area was conducted. Each plant that was originally installed in October 2007 and January 2008, as well as replacement plantings installed in October 2008; April and May 2010; and October 2011 were assessed for health and vigor, height, and its species recorded for use in assessing progress towards performance criteria (described below).

3.1. Plant Survival

The permit performance criteria for plant survival is as follows: **80% survival of all plantings at the end of five years.** Plant survival counts entail conducting a complete inventory of all plantings at the site. Each tree and shrub planting was identified by species, recorded as alive or dead. Survival and mortality of hydroseeded areas was visually estimated as a percentage of overall vegetative cover.

3.2 Vegetative Cover

Project permits include performance criteria for vegetative cover as follows: **70% cover at Year 3, and 75% at the end of 5 years**. Vegetative cover was visually estimated for the upper and lower creek bank areas, and then averaged for the entire site.

3.3 Plant Height

The U.S. Army Corps of Engineers Nationwide Permit 7 and the California Department of Fish and Game Streambed Alteration Agreement also include a requirement to monitor plant height for trees and shrubs. No parameters were given for standards of performance; however, an increase in height in line with other planting sites in the region is the anticipated outcome of the project. Average height of living trees and shrubs were recorded to the nearest half of a foot using visual estimates and recorded on field data sheets.

3.4 General Site Observations

Prior to conducting plant survival counts, the site was thoroughly investigated on foot to record possible maintenance problems, trespass issues, weed problems, irrigation issues, or other factors that may have bearing on the site's overall habitat function or value.

4.0 MONITORING RESULTS

4.1 Plant Survival

Refer to Table 2 below for an overview of Year 5 (October 19 2012) survivorship monitoring results presented by species.

Of the 92 trees that were installed as per the original restoration plan, 24 trees were still alive at the end of 2009. A total of 80 replacement trees (i.e. 67 willows, 3 Fremont's cottonwoods, 9 coast live oak, and 1 white alder) were installed in April and May 2010 to offset tree losses to date. This represents overplanting of the required trees as specified in the original site restoration plan, but was determined to be the best 'field fit' to match site conditions and to help ensure a balanced number of tree species onsite, and a functioning riparian ecosystem by the end of the project. Most of the additional trees planted were willows, intended to establish riparian trees along the low flow creek channel. Replacement plantings were approved by the permitting agencies in advance of implementation.

A total of 107 trees were live as of the October 2012 monitoring site visit (Table 3), a survivorship rate of 116% (due to installation of replacement trees in 2010). Additional years of monitoring of the newly planted replacement trees is required to ensure trees have established properly and meet the 80% survivorship requirement for the entire project. A total of 74 trees (i.e. 80% of the original 92 trees installed onsite) will be required to be live at the end of the extended monitoring period in 2014.

As of October 2012, a total of 881 shrubs (including 303 original planitngs, 138 replacement shrubs were installed in April and May 2010, 91 replacement shrubs installed in October 2011, and an estimated 349 "extra" volunteer marsh baccharis that had spread from the original marsh baccharis and coyote bush were counted as live. Shrub survivorship (if natural regenerating species are included in the survivorship counts) was estimated at 350% in October 2012, well above Year 5 performance standards. This better-than-anticipated result is due to the natural spread of just two species, marsh baccharis *(Baccharis douglasii)* and coyote bush (*Baccharis pilularis* and *Baccharis pilularis* var *pilularis*- dwarf form) as well as replacement shrub plantings. If volunteer marsh baccharis and coyote bush plants are excluded from survivorship counts, this represents a survivorship rate of 107%, well in excess of the 80% performance standard for Year 5.

A total of 281 shrubs were originally called for in the restoration plan. Only 99 of the original shrubs installed onsite (excluding natural spread of marsh baccharis and coyote bush) were alive by the end of 2009. To create a more sustainable species mix at the site, a total of 138 replacement shrubs were installed in April and May 2010 and an additional 91 shrubs were installed in October 2011. Replacement plantings were approved by the permitting agencies in advance of implementation.

The observed high shrub survivorship recorded in 2011 and 2012 is due in part to replacement planting installed in 2010 and 2011; these additional shrubs will have to monitored for additional years to help ensure project conditions are met. A total of 225 shrubs (i.e. 80% of the original 281

shrubs installed onsite) will be required to be live at the end of the extended monitoring period in 2014.

