



LIVE OAK ASSOCIATES, INC.

an Ecological Consulting Firm

CINNABAR HILLS GOLF CLUB YEARS 1-7 RIPARIAN MONITORING REPORT

Prepared by

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EXECUTIVE SUMMARY

In the summer and fall of 2007, Live Oak Associates, Inc., conducted Years 1-7 (depending on the site) riparian mitigation monitoring in the combination and riparian sites at Cinnabar Hills Golf Club. These surveys were conducted in accordance with the *Tradition Golf Club, Mitigation and Monitoring Plan* (H. T. Harvey and Associates 1996), which establishes a mitigation goal of 9.60 acres of onsite riparian habitat to be created. The purpose of the surveys was to determine if the combination and riparian mitigation areas have met their annual performance criteria. The riparian and combination mitigation areas were surveyed for tree and shrub survival from the previous years of plantings. Natural reproduction/recruitment and plant vigor/health were also recorded for the planted woody species. Tree height and basal area were collected for three percent of each tree species installed, which were randomly chosen.

Plant survival was monitored in twelve sites. Ten sites met the 80% survival performance criterion, and all remaining sites met the 60% mark. Replanting will be required at the two sites that fell below 80%. Natural reproduction/recruitment continued during this year's monitoring, particularly with the oak tree and shrub species. Tree height was monitored for all twelve of these sites, and eleven sites were monitored for basal area (sites subject to Year 3 and above monitoring). Forty-six of the 61 trees sampled met the required tree height for the site's respective monitoring year. Five of the eleven sites being monitored for basal area met the required criterion. Plant vigor and health of the surviving shrubs and trees was also monitored. Overall, 94.0% of these species were considered to have high vigor and health. During the 2007 monitoring, it was estimated that 10.17 acres of created riparian habitat were present.

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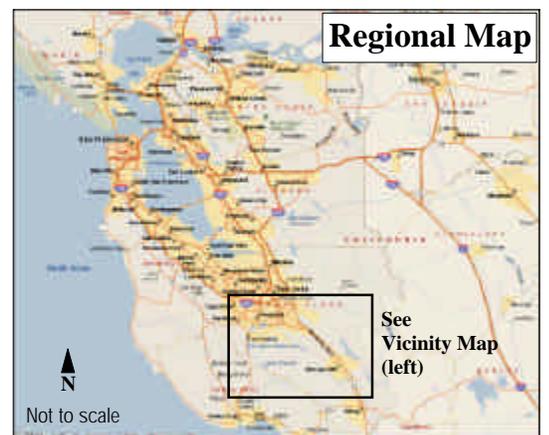
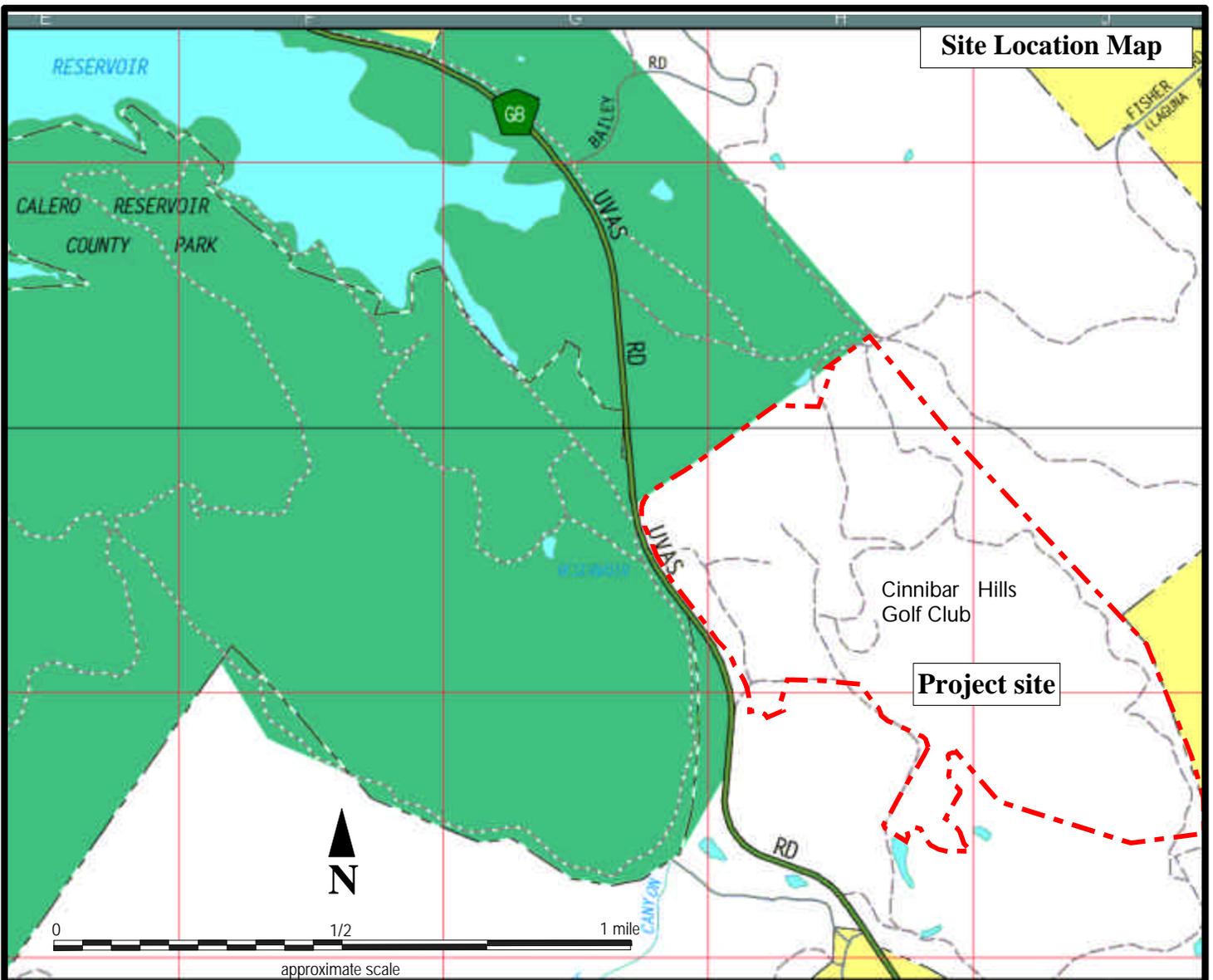
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1.0 INTRODUCTION

