

Status of Habitat Mitigation and Monitoring for
The Rio Linda Creek Conservation Area
Annual Report 2007



Prepared by:



April 01, 2008

Table of Contents

TABLE OF CONTENTS	I
LIST OF FIGURES AND TABLES	II
1. INTRODUCTION	1
1.1 MITIGATION PROJECT HISTORY	1
1.2 SITE DESCRIPTION	4
1.3 MANAGEMENT RESPONSIBILITY	5
1.4 HABITAT FEATURES	6
1.4.1 Annual Grassland	7
1.4.2 Riparian Savannah.....	7
1.4.3 Oak Trees.....	8
1.4.4 Freshwater Marsh/Seasonal Wetland.....	8
1.4.5 Other Waters of the U.S.	9
1.5 WILDLIFE.....	9
2. METHODS	10
2.1 HABITAT FEATURES	10
2.1.1 Annual Grassland	10
2.1.2 Riparian Savannah.....	10
2.1.3 Oak Trees.....	11
2.1.4 Freshwater Marsh/Seasonal Wetland.....	11
2.1.5 Other Waters of the U.S.	11
2.2 WILDLIFE.....	12
3. RESULTS & DISCUSSION	12
3.1 HABITAT FEATURES	12
3.1.1 Annual Grassland	13
3.1.2 Riparian Savannah.....	13
3.1.3 Oak Trees.....	15
3.1.4 Freshwater Marsh/Seasonal Wetland.....	16
3.1.5 Other Waters of the U.S.	17
3.2 WILDLIFE.....	17
4. CONCLUSIONS & RECOMMENDATIONS	18
5. REFERENCES	19
APPENDIX A – WETLAND VEGETATION MONITORING DATA	20
APPENDIX B – PHOTOPOINTS	27

List of Figures and Tables

Figure 1 - Old, channelized section of Robla Creek prior to construction of RLCCA.....	1
Figure 2 - Location of the Rio Linda Creek Conservation Area.	2
Figure 3 - Site plan for new Rio Linda Creek channel	3
Figure 4 - Limits of the Rio Linda Creek Conservation Area.....	5
Figure 5 - Oak tree being transplanted to RLCCA.	8
Figure 6 - Habitat areas delineated on 2004 aerial photo.....	13
Table 1 - Post-construction habitat acreages.	12
Table 2 - Summary of plant count, survival and vigor in riparian savannah habitat type.	14
Table 3 - Summary of vegetation height, crown spread and DBH in riparian savannah habitat type.	15
Table 4 - Freshwater marsh/seasonal wetland success criteria for the RLCCA and survey results.	16
Table 5 - Morning bird survey conducted September 2007 along RLCCA.	20
Table 6 - Species list of plants found at RLCCA during wetland vegetation survey (Sept. 17, 2007).....	21
Table 7 - Percent cover of quadrants by species type (Wetland vegetation survey on Sept. 17, 2007).....	22
Table 8 - Percent cover by wetland indicator type (Wetland vegetation survey on Sept. 17, 2007).....	24

1. Introduction

1.1 Mitigation Project History

In the 1970s, a reach of Robla Creek between Dry Creek Road and the Sacramento Northern Bike Trail was relocated to facilitate the construction of the Bell Aqua housing development and three water ski lakes. This channelized section of Robla Creek was restricted to a very narrow corridor that contained low-quality habitat and did not provide adequate room for flood flows (Figure 1).



Figure 1 - Old, channelized section of Robla Creek prior to construction of RLCCA

In 1993, the Sacramento Area Flood Control Agency (SAFCA) adopted a flood control program that would be initiated in two stages and would protect areas within the Natomas Basin, North Sacramento, Rio Linda and Elverta. The Stage 1 Project was completed in the summer of 1996. The second stage, the Robla Creek South Levee Stage 2 Improvements Project, was approved in 1997. SAFCA constructed a portion of the Stage 2 Project during the fall of 1997, but did not construct all levees to their full design height, because completion of the Stage 2 project at that time would have resulted in a slight increase of water levels during the 100-year flood in some areas of Rio Linda.

Beginning in 1998, SAFCA developed the Mitigation Project to offset the hydraulic impacts associated with the Stage 2 Project. A primary component of the Mitigation Project was the construction of the Robla Creek north levee. The alignment of the Robla Creek north levee extends from a point approximately 950 feet north of the intersection of Dry Creek Road and C Street, to the eastern side of the ski lakes, around the southern side of the ski lakes and then north along the western boundary of the Rio Linda Airport to G Street. The Stage 2 Project and the Mitigation Project were completed in 2002.

The Mitigation Project included the construction of a new Rio Linda Creek channel west of Dry Creek Road (Figure 2). Much of the former Robla Creek channel alignment west of Dry Creek Road was filled and that area was used to accommodate the Robla Creek north levee. The new

channel was built as a sinuous, meandering channel with improved flood flow capabilities and increased habitat values (Figure 3). The new alignment of the channel diverges from the existing channel just east of Dry Creek Road and crosses under the intersection of Dry Creek Road and C Street, through a newly constructed box culvert. On the west side of the box culvert, the channel meanders in a southerly direction to its new confluence with the Magpie Creek Diversion Channel (MCDC). The new channel has a variable width and allows for enough room for flood flows and a variety of habitat features.