Table 2. Summary of Survivorship Monitoring (Year 5)

Plant Species		Baseline Monitoring Results (Jan 2008)	Year 1 (October 2008)	Year 2 (Sept 2009)	Year 3 (Sept 2010)	Year 4 (Oct 2011)	Year 5 (Oct 2012)
Scientific Name	**Common Name**						
TREES							
Acer macrophyllum	Bigleaf maple	7	7	2	1	2	2
Aesculus californica	California buckeye	4	4	2	1	1	1
Populus fremontii	Fremont's cottonwood	9	9	9	12	12	12
Quercus agrifolia	Coast live oak	12	12	11	20	19	21
Sambucus caerulea/ Sambucus mexicana	Blue elderberry/ Mexican elderberry	58	3	0	0	0	0
Alnus rhombifolia	White alder				1	9	9
Salix sp.	Willows				65	64	62
SHRUBS							
Baccharis douglasii	Marsh baccharis	42	**76	400**	580**	650**	600**
Baccharis pilularis	Coyote bush	23	**32	47**	56**	68**	69**
Baccharis pilularis ssp. pilularis (dwarf form)	Dwarf coyote bush	24	14	13	33	30	30
Diplacus aurantiacus	Sticky monkey flower	64	31	24	20	32**	28**
Mimulus gutattus	Monkey flower	30	0	0	0	0	0
Perideridia kelloggii	Kellogg's yampah	29	0	0	0	0	0
Rosa californica	California wild rose	20	1	1	3	20**	21**
Scrophularia californica	California bee plant				47	45	42
Artemisia douglasiana	Mugwort				30	48**	45**
Heteromeles arbutifolia	Toyon				9	9**	9**
Rubus ursinus	California blackberry				21	28**	27**
Total Shrub And Tree Plantings Alive		**322**	**189**	**509**	**899****	**1,037****	**872****
**2012 plant totals include 2010 and 2011 replacement plantings and volunteer plants spreading naturally from planted stock.							

No additional remedial actions are required for 2012. Refer to Section 5.0 Conclusions and Discussion below for more information about ongoing remedial actions. Additional years of monitoring will be required for the replacement plantings as per project permit requirements, to 2014.

4.2 Vegetation Cover

Year 5 vegetation cover was visually estimated for upper creek banks and for lower creek banks that were hydroseeded in October 2007. By October 2012, both upper and lower creek bank areas were heavily vegetated with grasses and flowering annual plants, with observed vegetation cover at 95% for upper creek banks, and 95% for lower creek banks (Photos 1a, 1b). Please note that the site was mowed at the time of the survey, so photographs may not accurately represent vegetative cover. Also note that in some locations there was a great increase in in-channel plant cover from cattails, umbrella sedge, and rushes: for consistency, these plants were not included in the Year 5 2012 cover estimates for the lower creek banks.

The observed Year 5 cover meets or exceeds the Year 5 performance standards for the project. No remedial actions are necessary at this time for this monitoring parameter. Weeding or future mowing may be desirable around shrub planting sites to reduce competition from hydroseeded grasses and forbs. Weeding or clearing of cattails and other aquatic plants may be required to keep the creek channel function properly for floodwater conveyance, a maintenance activity that is not related to site restoration.

Photo 1a. Year 5 (2012). Typical vegetation cover, upper and lower creek banks

Photo 1b. Baseline (January 2008). Typical vegetation cover, upper and lower creek banks after planting

4.3 Plant Height

Baseline results were visually compared against each year's result to determine if there is an overall increase in plant height over time.

Baseline plant height for the originally installed shrubs averaged 8 inches. By October 2008, these original shrub plantings were considerably taller, estimated at an average height of 11 inches. In Year 2 (September 2009), shrubs were estimated at 13 inches in height, a steady increase over Year 1 and baseline conditions. By 2010 (Year 3), shrubs were estimated at between 13 and 16 inches, and many shrubs have reached their expected mature plant height. In Year 4 (2011), shrubs were estimated at between 1.5 (for prostrate baccharis) and 5 feet in height (the tallest shrubs being coyote brush which increased substantially in height in 2011). In Year 5 (2012), shrubs were estimated at 1.5 feet for prostrate baccharis and newly planted shrubs), and 7 feet for the tallest shrubs observed (e.g., coyote brush). This represents a yearly increase in plant height for all monitoring years.