Cinnabar Hills Golf Club is a 347-acre site located southeast of Calero Reservoir in southern San Jose, Santa Clara County, California (Fig. 1). The parcel is bordered by McKean Road and Calero County Park on the west, Calero County Park and Santa Clara Valley Water District (SCVWD) property on the north, and undeveloped lands to the east and south. Elevations range from approximately 320 feet National Geodetic Vertical Datum (NGVD) to 780 feet NGVD. Five soil-mapping units have been identified on the site; these include Gaviota gravelly loam, 30 to 75 percent slopes; Hillgate silt loam, 2 to 9 percent slopes; Positas-Saratoga loams, 2 to 9 percent slopes; Vallecitos loam, 15 to 30 percent slopes; and Vallecitos loam, 50 to 75 percent slopes (NRCS 1958). These five units are not considered to be hydric, but hydric inclusions may occur where drainage is poor.

Cinnabar Hills Golf Club, in compliance with the requirements outlined in the *Tradition Golf Club, Mitigation and Monitoring Plan* (H. T. Harvey and Associates 1996), was required to create 9.60 acres of new riparian habitat within the project area. Mitigation sites consisted of either combination (wetland/riparian) areas or riparian areas. Combination areas were created by excavating streambanks in lower channel areas of the site. These combination areas were created in 1999, while the riparian vegetation was planted between 2000 and 2007. Riparian areas that had been destroyed due to years of agricultural uses were required to be restored and existing riparian habitat expanded to make up for the loss of riparian habitat; these areas were planted between 2001 and 2007. The final success criterion for the replacement riparian habitats is that 9.60 acres meet the criteria set by the *Mitigation and Monitoring Plan* within 10 years after installation.

Live Oak Associates, Inc. (LOA), surveyed the Cinnabar Hills Golf Club combination (wetland/riparian) mitigation areas and riparian mitigation areas during August and September of 2007 (Fig. 2). Depending on the site, Years 2, 3, 4, 5, 6 or 7 riparian mitigation monitoring was completed in order to determine if the mitigation areas met the established criteria (Table 1).



	Live Oak Associates, Inc.	
	Cinnabar Hills Golf Course Riparian Mitigation and Monitoring Site / Vicinity Map	
Date	Project #	Figure #
9/27/07	294-07	1



LEGEND

-  Project Boundary
-  Photo Observation Location, Direction, and Number
-  Combination Wetland/Riparian Mitigation Sites
-  Riparian Restoration Sites

Base Map courtesy:
H.T. HARVEY & ASSOCIATES



500' 0 500'
approximate scale

Live Oak Associates, Inc.

Cinnabar Hills Golf Club
Riparian Mitigation and Monitoring
and Photographic Observation Points

Date	Project #	Figure #
12/17/04	294-07	2

Table 1. Riparian monitoring criteria to be used in 2007 for the riparian and combination sites.

Monitoring Year	Riparian Site	Reason
Year 2	R8	Percent survival greater than 60%
Year 3	C3	Percent survival greater than 60%
Year 4	C7	Percent survival greater than 60%
Year 5	R6	Percent survival greater than 60%
	R9	Percent survival greater than 60%
	C18, R11	Percent survival greater than 60%
	R12	Percent survival greater than 60%
Year 6	R1	Percent survival greater than 60%
	R2, C2	Percent survival greater than 60%
	R3	Percent survival greater than 60%
	R4	Percent survival greater than 60%
	R5	Percent survival greater than 60%
Year 7	C1	Percent survival greater than 60%
	C4	Percent survival greater than 60%

2.0 RECAPITULATION OF THE MITIGATION AND MONITORING PLAN

The following is a précis of the mitigation and monitoring goals for the Cinnabar Hills Golf Course as documented in the *Tradition Golf Club, Mitigation and Monitoring Plan* (1996) and *Cinnabar Hills Golf Club As-Built Plan for Wetland Mitigation Sites* (2000), both prepared by H.T. Harvey and Associates. According to the plans, the riparian mitigation sites, including combination areas, will be monitored over a minimum of 10 years, annually in Years 1-6, and once in Years 8 and 10. By Year 10, the riparian mitigation sites should be sufficiently well-established to determine if they will reach their long-term goals with little chance of failure. The results of the monitoring in Year 10 will be compared to the final success criteria to determine if these criteria have been met. If the final success criteria have not been met at the end of the respective monitoring periods, monitoring will continue until they have been met.

2.1 FINAL SUCCESS CRITERIA

The final success criteria will be evaluated in the last year of the monitoring periods. The final riparian target functions and values include the following:

- **Percent Cover.** Percent cover will be used as a primary indicator of successful establishment of riparian habitat. The final percent cover goal is 50% native tree cover and 20% native shrub cover for the floodplain and slope associations and 35% native tree cover for the valley oak.
- **Basal Area.** Basal area provides a good measure of riparian forest biomass and tree diameter growth. The basal area goal is 15 ft.²/acre and shall be applied equally to all plant associations.
- **Tree Height.** Final tree height goals vary between species and reflect their different growth patterns (Table 2).

Table 2. Cinnabar Hills Golf Course tree height final goals.

Common Name	Scientific Name	Height (ft.)
California sycamore	<i>Platanus racemosa</i>	20
Mexican elderberry	<i>Sambucus mexicana</i>	10
California bay	<i>Umbellularia californica</i>	8
California buckeye	<i>Aesculus californica</i>	10
Coast live oak	<i>Quercus agrifolia</i>	12
Red willow	<i>Salix laevigata</i>	20
Valley oak	<i>Quercus lobata</i>	12

2.2 PERFORMANCE CRITERIA

The performance criteria (i.e., survival, percent cover, basal area, tree height, and site maintenance) are quantitative benchmarks against which revegetation progress can be tracked. Trend characteristics, such as plant vigor, plant health, and natural reproduction, are site characteristics to be monitored over time, but these have no fixed criteria. Monitoring of the trend characteristics will provide valuable supplementary information concerning site development and will help guide maintenance activities and remedial action, if required.