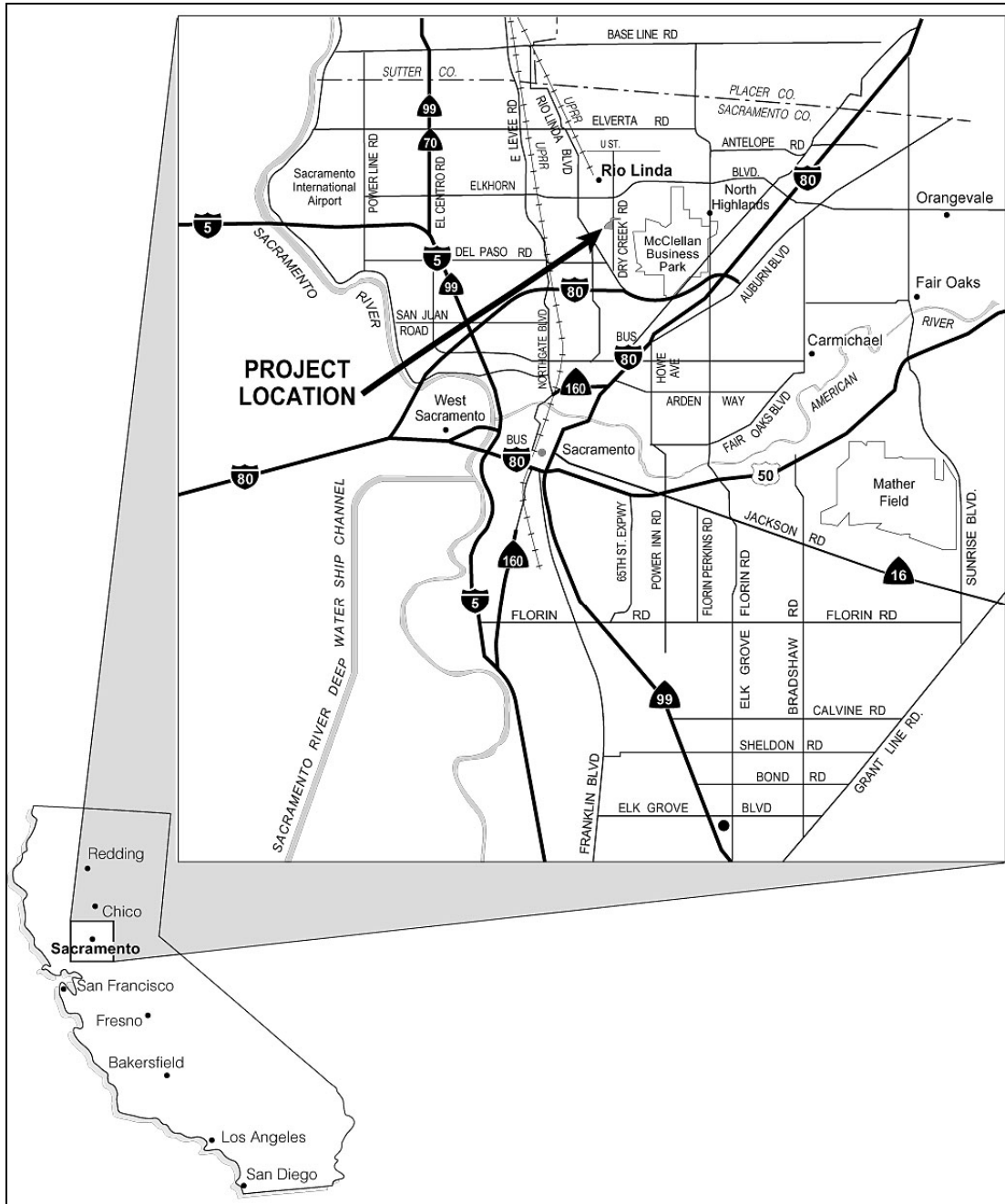


Figure 2 - Location of the Rio Linda Creek Conservation Area.

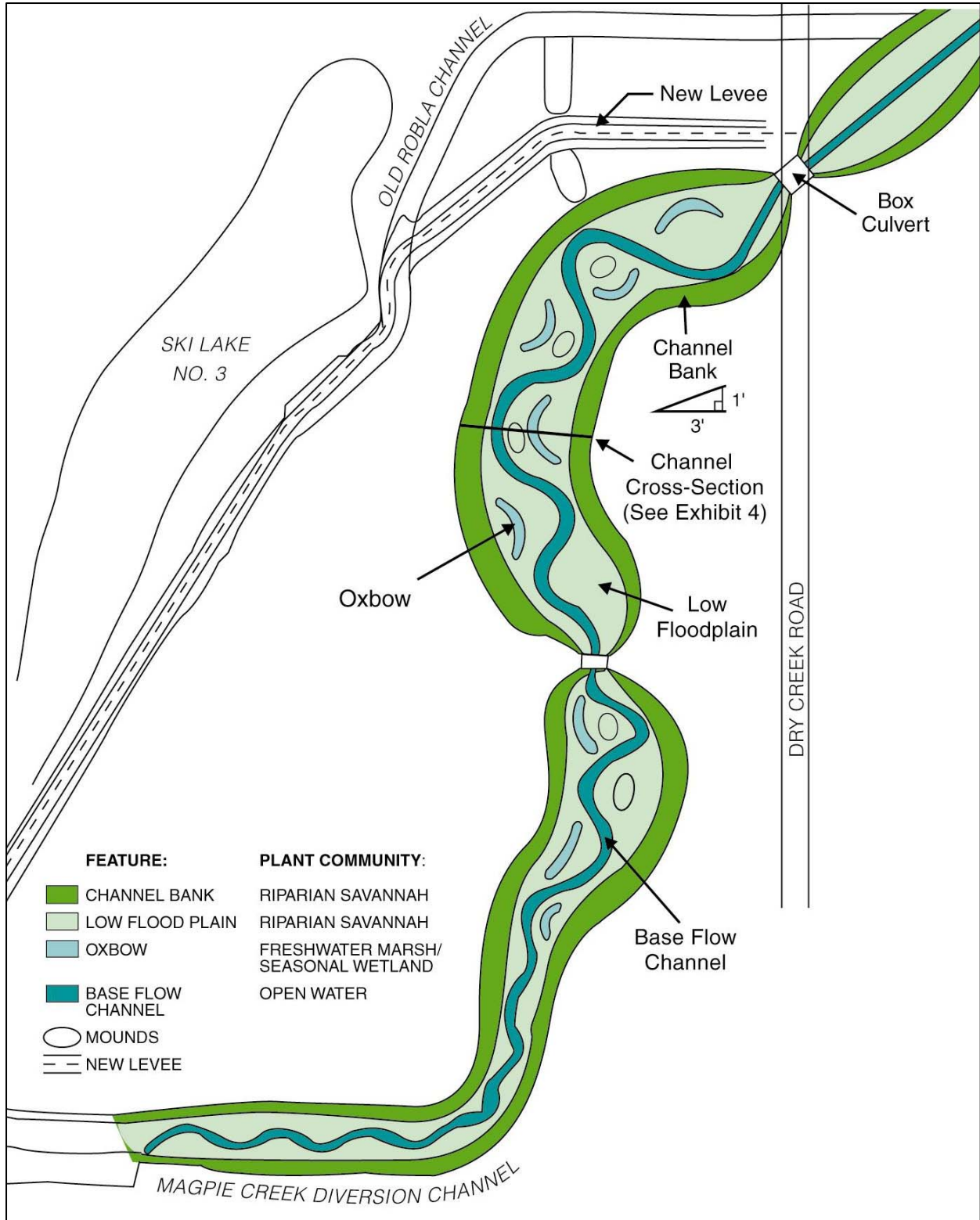


Figure 3 - Site plan for new Rio Linda Creek channel

SAFCA established the Rio Linda Creek Conservation Area (RLCCA) in 2003 as part of the Lower Dry Creek and Robla Creek Levee Improvements Mitigation Project. Specifically, on March 22, 2002 the U.S. Fish and Wildlife Service issued a Biological Opinion (BO) and Incidental Take Statement (USFWS 2002), as amended April 19, 2002, describing the impacts of the Mitigation Project on:

- giant garter snake, (*Thamnophis gigas*) – federally listed threatened species
- vernal pool fairy shrimp (*Branchinecta lynchi*) – federally listed threatened species
- vernal pool tadpole shrimp (*Lepidurus packardii*) – federally listed endangered species

The mandatory terms and conditions of the BO required SAFCA to compensate for loss of giant garter snake (GGS) habitat. This was accomplished by purchasing credits at a mitigation bank and creating the sinuous Rio Linda Creek channel to provide higher habitat value for GGS than was provided by the existing aquatic habitat and adjacent upland habitat. The BO stipulated that the new Rio Linda Creek channel and adjacent upland area be protected under a Conservation Easement. SAFCA prepared a Grant Deed of Perpetual Conservation Easement for the RLCCA, which identifies the Sacramento Valley Conservancy (SVC) as the grantee of the Conservation Easement. The easement protects the biotic, ecological, aesthetic, educational, scientific and habitat values in the RLCCA. A Conservation Area Management and Maintenance Plan (CAMMP) was also completed to ensure that managers make well-informed decisions for the long-term management of the RLCCA (EDAW 2003). The CAMMP contains information regarding maintenance activities, as well as permitted and prohibited activities within in the RLCCA boundaries.

1.2 Site Description

The RLCCA comprises three parcels that total approximately 16.2 acres and includes the newly created section of Rio Linda Creek and adjacent uplands. Figure 4 depicts the limits of the RLCCA. The new Rio Linda Creek channel incorporates features that make it environmentally superior to the previously channelized portion of the creek. Habitat features of the new channel were specifically chosen to meet GGS requirements, but also are beneficial for many other wildlife species. Planting of sparse woody vegetation allows open canopy areas for GGS basking while providing access for clearing of debris for flood capacity maintenance. The design for the new channel was developed based on both historical and recent data on soils, hydrology, and vegetation conditions. The created channel incorporates in-channel freshwater marsh, seasonal wetlands/oxbow pools in the low floodplain, and riparian savannah in the floodplain and along its banks. The upland areas adjacent to the created stream channel are open grassland fields with scattered seasonal wetlands and vernal pools that existed prior to implementation of the Mitigation Project.

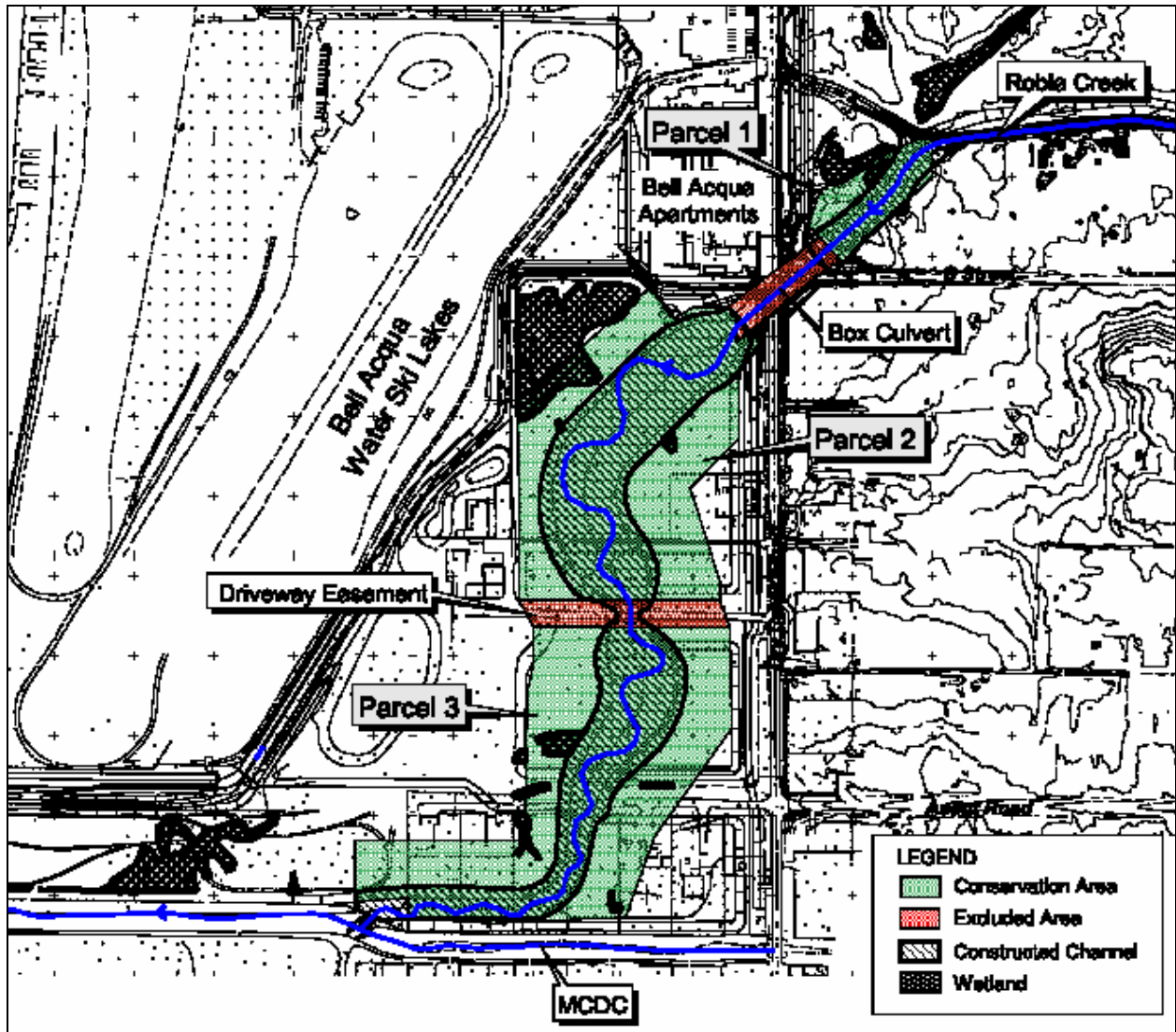


Figure 4 - Limits of the Rio Linda Creek Conservation Area.