Baseline tree height for the original tree planting varied from 4 to 5.5 feet for smaller trees such as bigleaf maple and California buckeye, to from 7 to 9.5 feet for larger trees such as Fremont's cottonwood (Photo 2a-2d), and coast live oak (Photos 3a-3e). In Year 1 (2008), tree height had increased to 4 to 6 feet for smaller trees such as bigleaf maple, and 8 to 11 feet for larger trees such as coast live oak and Fremont's cottonwood. In Year 2 (2009), tree height of remaining live trees was estimated at 4.6 to 6 feet for smaller trees and 8 to 16 feet for larger trees. In particular, Fremont's cottonwood had increased substantially in height to an average of 12.5 feet, up from the 10.5 feet reported in 2008. By Year 3 (2010) tree height had again increased for all remaining trees, with smaller trees at 4.5 to 6.5 feet; larger trees at 8-17 feet. In Year 4 in 2011, original planting tree height had continued to increase for all remaining trees, with smaller trees at 5 to 8 feet; larger trees at 8-22 feet. By Year 5 (2012), original planting tree height had continued to increase for all remaining trees, with smaller trees at 5 to 9 feet; larger trees at 8-30

feet. The net increase in height of remaining live trees is a positive indicator that remaining trees will reach stated goals by the end of the program.

In addition to original tree plantings, an additional 80 trees (i.e. 67 willow stakes and 13 rooted tree stock of other species) were installed in April and May 2010 to offset past tree mortality. Replacement trees will be monitored for an additional 4 years, with the 2010 data representing baseline conditions for tree height. Baseline 2010 conditions for replacement shrub plantings was recorded at 6-12 inches for rooted coast live oak, and Fremont's cottonwood, and 12-20 inches for willow stakes. 2011 replacement trees were estimated at 12-18 inches for rooted coast live oak and Fremont's cottonwood, and 2-8 feet for willow stakes. By 2012, replacement trees were estimated at 2-3.5 feet for rooted coast live oak and Fremont's cottonwood, and 5-17 feet for willow stakes, a substantial increase over 2010 baseline conditions.

Photo 2a. Year 5 (October 2012) site conditions.
Typical Fremont's cottonwood average tree height (est. at 9-30 feet for cottonwoods).
Note Height increase, robust growth and excellent condition of cottonwood trees.

Photo 2b. Year 4 (October 2011) site conditions.

Photo 2c. Year 3 (September 2010) site conditions.
Typical Fremont's cottonwood average tree height (est. at 9-17 feet for cottonwoods).
Note height increase, robust growth and excellent condition of cottonwood trees.

Photo 2d. Year 2 (September 2009) site conditions.
Comparison Photo, Typical Fremont's cottonwood (est 12 feet in 2009)

Photo 3a. Year 5 (October 2012) site conditions.
Typical original coast live oak planting showing average tree height (est. at 9-15 feet), replacement oak plantings 1.5-5 feet.

Photo 3b. Year 4 (October 2011) site conditions.
Typical coast live oak planting showing average tree height (est. at 8-13.5 feet).

Photo 3c. Year 3 (September 2010) site conditions.
Typical coast live oak planting showing average tree height

Photo 3d. Year 2 (September 2009) site conditions.
Comparison photo: Typical coast live oak planting 2009

Photo 3e. Baseline (January 2008) site conditions.
Typical coast live oak planting showing baseline for average tree height (est. at 7 to 9.5 feet in 2008).

Photo 4. Year 5 (2012). Replacement planting (mugwort, marsh baccharid) showing natural regeneration (outward spread) from original planting site.

Photo 5. Year 5 (2012).
Photo depicting increase in height of both shrubs (coyote bush, background) and trees (coast live oak-foreground, alder- left)

Photo 6b. Substantial increase in number and size of alders in 2012 (compare with Photos 6b below).

Photo 6b. Substantial increase in number and size of alders in 2011.

Photo 7a. Creek channel showing excessive growth of cattails and other aquatic vegetation (2012). (Compare with Photo 7b below)

Photo 8. Typical channel conditions in 2011-cattails covering most of creek channel bottom.

The Year 5 (2012) observed plant height is within the acceptable range at this time for the project. No remedial actions are necessary at this time for this monitoring parameter.

4.4 General Site Observations

In October 2012, there was no evidence of unusual erosion, trespass, litter, or other site problems or issues that would require attention.

4.4.1 Invasive Plants. UC Berkeley has conducted invasive plant control in 2010, 2011, and again in 2012, resulting in a substantial reduction of several invasive species that were identified as problematic in the Year 2 (2009) report, including French broom, fennel, sweet clover, and Himalayan blackberry. Some of these species were still detected as present in 2012 (French broom, fennel, Himalayan blackberry), but in very small numbers. These

species should be continued to be monitored in future years to prevent re-infestation if the site.