2.2.1 Plant Survival

All trees and shrubs installed have an 80% survival performance criterion during the three-year plant establishment period. All dead plants will be replaced if survival falls below this performance criterion. In Year 5, two years after the completion of plant establishment and the cessation of artificial irrigation, survival shall not be lower than 60%. All dead plants will be replaced if survival falls below the Year 5 performance criterion. The monitoring period shall start anew following replanting at any time in Years 1-5, if survival falls below 60%. Survival results following the cessation of irrigation will indicate whether plants' roots are sufficiently developed to support the plants under natural conditions.

2.2.2 Percent Cover, Basal Area, and Tree Height

While the ultimate goal is to meet the final performance criteria, annual quantitative benchmarks have been set for percent cover (Tables 3 and 4), tree height (Table 5), and basal area (Table 6).

Table 3. Cinnabar Hills Golf Course floodplain and slope association percent cover performance criteria.

Monitoring Year	Tree cover	Shrub Cover
Year 2	2%	1%
Year 3	4%	3%
Year 4	8%	5%
Year 5	15%	7%
Year 6	25%	10%
Year 8	35%	15%

Table 4. Cinnabar Hills Golf Course valley oak association percent cover performance criteria.

Monitoring Year	Tree cover
Year 2	2%
Year 3	4%
Year 4	8%
Year 5	15%
Year 6	25%
Year 8	35%

Table 5. Cinnabar Hills Golf Course monitoring tree height performance criteria.

Species	Year 2 (ft.)	Year 3 (ft.)	Year 4 (ft.)	Year 5 (ft.)	Year 6 (ft.)	Year 8 (ft.)
California sycamore	3	5	8	11	14	17
Mexican elderberry	3	4	5	6	7	9
California bay	3	5	8	11	14	17
California buckeye	2	3	4	5	6	7
Coast live oak	3	4	5	6	7	9
Red willow	2	3	4	5	7	9
Valley oak	2	3	4	5	7	9

Table 6. Cinnabar Hills Golf Course monitoring basal area performance criteria.

Year	Year 3	Year 4	Year 5	Year 6	Year 8
Square feet per acre	0.25	1	3	7	11

2.2.3 Site Maintenance

Site maintenance is included in the performance criteria because of the critical importance of proper procedures during the plant establishment period. Site maintenance monitoring will assess plant replacement, weed control, irrigation system maintenance, and foliage protector maintenance. Site maintenance will be monitored during the three-year plant establishment period.

3.0 METHODS FOR MITIGATION MONITORING

The following methods were designed according to the *Tradition Golf Club, Mitigation and Monitoring Plan* (H.T. Harvey and Associates 1996), *Cinnabar Hills Golf Club As-Built Plan for Wetland Mitigation Sites* (H.T. Harvey and Associates 2000), and previous monitoring reports (Live Oak Associates, Inc. 2002, 2003, 2004, 2005, 2006). As per the *Tradition Golf Club, Mitigation and Monitoring Plan* (1996), sites in Year 7 of monitoring were not monitored this year.

3.1 PERCENT COVER

Overall percent cover of the trees and shrubs within the riparian and combination mitigation sites were visually estimated during monitoring.

3.2 PLANT SURVIVAL

The survivorship of plantings was determined by field counts of all trees and shrubs by species planted in the four combination mitigation sites and ten riparian sites. This was modified from the *Tradition Golf Club, Mitigation and Monitoring Plan* (H.T. Harvey and Associates 1996) requiring a minimum of 10% of all trees and shrubs planted to be randomly selected. Plant survival will be conducted over a five-year period or until such time that the growth of the plants makes survivorship too difficult to accurately assess. At that time, percent cover measurements will become the primary indicator of plant establishment rates.

Two pairs of adjacent sites—sites C2 and R2 and sites C18 and R11—were sampled together because their individual boundaries had become less distinctive as the sites have matured. Additionally, sites C1 and C4 are in Year 7 of restoration and were therefore excluded from monitoring. Therefore, in 2007, twelve sites were evaluated.

3.3 NATURAL REPRODUCTION/RECRUITMENT

Natural reproduction and recruitment of woody plant species within two of the four combination sites and ten riparian sites were monitored in 2007 while surveying for plant survival. Additional trees or shrubs of species that had been previously planted were counted and considered to be

natural reproduction and recruitment. Any other native and non-native woody plants that became established were counted and reported by species. This was modified from the *Tradition Golf Club, Mitigation and Monitoring Plan* (H.T. Harvey and Associates 1996) requiring that natural reproduction and recruitment of woody plant species were to be monitored in a five-foot wide band along each transect.

3.4 TREE HEIGHT

Each tree selected for height monitoring was marked with flagging tape and an aluminum tag labeled with the mitigation site number, plant number being tagged at that site, date, and tree species. A total of 61 trees were tagged in the four combination areas and ten riparian areas. At a minimum, three percent of each tree species installed were sampled in each site. Selection of the individuals to be monitored was semi-random, with individuals from all parts of each site selected. Results were reported by species.

3.5 BASAL AREA

All trees sampled for height were also sampled for basal area. Basal area was measured utilizing the diameter at breast height (DBH) or at 4.5 feet, with the exception of the trees that fell below this height. The square feet of basal area per acre for each mitigation site was calculated based on the size of the mitigation site and percentage of trees within the site that were sampled beginning in Year 3 (Table 6). The following formula was used:

$$\text{Basal area per acre (ft.}^2\text{/acre)} = \text{Sum of basal areas (ft.}^2\text{)} * \frac{\text{\# of trees observed}}{\text{\# of trees sampled}} * \frac{1}{\text{Area of mitigation site (acres)}}$$

3.6 PLANT VIGOR AND HEALTH

At each riparian and combination mitigation site, the overall plant vigor and health of the installed trees and shrubs were monitored. Factors taken into consideration in the qualitative observation of vigor and health include plant color, bud development, new growth, herbivory, drought stress, fungal/insect infestation, and physical damage. Overall health and vigor was rated according to the following scale:

High = 1-3 = 67-100% healthy foliage
Medium = 4-6 = 34-66% healthy foliage
Low = 7-9 = 0-33% healthy foliage
Dead = 10

If a plant's foliage was abnormally sparse, then the health/vigor rating was lowered accordingly, even if the foliage present was healthy.