1.3 Management Responsibility

The RLCCA is managed and maintained for flood control purposes by SAFCA. SAFCA also manages and maintains the RLCCA to ensure that the success criteria for all mitigation requirements are accomplished and the conservation values are protected in perpetuity as stipulated in the regulatory and environmental compliance requirements. The success criteria for the restored wetlands and other Waters of the U.S. are stated in the wetland CAMMP and GGS mitigation requirements are discussed in the Compensation Criteria for Restoration and/or Replacement of Giant Garter Snake Habitat Section of the BO. Specifically, the BO requires that SAFCA fund the monitoring and perpetual management and maintenance of the RLCCA and provide written documentation to the USFWS that such management will be provided in perpetuity (USFWS 2002). Accordingly, the Conservation Easement provides that SAFCA bears all costs related to the operation, upkeep, and maintenance of the RLCCA. SAFCA must obtain written approval from the USFWS and the SVC before taking actions that may impact the RLCCA's conservation values.

The SVC, as SAFCA's grantee under the Conservation Easement, is responsible for reviewing the periodic reports, prepared at SAFCA's direction, regarding the long-term management, maintenance and monitoring activities at the RLCCA. The SVC, at its discretion, is authorized by the Conservation Easement to enforce the terms of the Conservation Easement, in accordance with the CAMMP and the BO, to protect the RLCCA's Conservation Values, in particular for conservation of GGS. The SVC will monitor the RLCCA annually to document any use violations and to assess the Conservation Values. The SVC will undertake reasonable efforts to prevent any activity or use of the RLCCA that is inconsistent with the purposes of the BO, the CAMMP, or Conservation Easement, including requiring SAFCA to restore any areas or features impacted by use violations. Additionally, the SVC is obligated to use reasonable efforts to protect and conserve mineral rights (to the extent that SAFCA holds such rights), air rights, water rights, and groundwater essential to protect and to sustain the biotic resources of the RLCCA.

The USFWS has the right to enforce the terms of the Conservation Easement and the CAMMP and to access the property if necessary. Persons with the legal right to exercise either the Utility Line Rights or the Drainage Facilities Easement have the right to enter these areas, as necessary to exercise such rights. The exercise of these rights must comply with the Endangered Species Act.

1.4 Habitat Features

Several features of the RLCCA constitute the conservation values to be protected in perpetuity. These values are to be monitored over time, pursuant to the CAMMP (EDAW 2003) for the Mitigation Project. Under the CAMMP, success criteria were defined as follows:

1. Restore at least 4.44 acres of self-sustaining riparian savannah in the new Rio Linda Creek channel within five years following construction;
2. Restore at least 25 self-sustaining valley oak trees along the new Rio Linda Creek channel within five years following construction;
3. Create at least 0.163 acres of self-sustaining seasonal wetlands that provide vegetation and hydrological characteristics and functions similar to those provided by the affected habitat within three years following wetland construction or completion of any remedial measures; and
4. Create at least 2.87 acres of freshwater emergent marsh in the new Rio Linda Creek channel within three years following wetland construction or completion of any remedial measures; and
5. Create at least 1.39 acres of other Waters of the U.S. within one year following the new Rio Linda Creek channel construction or completion of any remedial measures.

SAFCA is responsible for ensuring that a qualified biologist or restoration ecologist annually monitors the success of the mitigation project until success criteria are met. In order to be compliant with the BO, success criteria are to be met by the 5th year for the riparian savannah, valley oak trees, stream channel, and freshwater marsh/seasonal wetlands. The timeframe may be extended if remedial measures are required to fulfill success criteria. If an extended drought occurs within the first five years following construction, it is likely that success criteria may not be met for the wetlands by the 5th year of monitoring. If monitoring indicates that the success criteria will not be met by the specified timeframe for any community type, adaptive management will be implemented and monitoring will be extended beyond the establishment period or until success criteria are met.

1.4.1 Annual Grassland

Upland areas surrounding the new channel consist of annual grassland, which is the most abundant habitat type in the area. The grasslands were used for hay and row crops in the past, although none of these areas are presently under active cultivation. A portion of the grassland areas were also utilized as residential home sites. As part of the Mitigation Project, SAFCA purchased the properties and removed all of the above ground structures associated with the residential use.

The annual grassland within the RLCCA is characterized by mostly non-native grasses mixed with native and non-native forbs, including Italian rye (*Lolium multiflorum*), soft brome (*Bromus hordeaceus*), wild oats (*Avena fatua*), vulpia (*Vulpia myuros*), butter and eggs (*Triphysaria eriantha ssp. eriantha*), brodiaea (*Brodiaea sp.*), California poppy (*Eschscholzia californica*), filaree (*Erodium moschatum*), vinegar weed (*Trichostemma lanceolata*), winter vetch (*Vicia villosa*), cutleaf geranium (*Geranium dissectum*), and tarweed (*Hemizonia sp.*).

1.4.2 Riparian Savannah

In accordance with the Draft Recovery Plan for the GGS (USFWS 1999) and discussions with USFWS staff, a riparian community type was developed to meet specific habitat requirements for the GGS. Riparian savannah is a predominantly open plant community with clumped shrubs and trees. This community was planted on the floodplain and the lower banks. It consists of a matrix of open areas with clusters of herbaceous plants, such as Barbara sedge (*Carex barbarae*), single-trunk plants such as box elder (*Acer negundo*) and buttonbush (*Cephalanthus occidentalis*), and clusters of thicket-forming shrubs, such as mule fat (*Baccharis salicifolia*) and sandbar willow (*Salix exigua*). Other thicket-forming shrubs/trees included in the planting design are Gooding's willow (*Salix gooddingii*), red willow (*Salix laevigata*), and arroyo willow (*Salix lasiolepis*). Taller trees incorporated into the planting design include cottonwood (*Populus fremontii*) and valley oak (*Quercus lobata*). Valley oaks planted in the riparian savannah also count toward mitigation for native and heritage trees affected by implementation of the Mitigation Project.