Several invasive plant species still remain at the site, including the following that were recorded as present in 2012:

- Acacia *(Acacia melanoxylon);*
- Blue gum eucalyptus *(Eucalyptus globulus);*
- Burr clover *(Medicago polymorpha;*
- Canary reed grass *(Phalaris* sp.);
- Cattails (*Typha* spp.);
- Duckweed *(Lemna* sp.*);*
- English plantain *(Plantago lanceolata);*
- Fennel *(Foeniculum vulgare);*
- Fireweed *(Epilobium sp.);*
- French broom *(Genista monspessulana);*
- Himalayan blackberry *(Rubus discolor= Rubus armeniacus)*;
- Nasturtium *(Nasturtium officinale);*
- Pampas grass *(Cortaderia* sp.);
- Prickly ox tongue *(Picris echioides);*
- Sweet clover *(Melilotus indicus);*
- Umbrella sedge *(Cyperus* sp.); and
- White clover *(Trifolium* sp.).

A few of these species were reported in past monitoring years, and continue to be problematic at the site in 2011 (i.e. acacia, prickly ox tongue, canary reed grass). These species are of concern because they are known to be problematic at similar riparian habitats in the area, spreading rapidly and displacing native plants. The remaining invasive species listed above are either not problematic at present (i.e. blue gum eucalyptus), or are just beginning to establish at the site (i.e., most are seedlings or young plants). Ongoing invasive plant treatment is recommended to prevent invasive plants from becoming established or re-established at the site. Invasive plants should be removed (hand or machine pulled, root and all), or cut, then painted with herbicides (most likely glyphosate).

4.4.2 Annual Grasses and Flowering Plants in Hydroseeded Areas. Annual grasses and flowering plants observed in hydroseeded areas had vigorous growth, and there was evidence of flowering and/or seed set in all monitoring years, including 2011, indicating overall health of these plants. Overall, the hydroseed mixtures used in the upper and lower creek bank areas appears to conform to the approved planting plan prepared by J.R. Roberts Corporation. Hydroseeded areas of both the upper and lower creek bank areas have an acceptable vegetative cover of grasses and forbs. The site was mowed, and should be mowed and/or weeded again in 2012 around the shrub planting sites to help reduce competition from annual grasses and flowering plants.

4.4.3 Planted Trees and Shrubs. Shrub and tree plantings in general appear to conform to the approved planting plan (Sheet L7.01, prepared by J.R. Roberts Corporation). Planted trees were reported to be not doing well by 2009. Of the 92 trees that were installed as per the original restoration plan, 24 trees were still alive at the end of 2009. In response, a total of 80 replacement trees (i.e. 67 willows, 3 Fremont's cottonwoods, 9 coast live oak, and 1 white alder) were installed in 2010 to offset high tree mortality. This represents overplanting of the required trees as specified in the original plan, but was determined to be the best 'field fit' to match site conditions and to help ensure a balanced number of tree species onsite, and a functioning riparian ecosystem by the end of the project. Willows were installed in the low flow channel to help increase the diversity of the structure and function of the riparian woodland near the active creek channel. Willow cuttings were collected from nearby locations and installed onsite, immediately above the active flow channel of the creek. Most of the remaining original tree plantings observed in 2011 were taller than the same trees as observed in January 2008, indicating healthy growth of remaining planted trees. The replacement tree plantings were also present and increasing in height in 2011. These replacement trees will be monitored for an additional 4 years, from 2010 until 2014. A total of 74 trees (i.e. 80% of the original 92 trees installed onsite) will be required to be live at the end of the extended monitoring period in 2014.

As reported in 2009, some planted shrubs, including marsh baccharis *(Baccharis douglasii)*, coyote bush *(Baccharis pilularis),* and California wild rose *(Rosa californica)* are continuing to establish and spreading naturally onsite, resulting in a substantial net increase in the number of plants over those planted as part of the project. Seedlings of the same species were observed adjacent to the planted material, indicating spreading via natural regeneration from the planted material. In contrast, other planted shrubs were reported to have unexpectedly low survival rates by 2009 (and again in 2010 and 2011), with few or none of the original planted material present. A total of 281 shrubs were originally called for in the restoration plan. Only 112 of the original shrubs installed onsite (excluding natural spread of marsh baccharis and coyote bush) were alive by the end of 2009. Shrubs with low survival rates included Monkey flower *(Mimulus guttatus),* Kellog's yampah *(Perideridea kellogii),* elderberry *(Sambucus caerulea*), and California wild rose *(Rosa californica).* Sticky monkey flower *(Diplacus aurianticus)* was also in decline by 2009. Supplemental plantings of different shrub or tree species was recommended in the 2009 report to offset these losses and to help ensure a diversity of shrub species at the site.