3.7 DETERMINING TOTAL ACREAGE OF RIPARIAN MITIGATION SITES

The total acreage of combination and riparian areas created was determined using a GPS unit to ascertain if the required acreage of constructed mitigation sites were met. The total area that needs to be constructed for riparian areas as required by the CDFG is 9.60 acres.

3.8 SITE MAINTENANCE

Site maintenance was assessed during site monitoring. The golf course maintenance supervisor was contacted if sites appeared to be inadequately maintained and for updates on what maintenance measures had occurred during the monitoring year.

3.9 PHOTO DOCUMENTATION

Photos were taken from vantage points that most clearly depicted conditions in the various mitigation sites. All photo points were taken in the same location and direction as in previous monitoring years (Appendix B).

4.0 RESULTS OF MITIGATION MONITORING

Per the *Tradition Golf Club, Mitigation and Monitoring Plan* (1996), two sites, C1 and C4, were in Year 7 of monitoring this year and, therefore, were not monitored for survivorship, tree height, or basal area. All other combination and riparian monitoring sites were monitored in 2007.

4.1 PERCENT COVER

The percent cover of the trees and shrubs were required to meet specific benchmark performance criteria beginning in Year 2 (Tables 3 and 4). Twelve mitigation areas were monitored according to when they were planted and whether or not they met the performance criteria for previous monitoring years. Thus, the mitigation sites are in various stages of monitoring. Percent cover was determined by visually inspecting the sites, and all but R1 appear to meet their required success criterion for their respective monitoring years. The oak trees in site R1, which is in Year 6 of monitoring, appears to be slightly lagging in meeting its percent cover criteria. This is likely due to a combination of factors such suboptimal soil conditions and/or microclimate. Recommendations for adaptive management are provided in Section 6.

4.2 PLANT SURVIVAL

The total number of trees and shrubs were counted in each of the mitigation areas. Thirteen species of trees and shrubs were planted in the combination and riparian areas every year from 2000-2007. All trees and shrubs installed have an 80% survival performance criterion during the three-year plant establishment period. Years 4 and 5 have a 60% survival criterion. Replacement planting is required if the survival falls below the set criterion for that year.

Out of the twelve areas being monitored for Year 2, 3, 4, 5 and 6 performances, all sites exceeded the 60% survival rate, and ten sites (C7, C18/R11, R6, R9, R12, R1, R2/C2, R3, R4, and R5) met the 80% survival performance criterion (Table 7). Of the two sites being monitored during the initial three-year establishment period (R8 and C3), neither met the 80% survival criterion (Table 7).

The ten sites that exceeded the 80% survival rate met their annual success criteria. Additional plantings will be required at sites C3 and R8, both of which fell below the 80% survivorship criterion. Notably, in site C3 only seven of the 23 planted red willows were present. Also, only six of 27 California bays were present throughout all the monitored sites.

Table 7. Number of trees and shrubs planted, number observed in 2007, and percent survival.

Monitoring Year	Riparian Number		Trees							Shrubs						Total	Percent Survival (%)
			Valley Oak	Coast Live Oak	California Bay	California Sycamore	Red Willow	California Buckeye	Mexican Elderberry	California Wild Rose	Mugwort	Pacific Blackberry	Common Snowberry	Coyote Bush	California Sage		
2	R8	Planted	62	72	1	18	2	34	30	102	11	30	2	60	13	437	78
		Obs.	37	63	1	15	2	10	13	102	11	14	2	60	10	340	
3	C3	Planted	19	7	2	2	23	2	0	26	4	30	0	10	0	125	66
		Obs.	13	6	1	2	7	0	0	26	4	14	0	10	0	83	
4	C7	Planted	0	0	2	3	12	5	1	6	17	29	32	0	0	107	98
		Obs.	0	0	0	3	12	5	1	6	17	29	32	0	0	105	
5	C18, R11	Planted	1	32	0	9	41	6	1	38	18	58	27	9	0	240	96
		Obs.	1	32	0	6	41	0	1	38	18	58	27	9	0	231	
	R6	Planted	3	9	0	0	1	6	6	6	4	10	10	0	0	55	91
		Obs.	3	9	0	0	1	5	2	6	4	10	10	0	0	50	
	R9	Planted	0	40	0	0	3	0	5	37	10	40	0	30	10	175	89
		Obs.	0	38	0	0	0	0	0	37	10	40	0	30	10	156	
	R12	Planted	0	20	6	0	0	0	0	0	0	20	20	0	0	66	80
		Obs.	0	13	0	0	0	0	0	0	0	20	20	0	0	53	
6	R1	Planted	17	42	0	2	5	0	16	39	22	34	24	0	10	211	84
		Obs.	10	42	0	2	1	0	10	39	22	34	12	0	5	177	
	R2, C2	Planted	21	12	2	10	14	11	7	55	60	60	62	0	0	314	83
		Obs.	17	10	1	5	14	6	4	21	60	60	62	0	0	260	
	R3	Planted	59	63	3	2	8	7	1	25	70	66	36	10	0	350	85
		Obs.	35	48	0	1	4	2	1	25	70	66	36	10	0	298	
	R4	Planted	14	4	2	2	1	1	1	12	8	2	12	0	0	59	81
		Obs.	5	4	2	2	1	1	1	12	8	0	12	0	0	48	
	R5	Planted	50	55	9	4	7	22	13	110	11	66	100	0	0	447	85
		Obs.	48	52	1	4	7	5	1	85	11	66	100	0	0	380	

4.3 NATURAL REPRODUCTION/RECRUITMENT

Natural reproduction/recruitment of planted species continued during 2006-2007 at the mitigation sites. The shrub species (i.e., California wild rose, mugwort, Pacific blackberry, common snowberry, and coyote bush) have formed dense stands in many areas of the mitigation sites. Naturally reproducing tree species primarily included the valley oak, coast live oak, and red willow. Natural recruitment of target species was observed in approximately half of the mitigation sites. It is expected that the remaining tree species will begin recruiting as they become more established. This criterion has been successfully met and will continue to be a good indicator of success in future monitoring years as the mitigation sites become more established.