Trees and shrubs selected for installation along the upper slope of the banks are adapted to drier conditions. These species include live oak (*Quercus wislizenii*), coffeeberry (*Rhamnus tomentella*), California rose (*Rosa californica*), and coyote brush (*Baccharis pilularis*). The understory is mainly herbaceous grasses and forbs. Herbaceous species seeded along the floodplain and upper and lower banks include rose clover (*Trifolium hirtum*), purple needlegrass (*Nasella pulchra*), blue wildrye (*Elymus glaucus*), California poppy, California barley (*Hordeum brachyantherum ssp. californica*), creeping wildrye (*Leymus triticoides*), miniature lupine (*Lupinus bicolor*), and fourspot (*Clarkia purpurea*).

Because impact mitigation requires only approximately 2 acres of created riparian habitat, and 4.44 acres were proposed for creation, approximately 2.44 acres of riparian savannah should be available for other uses. SAFCA will seek concurrence from the resource agencies to use the excess acres as future mitigation credit for flood control, maintenance, and other projects that may impact riparian habitat in the Robla Creek and Magpie Creek hydrologic basin/watershed. Although riparian savannah vegetation to be used as future mitigation credit was planted under the same schedule and using similar methods to those described for the compensatory riparian mitigation in the MMP, the

future mitigation credit would be separate from compensatory mitigation requirements associated with this project.

1.4.3 Oak Trees

A number of young oak trees were transplanted to the terrace outside of the flood channel in February 2003 (Figure 5). These trees were removed from the Rio Linda airport to resolve aeronautical safety concerns. They are being irrigated and maintained as part of the restoration of the RLCCA.



Figure 5 - Oak tree being transplanted to RLCCA.

1.4.4 Freshwater Marsh/Seasonal Wetland

Oxbow pools were created in the low floodplain of the new Rio Linda Creek channel. These are depressions on the floodplain separated from the low flow channel. The pools are approximately 5 feet deep, 15 to 25 feet wide, and have side slopes of approximately 3H to 1V. These oxbows are expected to pond throughout the rainy season with relatively slow moving stream water. Depending on the permeability of the soil substrate and their location in the channel, pools will likely vary in the degree that they remain ponded or dry up in summer and fall months. In general, given the slight gradient that was built into the channel, it is anticipated that oxbows will be wettest and thus support marsh vegetation toward the downstream end and drier at the upstream end supporting seasonal wetland vegetation. The wetter downstream conditions result in part because of the backwater effect from the confluence with the Magpie Creek Diversion Channel. Wetland plantings included Barbara sedge, baltic rush (*Juncus balticus*), common rush (*Juncus effusus*), Iris-leaved rush (*Juncus xiphioides*), and bulrush (*Scirpus americanus*).

Vegetation plantings in the oxbows will vary from emergent wetland to drier seasonal wetland plants from downstream to upstream. Vegetation will be allowed to adapt to the hydrological conditions. Supplemental seeding or planting may be necessary based on actual site conditions.

The anticipated size of the created oxbows is approximately 0.43 acres. This area includes 0.163 acres of seasonal wetland and 0.267 acres of freshwater marsh. An additional 2.6 acres of freshwater marsh is anticipated to be created within the lower end of the floodplain where conditions are expected to be wetter for a total of 2.87 acres. Because impact mitigation requires only 0.069 acres of created freshwater marsh habitat, 2.8 acres of freshwater marsh is available for other uses. SAFCA will seek concurrence from the resource agencies to use excess acreage of this created habitat as future mitigation credit for flood control, maintenance, and other projects that may result in impacts to freshwater marsh in the Robla Creek and Magpie Creek hydrologic basin/watershed, within reasonable proximity of the new channel and subject to approval by USACE. Although freshwater marsh to be used as future mitigation credit will be planted under the same schedule and using similar methods to those described for the compensatory freshwater marsh mitigation in the MMP, the future mitigation credit would be separate from compensatory mitigation requirements associated with this project.

1.4.5 Other Waters of the U.S.

The mitigation design includes a base-flow channel within the low floodplain of the new Rio Linda Creek channel. The low flow channel is designed to be approximately 1.39 acres. The low-flow channel meanders across the low floodplain and is approximately 20 feet wide, with a setback from the channel banks to avoid undercutting. During winter of most years, the channel will fill to an ordinary high water mark (OHWM) above the low floodplain, but below the top of the new channel bank. During summer and fall, water in the new Rio Linda Creek channel is expected to be confined to the base-flow channel and oxbows. Some base-flow channel areas and oxbows may dry out in summer and fall. Erosion and reshaping of the designed channel features are expected to be slow, but these processes are difficult to predict. Natural erosion and sedimentation are processes that are acceptable as part of adaptive management goals for the RLCCA.

1.5 Wildlife

Many wildlife species are known to use the RLCCA. These include common species of aquatic invertebrates, fish, amphibians, reptiles, birds, and mammals. It is anticipated that as the vegetation matures and the site develops, wildlife diversity will increase.

The RLCCA also provides potential habitat for some special-status species, including GGS, vernal pool crustaceans, Swainson's hawk (*Buteo swainsonii*), and western pond turtle (*Emys marmorata*). Because Rio Linda Creek is suitable aquatic habitat adjacent to the Natomas Basin GGS population, it is considered potential GGS habitat. However, Eric Hansen, consulting herpetologist, notes that despite the close proximity of the Natomas Basin population, GGS have not been documented utilizing habitat in Steelhead Creek or any tributaries east of the creek, including Dry and Robla Creeks (Hansen 2004, pers. comm.). Sampling has included multiple seasons of visual surveys along Steelhead Creek and the adjacent Carmichael Ranch, as well as focused aquatic trapping at Wolf Ranch Wildlife Sanctuary during the snake's active period in 2004 and 2005. Additional trapping was completed in 2005 along Robla and Rio Linda Creek and no giant garter snakes were found. The closest giant garter snake occurrence was along Elkhorn Boulevard, 0.5 miles west of East Levee Road. The reasons for this lack of documented GGS sightings east of East Levee Road are unclear, but may include subtle changes in habitat resulting from differences in soil type and hydrology, high peak flows during the winter months, and the presence of predators such as bass, catfish and bullfrogs.