A total of 138 replacement shrubs were installed in April and May 2010 and 91 shrubs in October 2011. These plants included recommended substitute plantings of certain species that had low survivorship rates over multiple years; substitute plantings were approved by the permitting agencies. The replacement shrubs will be monitored for additional years to help ensure project conditions are met. A total of 225 shrubs (i.e. 80% of the original 281 shrubs installed onsite) will be required to be live at the end of the extended monitoring period in 2014.

5.0 CONCLUSIONS AND RECOMMENDATIONS

In conclusion, the Village Creek site was planted in accordance with approved design drawings and specifications. Refer to Tables 3 and 4 for a summary of Year 4 performance as compared to overall project performance standards.

Vegetation cover exceeds Year 5 requirements. The site was hydroseeded with a seed mixture that was approved by the University of California, Berkeley. Overall, hydroseeded areas had good grass and forb establishment, estimated at 90-95% vegetative cover at the time of the 2009site survey. The Year 5 observed vegetation cover exceeds performance standards for the project. No remedial actions are required.

The Year 5 observed plant height is within the acceptable range at this time for the project. No remedial actions are required.

Year 5 tree and shrub survivorship standards were met, but only as a result of replacement plantings. These replacement plantings will have to be monitored for an additional 4 years to meet project permit requirements. A total of 74 trees (i.e. 80% of the original 92 trees installed onsite) and 225 shrubs (i.e. 80% of the original 281 shrubs installed onsite) will be required to be live at the end of the extended monitoring period, in December 2014.

To date, the project has met Year 5 performance requirements for all plantings except replacement plantings installed in 2010. Therefore, starting in 2013, only replacement plantings will be monitored. Replacement planting will continue to be monitored for 5 years, until 2014. Supplemental water to original plantings can now be tapered off, and discontinued.

The following remedial actions are recommended for planted tree and shrub species to keep the project on track to meet Year 5 performance criteria, as described below in Section 5.0.

> *Remedial Action 1: Continue to Monitor Replacement Plants.* As per project permit requirements, the replacement plantings installed in April and May 2010 will be monitored for a period of 5 years, beginning in 2010 and ending in 2014. **Starting in 2013, only replacement plantings will be monitored.**
>
> *Additional Recommendation: Continue to Control Invasive Plants.* As part of remedial actions, invasive plants that are encountered during weeding and replanting efforts should be treated. If herbicide application is selected, a qualified certified herbicide applicator is required to perform this activity.

Table 3. Summary of Year 5 Performance (October 10, 2012)

Monitoring Parameter	Project Performance Standard	Observed Year 1 Site Conditions	Observed Year 2 Site Conditions	Observed Year 3 Site Conditions	Observed Year 4 Site Conditions	Observed Year 5 Site Conditions	Performance Standard Met? Y/N
Plant Survivorship	80% survival of all plantings by Year 5	100% Survivorship Trees, 49% Survivorship Shrubs	75% Survivorship Trees, 39% Survivorship Shrubs	110% Survivorship Trees (include replacement plantings), 96% Survivorship Shrubs (including replacement plantings and excluding volunteer plants)	109% Survivorship Trees (i.e. 107 trees present in 2011 of 92 originally installed), 330% Survivorship Shrubs (930 plantings and volunteers present in 2011 of 281 original shrub plantings)	109% Survivorship Trees (i.e. 107 trees present in 2012 of 92 originally installed), 313% Survivorship Shrubs (881 plantings and volunteers present in 2012 of 281 original shrub plantings)	**Y** However, additional monitoring of replacement plantings is required (from 2010 to 2014)
Vegetative Cover	70% vegetative cover by Year 3 75% vegetative cover by Year 5	90% Upper Creek Bank, 95% lower creek bank	90-95% Upper Creek Bank, 95% lower creek bank	90-95% Upper Creek Bank, 95% lower creek bank	95% Upper Creek Bank, 95% lower creek bank	95% Upper Creek Bank, 95% lower creek bank	**Y**
Plant Height	Overall Increase by Year 5	Tall Trees, 8-11 feet, Shrubs 11 inches	Tall Trees, 8-16 feet, Shrubs 12 inches	Original plantings: Trees, 8-17 feet, Shrubs 13 inches	Original plantings: Trees, 8-20 feet, Shrubs 1.5 to 5 feet	Original plantings: Trees, 8-30 feet, Shrubs 3 to 7 feet Replacement plantings: Trees 1.5 to 5.5 feet, shrubs 1.0 feet to 4.5 feet)	**Y**