4.4 TREE HEIGHT AND BASAL AREA

An established tree height performance criterion was not specified in the *Mitigation and Monitoring Plan* (1996) until Year 2 (Table 5), which included twelve mitigation sites during the 2006 monitoring. Basal area has a set performance criterion beginning in Year 3 (Table 6), which, during the 2007 monitoring, included eleven sites.

Tree height was measured according to the performance criterion determined in Table 5. Forty-six of the 61 trees tagged met the benchmark performance criteria for tree height, which equates to 75% (shown in bold and italic in Table 8). It is expected that the percentage of trees meeting this criterion will increase in future years.

Basal area in the riparian and combination areas was measured according to the performance criterion determined in Table 5. Five of the eleven sites, or 45%, being monitored for basal area met the required criterion (shown in bold and italic in Table 8).

Table 8. Tree heights and basal area measurements taken during riparian monitoring in 2008.*

Riparian Number	Monitoring Year	Species	Tree Tag Number	Height (ft)	DBH (in)	Basal Area (ft ² /acre)
C3	3	Valley Oak	1	3.0	0.4	7.31
		California Sycamore	11	14.8	4.9	
		Red Willow	4	7.2	6.5	
C7	4	California Sycamore	4	13.1	1.4	6.37
		Red Willow	11	13.1	11.8	
		Red Willow	13	10.5	4.3	
		California Buckeye	3	4.9	2.4	
		Mexican Elderberry	12	6.2	0.6	
C18, R11	5	Coast Live Oak	1	4.9	0.5	54.10
		Coast Live Oak	4	11.5	2.0	
		Coast Live Oak	13	9.8	2.8	
		California Sycamore	2a	23.0	5.5	
		California Sycamore	12	19.7	3.0	
		Red Willow	2b	23.0	17.3	
		Red Willow	3	26.2	12.2	
R1	6	Coast Live Oak	11	7.5	3.1	3.30
		California Sycamore	3	8.2	2.4	
		Mexican Elderberry	13	7.2	1.0	
		Mexican Elderberry	14	7.5	4.1	
R2, C2	6	Valley Oak	1	16.4	3.9	22.75
		Valley Oak	11	10.5	3.9	
		Coast Live Oak	2	31.2	14.2	
		Coast Live Oak	12	6.2	1.6	
		California Bay	3	3.6	NA	
		California Sycamore	4	9.8	1.9	
		California Buckeye	6	2.6	NA	
		Mexican Elderberry	7	14.8	9.1	
R3	6	Valley Oak	11	13.1	4.5	5.66
		Valley Oak	13	13.1	3.4	
		Valley Oak	15	7.5	2.8	
		Coast Live Oak	12	8.2	4.8	
		Coast Live Oak	14	10.5	2.3	
		Coast Live Oak	16	2.8	3.4	
		California Sycamore	4	8.5	2.0	
		Red Willow	5	20.3	10.2	
		California Buckeye	6	7.5	0.9	
		Mexican Elderberry	7	8.2	4.5	

* Monitoring data for sites C1 and C4 were not required in 2007.

Table 8. Tree heights and basal area measurements taken during riparian monitoring in 2008 (cont'd).*

Riparian Number	Monitoring Year	Species	Tree Tag Number	Height (ft)	DBH (in)	Basal Area (ft ² /acre)
R4	6	Valley Oak	1	16.4	1.9	30.03
		Valley Oak	11	12.5	3.1	
		California Bay	3	32.8	4.0	
		California Sycamore	4	17.4	10.8	
		Mexican Elderberry	12	8.2	6.9	
R5	6	Valley Oak	11	9.2	1.1	5.06
		Valley Oak	14	7.9	4.7	
		Coast Live Oak	2	6.6	1.1	
		Coast Live Oak	12	7.5	1.6	
		Coast Live Oak	13	8.2	4.8	
		California Sycamore	4	5.9	1.9	
R6	5	Valley Oak	1	7.6	1.3	0.76
		Coast Live Oak	2	3.6	1.1	
		Coast Live Oak	3	5.9	0.8	
R8	2	Valley Oak	12	8.2	2.0	N/A
		Coast Live Oak	11	5.6	0.6	
		California Sycamore	13	10.5	2.8	
		California Buckeye	6	5.6	1.6	
		Mexican Elderberry	7	6.9	3.5	
R9	5	Coast Live Oak	12	2.6	2.0	0.57
		Coast Live Oak	13	3.3	0.4	
		Coast Live Oak	14	7.2	2.6	
		Mexican Elderberry	11	5.6	0.6	
R12	5	Coast Live Oak	1	2.0	0.2	0.02

* Monitoring data for sites C1 and C4 were not required in 2007.

4.5 PLANT VIGOR AND HEALTH

The overall plant vigor and health of all live tree and shrub species present (dead plants were excluded) at each combination and riparian site was assessed. Species listed as NA were not present at that particular site; this includes species that have died (health and vigor of 10), as these plants were not included in the count of existing plants. Overall, the success of each species, regardless of the number of individuals present, was positive (Table 9). In summary, high vigor and health ratings (i.e., ratings of 1-3) were given to 94.0% of the surviving species. Medium vigor and health (rating of 4-6) constituted for 4.3%, and low vigor and health (rating of 7-9) constituted for 1.7%.

Table 9. Plant vigor and health of trees and shrubs monitored in combination and riparian mitigation sites.*

Riparian Number	Valley Oak	Coast Live Oak	California Bay	California Sycamore	Red Willow	California Buckeye	Mexican Elderberry	California Wild Rose	Mugwort	Pacific Blackberry	Common Snowberry	Coyote Bush	California Sage
C3	3	1	1	2	1	NA	NA	1	1	2	NA	1	NA
C7	NA	NA	NA	2	1	4	10	1	1	1	1	NA	NA
C18, R11	1	1	NA	3	1	2	1	1	1	1	1	1	NA
R1	2	2	NA	3	1	NA	3	1	1	1	3	NA	2
R2, C2	1	1	1	2	1	1	1	1	1	1	1	NA	NA
R3	5	1	NA	1	1	3	5	1	1	1	1	1	NA
R4	4	1	1	1	1	1	1	1	1	1	1	NA	NA
R5	1	1	1	3	1	3	2	1	1	1	1	NA	NA
R6	2	1	NA	NA	1	3	4	1	1	1	1	NA	NA
R8	1	1	1	1	1	2	2	1	1	1	2	1	2
R9	NA	2	NA	NA	NA	NA	10	1	1	1	NA	1	2
R12	1	1	1	NA	NA	NA	NA	NA	NA	1	1	NA	NA

* Monitoring data for sites C1 and C4 were not required in 2007.