2. Methods

All mitigation features, including riparian savannah, native and heritage trees, freshwater marsh, and seasonal wetland, will be monitored annually for 5 years, depending on the habitat type. SAFCA is responsible for ensuring that a qualified botanist or restoration ecologist annually monitors the success of the project. The construction of the RLCCA channel project was completed in 2003, therefore 2007 is considered the fourth year of monitoring.

2.1 Habitat Features

To constitute mitigation acreage, success criteria must be met by the 5th year following construction of the freshwater marsh, riparian savannah and native oak trees. If the criteria are met sooner and continue to be met for one or two years with no trend toward failure (i.e. non-sustainable habitat), the mitigation for that particular habitat type may be considered successful before the full 3- to 5-year period is completed.

Acreages of each constructed habitat type were determined by tracing habitat polygons using ArcMap onto an ortho-rectified aerial photo taken March 2004, a year after construction. This allowed the determination of whether newly constructed habitats meet the acreage criteria.

2.1.1 Annual Grassland

Annual grassland within the RLCCA boundary will be qualitatively assessed during annual surveys but will not be quantitatively monitored as part of the mitigation success criteria. Assessment will be made to best manage the grassland for weed abatement and wildfire control.

2.1.2 Riparian Savannah

The riparian savannah mitigation will be considered successful if 50% of installed trees and shrubs are alive and growing with good vigor after 5 years, regardless of species or source materials (e.g., cutting vs. rooted stock). Native volunteer trees and shrubs may be included in the overall survival count.

The created riparian savannah community has been monitored each year since the initial planting of the trees and shrubs. During 2007 all of the trees were monitored and 20% of the shrubs were randomly selected for measurements¹. These selected individuals were tagged and the GPS coordinates were logged to ensure that these same plants will be evaluated for all future monitoring years. In addition to plant survivorship and vigor (dead=0, poor=1, poor-fair=2, fair=3, fair-good=4 or good=5)², measurements of the height, crown size and the diameter at breast height of all of the trees and measurements of the height and crown size of targeted shrubs were collected. Any signs of reproduction were noted and volunteer recruitment was tallied. The total plant counts (surviving planted stock + volunteer plants) were then compared to the original planting numbers to determine survival. Sandbar willows were not included in

¹ Conservation Area Management and Maintenance Plan, October 28, 2003

² Good rating - plants are healthy with large green leaves, and less than 10% yellow leaves

Good- fair – plants have 10-25% yellow leaves but otherwise look healthy

Fair – plants have 25-50% yellow leaves and are looking stressed

Fair-poor – plants have 50-75% yellow leaves, are drying out and looking stressed

Poor – plants have more than 75% yellow leaf, are losing leaves, dried out, and looking very stressed.

the above measurements because their multi-stemmed growth form made it too difficult to accurately count. Instead the length and width of the area that was occupied by sandbar willow was measured. The total of number of sandbar willows were then estimated according to the following criteria: every 3 feet parallel to the stream channel equals one sandbar willow.

2.1.3 Oak Trees

Mitigation for native oaks and heritage trees removed by the project will be considered successful if at least 25 valley oak trees are alive and growing with good vigor after 5 years in the created riparian woodland community or wherever they were planted or have volunteered along the new channel.

Since the summer following the planting season (2004), all of the planted and transplanted valley oak trees were monitored for species, survival, height, DBH (diameter breast height), crown size and signs of reproduction. In the first year of monitoring, soil moisture was also recorded to ensure that the irrigation system was functioning properly and that the oaks were receiving adequate moisture. Based on this information, a deep watering event was conducted every 4 weeks as recommended by the California Oak Foundation.

2.1.4 Freshwater Marsh/Seasonal Wetland

The freshwater marsh/seasonal wetland habitat will be considered successful if it exhibits the following vegetation success criteria by the end of 5 years following installation after all construction and remedial actions have been completed:

- Total vegetation cover will be at least 30%
- Total cover by wetland indicator species (e.g. OBL, FACW or FAC) will be at least 50%, and

The created habitat will be monitored beginning in the summer following the initial installation of plants. Relative cover by wetland indicator species (OBL, FACW or FAC), and native species (wetland indicator and non-indicator) will be determined along with total vegetation cover. Total cover values and relative cover values will be determined using an appropriate method.

In 2004, downstream beaver activity caused these areas to be inundated with water throughout the summer, preventing plant surveys from being completed. In 2005, 2006, and 2007 biologists used chest waders to conduct vegetation surveys. Four transects were laid across the floodplain, two upstream of the bridge and two downstream of the bridge. Along each transect a 1' X 1' square quadrant was laid down every 10 feet from the channel edge and the percent cover of each plant species was recorded. The species were then classified by wetland indicator type and whether they are native.

2.1.5 Other Waters of the U.S.

There is no success criterion for other Waters of the U.S., provided the newly created Rio Linda Creek channel functions to carry water downstream to the Magpie Creek Diversion Channel. Photographic documentation and general observations will be used to record the progress of all restoration and enhancement actions, and monitor any erosion. After construction was completed, permanent locations for photographic documentation were established within each vegetated community. Observations of the

overall conditions of revegetated communities will be recorded and dated photographs will be archived every year.

2.2 Wildlife

No performance or success standards have been established for wildlife monitoring. However, whenever site checks are done, notes are taken on the wildlife utilizing the site. Also, a baseline quantitative bird survey was conducted just after the oak trees were transplanted in March 2003. This survey was repeated in March 2005 and September 2007 to see how site utilization may have changed over time. In September 2007, additional faunal surveys were conducted to assess presence/absence of fish, mammals, reptiles and amphibian species. During the bird survey, any mammals, reptiles or amphibians observed either visually, by audio or sign were noted. A separate shoreline dip-net survey was conducted for aquatic species. Wildlife monitoring will continue until plant survival monitoring is completed.

3. Results & Discussion

Quantitative and qualitative monitoring has shown that the habitat types are becoming established and the vegetation is growing successfully. The results of the 2007 monitoring season can be seen below. Site monitoring will continue to guide adaptive management and future maintenance needs at the site.

3.1 Habitat Features

There are three habitat acreage goals that were defined in the USACE-approved wetland CAMMP. The post-construction acreages were determined from 2004 aerial photos and can be seen below in Table 1. The measured acreages were then compared with the acreage goals required for mitigation as discussed in Sections 1.4.2 and 1.4.4.

Table 1 - Post-construction habitat acreages.