Table 4. Summary of Survivorship and Replacement Plantings, (Year 5)

Plant Species		Original Plantings (Oct 2007)	Remedial Plantings (Installed April-May 2010)	Remedial Plantings (Installed October 2011)	Total Plants Live in 2008	TOTAL Plants Live in 2009+	TOTAL Plants Live in 2010+**	TOTAL Plants Live in 2011+**	TOTAL Plants Live in 2012+**
Scientific Name	**Common Name**								
TREES									
Acer macrophyllum	Bigleaf maple	7	0	0	7	2	1	2	2
Aesculus californica	California buckeye	4	0	0	4	1	1	1	1
Populus fremontii	Fremont's cottonwood	9	3	0	9	12	12	12	12
Quercus agrifolia	Coast live oak	12	9	0	12	19	20	19	21
Sambucus caerulea	Blue elderberry	59 (66 actual installed)*	0	0	3	0	0	0	0
Alnus rhombifolia	White alder	0	1	0		9	1	9	9
Salix sp.	Willow	0	67	0		64	65	64	62
Subtotal Trees		**91 (98)***			**98**	**107**	**100**	**107**	**107**
SHRUBS									
Baccharis douglasii	Marsh baccharis	51	0	0	76	51(650+)	51 (580+)	51(650+)	51 (600+)
Baccharis pilularis ssp. pilularis	Dwarf coyote bush	26	0	0	32 regular, 14 dwarf	26 (68+) regular, 33 dwarf	26 (59+) regular, 33** dwarf	26 (68+) regular, 33 dwarf	26 (69+ regular) 30 dwarf
Diplacus aurantiacus	Sticky monkey flower	69	0	30	31	32**	20	32**	28**
Mimulus gutattus	Monkey flower	50	0	0	0	0	0	0	0
Perideridia kelloggii	Kellogg's yampah	46 (39 actual installed)*		0	0	0	0	0	0
Rosa californica	California wild rose	23	0	20	1	20**	3	20**	21**
Scrophularia californica	California bee plant	0	50**	0	50	45	47**	45	42
Artemisia douglasiana	Mugwort	0	35**	30	0	48**	21**	48**	50**
Heteromeles arbutifolia	Toyon	0	10**	0	0	9**	9**	9**	9**
Rubus ursinus	California blackberry	0	25**	11	0	28**	21**	28**	27**
Subtotal Shrubs		**265**	**80**	**91**	**154****	**303 (930+**)**	**237 (799+**)**	**303 (930+**)**	**303(881+**)**
Total Shrub And Tree Plantings		**356**				**129 (509+)**	**410 (1,037+**)**	**410 (1,037+**)**	**354 (988+**)**

6.0 REFERENCES

6.1 Printed References

J.R. Roberts Corporation. 2004. Village Creek Planting Sheet L7.02 dated September 9, 2004.

J.R. Roberts Corporation. 2007. Village Creek Seed Mix for Village Creek (Submittal Package No 122-02920-01-006).

California Department of Fish and Game Streambed Alteration Agreement, Notification No. 1600-2004-0664-3 dated December 13, 2004.

California Regional Water Quality Control Board, Water Quality Certification No. 2198.11, Site No 01-02-C0829 Dated December 14, 2004.

U.S. Army Corps of Engineers, Section 404.Natonwide Permit No. 7 File # 29071S Dated December 11, 2004.

6.2 Personal Communications

Nowak, Tom. Project Coordinator, University Village, Albany, Step 2. Personal communication via email on 1-07-2008. tnowak@cp.berkeley.edu (510) 643-3303.

Pree, Stephen. University Village, Albany, Step 2. Personal communication regarding cessation of irrigation in 2009 during field meeting on September 24, 2009. stephenp@berkeley.edu

APPENDIX A. SITE PHOTOGRAPHS