4.6 TOTAL AREA OF CONSTRUCTED COMBINATION AND RIPARIAN MITIGATION SITES

Cinnabar Hills Golf Course was required to create 9.60 acres of riparian habitat within the project area. In 2007, the total area of riparian habitat present onsite, totaling 10.17 acres, remained unchanged from the previous year (Table 10). Continued maintenance will be required to ensure that the created riparian habitat continue to establish, thereby meeting the final criteria in Year 10. Section 6 discusses adaptive management strategies for next year prior to monitoring.

4.7 SITE MAINTENANCE

In 2007, a number of valley oaks and coast live oaks near the base of the slope of R1 appeared to be dead or dying during this year’s monitoring. This is likely due to a combination of suboptimal soil conditions and microclimate. While the site had greater than 80% survivorship, it does not achieve a continuous riparian canopy cover with the adjacent site C1. Therefore, we will recommend replanting trees at the base of the slope. The irrigation system in this mitigation

site should be regularly inspected and maintained throughout the year to allow these new plantings to become established.

Overall, however, the mitigation areas continue to be well-maintained. A continued effort should be made to ensure that no vehicles or golfers enter the mitigation sites. Waste, leaf litter, and grass cuttings from areas outside the mitigation sites should not be discarded within the mitigation sites, as this can lead to adverse ecological effects within the mitigation sites. Continued efforts should be made in the coming year to clear out ruderal vegetation, control for rodents, and monitor irrigation systems so that the installed riparian plantings can become established.

Table 10. Area of riparian and combination mitigation sites.

Site Number	Area of Riparian (acres)						
	2001	2002	2003	2004	2005	2006	2007
R1	0.68	0.64	0.92	0.90	0.90	0.90	0.90
R2	0.33	0.28	0.37	0.30	0.30	0.30	0.30
R3	1.91	1.82	1.55	1.84	1.84	1.84	1.84
R4	0.03	0.13	0.11	0.12	0.12	0.12	0.12
R5	1.34	1.17	1.17	1.17	1.17	1.17	1.17
R6	0.11	0.15	0.15	0.17	0.17	0.17	0.17
R8	1.95	1.89	1.85	1.92	1.92	1.92	1.92
R9	-	0.65	0.63	0.64	0.64	0.64	0.64
R11	-	0.41	0.41	0.50	0.50	0.50	0.50
R12	-	0.18	0.18	0.22	0.22	0.22	0.22
C1	0.56	0.5	0.47	0.54	0.54	0.54	0.54
C2	0.27	0.28	0.27	0.30	0.30	0.30	0.30
C3	0.47	0.52	0.44	0.48	0.48	0.48	0.48
C4	0.42	0.44	0.31	0.52	0.52	0.52	0.52
C7	0.18	0.18	0.37	0.37	0.37	0.37	0.37
C18	0.21	0.19	0.19	0.18	0.18	0.18	0.18
Total	8.46	9.43	9.39	10.17	10.17	10.17	10.17

5.0 DISCUSSION

All mitigation sites continue to show steady progress towards meeting the final success criteria set forth in the *Tradition Golf Club, Mitigation and Monitoring Plan*. All sites continue to meet the percent cover criterion. In 2007, 75% of the sampled trees met the required tree height, and 45% of the sites met the basal area performance criterion. This is similar to 2006 values, when 72% of the sampled trees met the required tree height, and 55% of the sites met the basal area performance criteria.

However, some trees of less-than-average height, while healthy, do not appear to be growing (i.e., plant vigor and health continues to be high, but the tree height remains the same year over year). These trees may not meet the final success criterion for tree height as rapidly as was expected and, therefore, they may affect a site achieving the final success criterion for percent cover and basal area. As discussed in Section 4.7, all mitigation sites are well-maintained; these unusual growth patterns likely are a result of factors beyond human control and, therefore, should not determine the success or failure of a particular mitigation site, as the primary goal of the mitigation is to establish a self-sustaining riparian woodland that would develop its own ecological equilibrium. This certainly seems to be what is occurring on the site. A number of external environmental factors, such as slope, suboptimal light exposure, climate related constraints, and the physical properties of soils that affect the soils' water-holding capacity, aeration, and available minerals and nutrients, likely influence their growth and should be taken into consideration when assessing the final success or failure of a restoration site. When considered with other important quantitative and qualitative benchmarks such as plant survivorship and overall health and vigor, these sites appear to be highly successful.

6.0 RECOMMENDATIONS

6.1 RIPARIAN AND COMBINATION SITES MONITORED FOR RIPARIAN MITIGATION

During the 2007 monitoring, 10.17 acres, exceeding the required 9.60 acres, of created riparian habitat were determined to be present; however, riparian vegetation in two of the mitigation sites fell below the required percent survival of 80%. These two sites, C3 and R8, will require some additional plantings in order to bring them back up to a greater than 80% survival rate. The species and number of individual plants that need to be replanted at the two sites are listed below in Table 11.

In addition to sites C3 and R8, we recommend replanting the dead oaks at the base of the slope of R1 with a mix of valley oaks and coast live oaks (Table 11). The irrigation system and schedule should be closely monitored at this site. This planting recommendation is optional but strongly recommended in order to maintain a continuous riparian canopy cover with the adjacent site C1. If the continuous canopy cover is not achieved, the California Department of Fish and Game, the agency that will sign off on the riparian mitigation, may not count this site towards the overall necessary riparian mitigation acreage once the ten-year monitoring is complete.

Table 11. Numbers per species of riparian plants that need to be replanted in 2007 at riparian and combination sites.