Habitat Type	Impact Mitigation Acreage Goal	2004 Measured Acreage	Potential Available Credit
Riparian Savannah	2.0	5.18	3.18
Seasonal Wetland/Emergent Marsh	0.069	4.18	4.11
Other Waters of the U.S.	1.39	1.55	0.16

Beaver activity downstream of the RLCCA has caused the site to become much more inundated than initially designed. As a result, the only habitat truly functioning as riparian savannah was along the channel banks (see Figure 6). The majority of the channel bottom, except for the open water creek, was determined to be functioning as seasonal wetland/emergent marsh. Despite the fact that we did not classify any riparian savannah habitat within the channel bottom, the restored stream bank habitat provided sufficient acreage to meet our mitigation goals. These habitat acreages will be mapped and recalculated in Year 5 (2008) to ensure acreage goals are met.

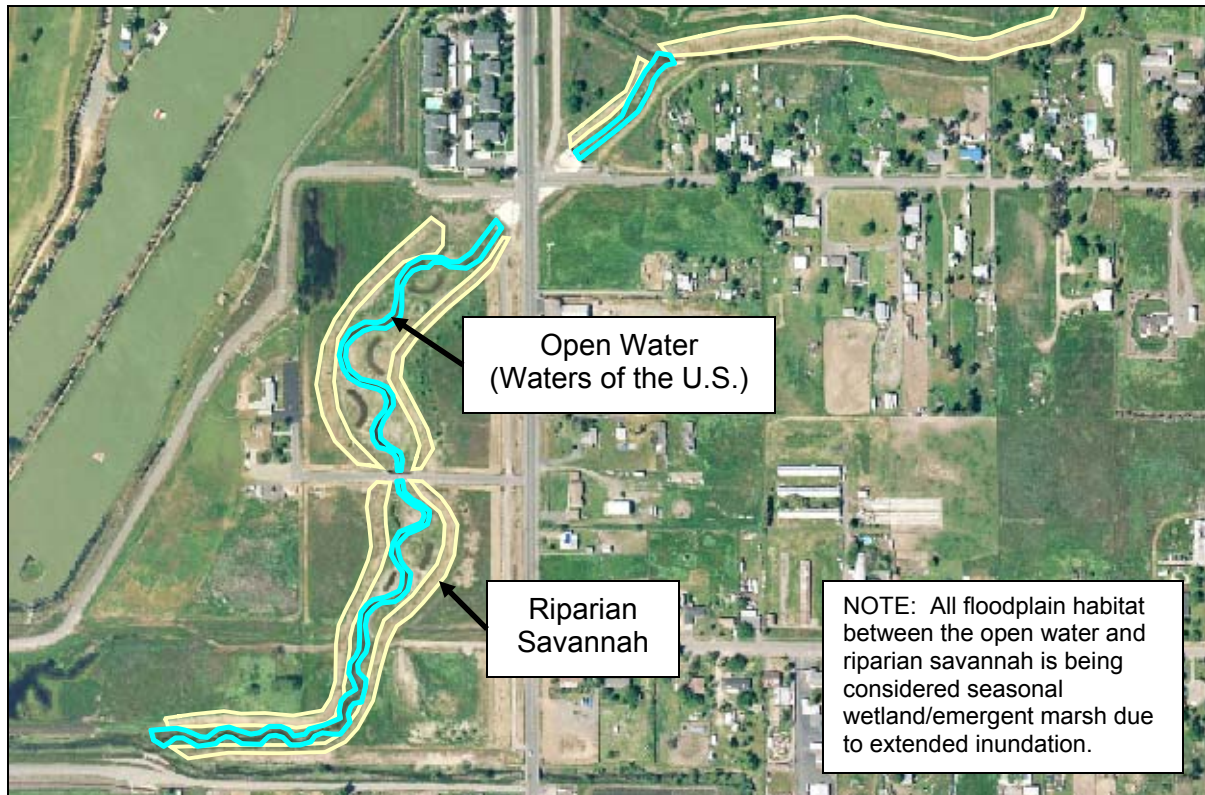


Figure 6 - Habitat areas delineated on 2004 aerial photo.

3.1.1 Annual Grassland

The upland annual grassland areas have become established. The primary management concern in this habitat type is the spread of non-native weeds. Weeds are difficult to control in the grassland areas considering the vegetation maintenance restrictions under the Biological Opinion. These restrictions preclude the use of herbicides at all times and only allow mowing from July through to the end of September. This makes it very difficult to maintain weeds that typically flush in the spring and winter. Also, the soil appears to be very compact, inhibiting saturation and presenting a challenge to newly emerging plants. The nutrient content of the soil is unknown.

3.1.2 Riparian Savannah

The planted vegetation in the riparian savannah has been very successful. On average, there is an 86% survival rate of the trees and 78% survival rate of the shrubs for an overall average survival rate of 81% after four years of monitoring (Table 2). Many species survival rates decreased from 2006 to 2007; possibly due to beaver pruning and damage. To address this issue, remedial measures such as individually caging trees and fencing preferentially pruned species, as well as additional plantings, occurred during spring 2007. The health indices for the trees and 20% of the shrubs averaged 4.9 each, indicating an overall population of healthy vegetation (Table 2). Additionally, many of the California rose bushes, coffeeberry plants and coyote brush were in fruit and many of the interior live oak trees were developing acorns.

Baseline height and health information was not collected immediately after planting but the initial years' qualitative assessment indicated that the plants were growing vigorously. Quantitative measures during 2007 show that the average height of trees is 9.9 feet, with an average DBH of 1.4 inches, and the average height of the shrubs is 6.3 feet. Additionally the collected data indicates that the average crown spread for all of the trees is 9.0 feet and for 20% of the shrubs is 5.3 feet (Table 3).

It is difficult to make yearly comparisons of sandbar willow since the data collection methods in 2007 differed from previous years (see Methods above). However, if comparisons are made, the total number of sandbar willow has increased substantially, from the 35 initially planted to 180; a 514% increase. Using the methods stated above, the sandbar willow occupies 2.89 of the 5.18 acres in the riparian savannah habitat.

Maintenance in the riparian savannah area included periodic irrigation during summer months, weed control and some minor garbage pickup. Weed control occurred primarily in the planting basins using a combination of hand pulling and string trimmers.

Table 2 - Summary of plant count, survival and vigor in riparian savannah habitat type.