Riparian Number	Trees							Shrubs					Total	
	Valley Oak	Coast Live Oak	California Bay	California Sycamore	Red Willow	California Buckeye	Mexican Elderberry	California Wild Rose	Mugwort	Pacific Blackberry	Common Snowberry	Coyote Bush		California Sage
<i>Sites that need to be replanted</i>														
C3	6	1	1	0	16	2	0	0	0	16	0	0	0	42
R8	25	9	0	3	0	10	13	0	0	16	0	9	7	92
R1	7	13	0	0	0	0	0	0	0	0	0	0	0	20
Total	38	23	1	3	16	12	13	0	0	32	0	9	7	154

Planting should take place during the winter of 2007/2008. It is important to get the plants in the ground during the rainy season in order to help the roots to establish. All plants need to be ordered from a native plant nursery with the exception of the red willows, which can be propagated from pole cuttings taken on the project site. If desired, coyote brush plantings can also be propagated or transplanted from existing plants in other mitigation areas.

Once all plants are in the ground, a biologist needs to visit the site at least every other month to monitor site maintenance. Weeds need to be kept clear around all individuals planted in the riparian and combination sites. Tall weeds outcompete newly planted individuals and encourage rodents to burrow near these sensitive plants. If weeds are kept down, the young plants can get the nutrients and sun that they need. Also, raptors can more easily hunt for problematic rodents if they have a clear view of the ground.

We also recommend ceasing irrigation at those sites that appear to be relatively well-established to see if the installed plantings will persist on their own. This includes sites C1, C4, R2/C2, R3, and R4. We will continue to monitor these sites on at least a bi-monthly basis for signs of water-stress; if the plants appear to be stressed, then irrigation will resume.

After the rainy season, drip irrigation systems need to be fully functional in all riparian and combination sites where irrigation is still recommended. The irrigation systems also need to be monitored. Young plants are sensitive to getting too much or too little water. Irrigating needs to be closely watched to observe any adverse effects that watering amounts may be having on the mitigation sites.

6.2 MONITORING IN 2008

The riparian and combination sites will be monitored in 2008 for the riparian criteria established for Years 1-8, depending on the site. Per the *Tradition Golf Club, Mitigation and Monitoring Plan* (1996), sites in Year 6 of monitoring and above (i.e., all sites but R8, C3, and C7) will no longer be monitored for percent survivorship. Rather, percent cover measurements will become

the primary indicator of plant establishment rates. Sites R8, C3, and C7 will continue to be monitored for percent survivorship in 2008.

The *Tradition Golf Club, Mitigation and Monitoring Plan* (1996) does not require sites in Years 7 and 9 to be monitored (Section 2.0). However, per the client, all sites, regardless of monitoring year, will be monitored in 2008. Table 12 divides the sites into monitoring year and gives the justification for their categorization.

Table 12. Riparian monitoring criteria to be used in 2008 for the riparian and combination sites.

Monitoring Year	Riparian Site	Reason
Year 3	R8	Percent survival greater than 60%
Year 4	C3	Percent survival greater than 60%
Year 5	C7	Percent survival greater than 60%
Year 6	R6	Percent survival greater than 60%
	R9	Percent survival greater than 60%
	C18, R11	Percent survival greater than 60%
	R12	Percent survival greater than 60%
Year 7	R1	Percent survival greater than 60%
	R2, C2	Percent survival greater than 60%
	R3	Percent survival greater than 60%
	R4	Percent survival greater than 60%
	R5	Percent survival greater than 60%
Year 8	C1	Percent survival greater than 60%
	C4	Percent survival greater than 60%

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<i>Raphanus sativus</i>	Wild Radish	UPL
<i>Rorippa nasturtium-aquaticum</i>	Watercress	OBL
CAPRIFOLIACEAE – Honeysuckle Family		
<i>Symphoricarpos albus</i>	Snowberry	FACU
CARYOPHYLLACEAE – Pink Family		
<i>Silene gallica</i>	Windmill Pink	UPL
<i>Silene</i> sp.	Campion	-
<i>Spergularia rubra</i>	Purple Sandspurry	FAC-
<i>Stellaria media</i>	Common Chickweed	FACU
CHENOPODIACEAE – Goosefoot Family		
<i>Chenopodium californicum</i>	California Goosefoot	FAC*
CONVOLVULACEAE – Morning Glory Family		
<i>Convolvulus arvensis</i>	Bindweed	UPL
CUSCUTACEAE – Dodder Family		
<i>Cuscuta</i> sp.	Dodder	UPL
CYPERACEAE – Sedge Family		
<i>Carex</i> sp.	Sedge	FACW
<i>Cyperus eragrostis</i>	Tall Flatsedge	FACW
<i>Eleocharis pauciflora</i>	Fewflower Spikerush	OBL
<i>Scirpus</i> sp.	Bulrush	OBL
EUPHORBIACEAE – Spurge Family		
<i>Eremocarpus setigerus</i>	Doveweed	UPL
FABACEAE – Pea Family		
<i>Lotus corniculatus</i>	Birdfoot Trefoil	FAC
<i>Lotus humistratus</i>	Hill Lotus	UPL
<i>Lotus purshianus</i>	Spanish Clover	UPL
<i>Lotus scoparius</i>	Deerweed	UPL
<i>Lotus</i> sp.	Lotus	-
<i>Lotus wrangelianus</i>	California Lotus	UPL
<i>Lupinus bicolor</i>	Miniature Lupine	UPL
<i>Lupinus</i> sp.	Lupine	-
<i>Medicago polymorpha</i>	Bur Clover	UPL
<i>Melilotus indica</i>	Sourclover	FAC
<i>Trifolium dubium</i>	Hop Clover	FACU
<i>Trifolium ciliolatum</i>	Tree Clover	UPL
<i>Trifolium hirtum</i>	Rose Clover	UPL
<i>Trifolium hybridum</i>	Alsike Clover	FACU
<i>Trifolium microcephalum</i>	Small-head Clover	FACU
<i>Trifolium willdenovii</i>	Tomcat Clover	UPL
<i>Trifolium wormskioldii</i>	Cows Clover	FACW
<i>Trifolium</i> sp.	Clover	-
<i>Vicia sativa</i>	Common Clover	FACU
<i>Vicia</i> sp.	Vetch	-
FAGACEAE – Oak Family		
<i>Quercus agrifolia</i>	Coast Live Oak	UPL
<i>Quercus douglassii</i>	Blue Oak	UPL
<i>Quercus lobata</i>	Valley Oak	FAC*
GERANIACEAE – Geranium Family		
<i>Erodium botrys</i>	Long-Beaked Filaree	FACU*
<i>Erodium cicutarium</i>	Erodium	UPL

<i>Geranium bicknellii</i>	Bicknell Geranium	UPL
<i>Geranium dissectum</i>	Cut-Leaved Geranium	UPL
<i>Geranium sp.</i>	Geranium	-
JUNCACEAE - Rush Family		
<i>Juncus balticus</i>	Baltic Rush	OBL
<i>Juncus bufonius</i>	Toad Rush	FACW+
<i>Juncus effusus</i>	Soft Rush	OBL
<i>Juncus mexicanus</i>	Mexican Rush	FACW
<i>Juncus xiphioides</i>	Iris-leaf Juncus	OBL
LAMIACEAE – Mint Family		
<i>Mentha pulegium</i>	Pennyroyal	OBL
<i>Trichostema lanceolatum</i>	Vinegar Weed	UPL
LAURACEAE – Laurel Family		
<i>Umbellularia californica</i>	California Bay	FAC
LEMNACEAE – Duckweed Family		
<i>Lemna minor</i>	Duckweed	OBL
LILIACEAE – Lily Family		
<i>Triteleia laxa</i>	Ithuriel’s Sphere	UPL
ONAGRACEAE – Evening Primrose Family		
<i>Epilobium brachycarpum</i>	Panicled Willow-herb	UPL
<i>Epilobium ciliatum</i>	Hairy Willow-herb	FACW
<i>Epilobium sp.</i>	Willow-herb	FACW
PAPAVERACEAE – Poppy Family		
<i>Eschscholzia californica</i>	California Poppy	UPL
PLANTAGINACEAE – Plantain Family		
<i>Plantago lanceolata</i>	English Plantain	FAC-
<i>Plantago sp.</i>	Plantain	-
PLATANACEAE – Sycamore Family		
<i>Platanus racemosa</i>	Western Sycamore	FACW
POACEAE - Grass Family		
<i>Agrostis viridis</i>	Bentgrass	UPL
<i>Aira caryophyllea</i>	Silver Hairgrass	UPL
<i>Avena barbata</i>	Slender Wild Oats	UPL
<i>Briza minor</i>	Little Quaking Grass	FACW-
<i>Bromus carinatus</i>	California Brome	UPL
<i>Bromus diandrus</i>	Ripgut	UPL
<i>Bromus hordaceous</i>	Soft Chess	FACU-
<i>Bromus madritensis</i>	Red Brome	UPL
<i>Bromus sp.</i>	Brome	-
<i>Cynodon dactylon</i>	Bermuda Grass	FAC
<i>Dactylis glomerula</i>	Orchard Grass	FACU
<i>Gastridium ventricosum</i>	Nitgrass	FACU
<i>Hordeum brachyantherum</i>	Meadow Barley	FACW
<i>Hordeum marinum ssp. gussoneanum</i>	Mediterranean Barley	FAC
<i>Hordeum murinum ssp. leporinum</i>	Wild Barley	UPL
<i>Hordeum sp.</i>	Barley	-
<i>Leymus triticoides</i>	Creeping Wild Rye	FACW
<i>Lolium multiflorum</i>	Italian Ryegrass	UPL
<i>Lolium perenne</i>	Perennial Ryegrass	FAC*
<i>Nassella pulchra</i>	Purple Needlegrass	UPL

<i>Phalaris arundinacea</i>	Reed Canary Grass	OBL
<i>Phalaris sp.</i>	Canary Grass	-
<i>Phalaris aquatica</i>	Harding Grass	FAC +
<i>Poa annua</i>	Annual Blue Grass	FAC
<i>Poa secunda</i>	One-Sided Blue Grass	UPL
<i>Polygonum amphibium</i>	Knotweed	OBL
<i>Polygonum arenastrum</i>	Common Knotweed	UPL
<i>Polypogon monspeliensis</i>	Rabbitsfoot Grass	FACW+
<i>Sisyrinchium bellum</i>	Blue-eyed Grass	FAC
Turf Grass	Turf Grass	UPL
<i>Vulpia myuros</i>	Rat-tail Fescue	FACU
POLEMONIACEAE - Phlox Family		
<i>Linanthus bicolor</i>	Bicolor linanthus	UPL
POLYGONACEAE - Buckwheat Family		
<i>Polygonum amphibium</i>	Knotweed	OBL
<i>Polygonum arenastrum</i>	Common Knotweed	UPL
<i>Rumex acetosella</i>	Sheep Sorrel	FAC-
<i>Rumex crispus</i>	Curly Dock	FACW-
<i>Rumex sp.</i>	Dock	-
PRIMULACEAE – Primrose Family		
<i>Anagallis arvensis</i>	Scarlet Pimpernel	FAC
ROSACEAE – Rose Family		
<i>Rosa californica</i>	Wild Rose	FAC+
<i>Rubus ursinus</i>	California Blackberry	FACW*
RUBIACEAE – Madder Family		
<i>Galium aparine</i>	Catchweed Bedstraw	FACU
SALICACEAE – Willow Family		
<i>Populus fremontii</i>	Fremont Cottonwood	FACW
<i>Salix laevigata</i>	Red Willow	UPL
<i>Salix lasiolepis</i>	Arroyo Willow	FACW
<i>Salix sp.</i>	Willow	NI
SCROPHULARIACEAE – Figwort Family		
<i>Mimulus guttatus</i>	Common Monkey-Flower	OBL
TYPHACEAE - Cattail Family		
<i>Typha augustifolia</i>	Narrow-leaved Cattail	OBL

APPENDIX B: PHOTOGRAPHS OF THE STUDY AREA



Site C3 (Year 3)



Site C7 (Year 4)



Site R9 (Year 5)



Sites C18 and R11 (Year 5)



Sites R3 and C3 (Years 6 and 3, respectively)



Site R1 (Year 6)



Sites C4 and R12 (Years 7 and 5, respectively)



Site C1 (Year 7)