Species	# Planted	2005 Monitoring			2006 Monitoring			2007 Monitoring		
		Plant Count	% Survival	Mean Vigor	Plant Count	% Survival	Mean Vigor	Plant Count	% Survival	Mean Vigor
Arroyo Willow	51	27	53%	5	15	29%	5	13	25%	5.0
Black Walnut	0	0	0	0	0	0	0	2	100%	5.0
Box Elder	27	32	119%	5	23	85%	4.91	11	41%	4.8
Fremont Cottonwood	30	29	97%	5	4	13%	5	10	33%	4.8
Gooding's Willow	13	23	177%	4.91	16	123%	5	10	77%	4.4
Interior Live Oak	58	50	86%	5	44	76%	4.95	37	64%	5.0
Oregon Ash	18	18	100%	5	15	83%	5	6	33%	5.0
Red Willow	60	34	57%	4.76	27	45%	5	10	17%	5.0
Sandbar Willow	35	60	171%	5	105	300%	5	*180	514%	5.0
Valley Oak	91	80	88%	5	73	80%	5	54	59%	4.9
TREES TOTAL	383	353	92%	4.97	322	84%	4.99	333	87%	4.9
Buttonbush	49	37	76%	5	32	65%	5	27	55%	4.6
California Rose	195	222	114%	4.27	278	143%	5	240	123%	5.0
Coffeeberry	116	58	50%	5	57	49%	5	53	46%	5.0
Coyote Brush	204	178	87%	5	175	86%	5	158	77%	4.9
Mulefat	103	62	60%	5	62	60%	4.55	40	39%	4.4
SHRUBS TOTAL	667	557	84%	4.71	604	91%	4.95	518	78%	4.9
TOTAL	1050	910	87%	4.81	926	88%	4.97	851	81%	4.9

* Vigor: dead=0, poor=1, poor-fair=2, fair=3, fair-good=4, good=5

** Mean vigor is representative of only 20% of the shrubs (see methods above)

† Sandbar willow was evaluated with a different method (see methods and results above)

Table 3 - Summary of vegetation height, crown spread and DBH in riparian savannah habitat type.

Species	2007 Monitoring				
	Sample Size Height/Crown Spread	Mean Height	Mean Crown Spread	Sample Size DBH*	Mean DBH
Arroyo Willow	13	6.3	6.2	6	0.5
Box Elder	11	10.1	9.6	9	1.3
Fremont Cottonwood	10	7.8	5.1	7	0.9
Gooding's Willow	10	13.7	11.9	10	1.9
Interior Live Oak	37	9.6	9.9	36	1.2
Oregon Ash	6	10.0	9.9	6	1.1
Red Willow	10	9.8	8.9	9	1.2
Valley Oak	54	10.9	9.1	54	1.6
Sandbar Willow [†]	*180	---	---	---	---
TREES TOTAL	151	9.9	9.0	137	1.2
Buttonbush	5	5.6	4.8	---	---
California Rose	32	5.6	3.0	---	---
Coffeeberry	8	7.6	7.8	---	---
Coyote Brush	35	6.5	6.7	---	---
Mulefat	5	8.0	6.2	---	---
20% of SHRUBS	85	6.3	5.3	---	---

* Sample size for DBH does not include trees less than ≤4' in height

[†] Sandbar willow was evaluated with a different method see methods and results

3.1.3 Oak Trees

In the spring of 2005, there were several empty planting basins in the upland area that were planted with 15-gallon valley oaks and sycamores. By the fall, the newly planted trees had extensive flathead borer injury at the base of their trunks, and had grown very slowly from their existing stems while watersprouts and suckers were growing vigorously from near or below the base of the trunks. In 2006, these newly planted trees were pruned to below the borer-girdled stem where possible and a dominant sprout was selected. The irrigation system was checked to ensure that it functioned properly, and any extra soil was removed from the top of the rootballs.

In 2007, there were 44 valley oak trees established, far exceeding the 25 tree requirement. Most of these trees were the original transplants, but some developed from root suckers of dead transplants or became established from additional planting efforts, including one new valley oak in 2007. Most of these trees were in good health and seemed to have recovered from the transplanting stress. The average tree height was 16.2 feet.

3.1.4 Freshwater Marsh/Seasonal Wetland

The freshwater marsh/seasonal wetland habitat will be considered successful if it exhibits certain vegetation success criteria by the end of five (5) years following plant installation and after all construction and remedial actions have been completed. The complete dataset for the wetland vegetation surveys can be seen in Appendix A and has been summarized below in Table 4.

Table 4 - Freshwater marsh/seasonal wetland success criteria for the RLCCA and survey results.

Success Criteria	Goal	2005 Survey	2006 Survey	2007 Survey
Total vegetation cover	30%	65%	89%	94%
Total cover by wetland indicator species	50%	62%	82%	43%
Total cover by native species	35%	37%	40%	19%

During September, 2007 the freshwater marsh/seasonal wetland habitat was monitored and the total vegetation cover was 94%; a continual increase since 2005 (Table 3, Table 7). The total cover by wetland indicator species is 43%; 7% short of the year five goal of 50%. Total cover by native species dropped to 19% in 2007. However, this year's survey included a considerable amount of dried unidentifiable annual vegetation (referred to as litter during the survey and hereafter) that was not included in the total cover by wetland indicator species or total cover by native species. The decline in total cover by wetland indicator species and total cover by native species from 2006 to 2007 may be attributable to the annual litter, especially since there were no observations of annual litter during the 2006 survey. Additionally, the total number of quadrats increased from 35 quadrats in 2006 to 72 quadrats this year, illustrating that the water level was much lower this year compared to 2006.

Maintenance in the wetland areas during 2007 included planting willows, cottonwoods and valley oaks, as well as removing linear fencing within the channel that was fragmenting habitats and obstructing the movement of wildlife. The following two part strategy toward protecting plants preferentially pruned by beavers while minimizing the amount of fencing was implemented: 1) individual trees were caged and 2) clumps of plants were caged. Red sesbania (which is becoming much more prolific at this site) and Chinese tallow were removed by hand from the stream channels to prevent the downstream spread of these highly invasive weeds. Debris removal is an ongoing part of maintenance.

Beavers and their dams have been located just downstream of RLCCA. Because the RLCCA has a wide floodplain and the area would not be susceptible to flood damage as a result of raised water surface, it may be better to simply allow the beavers to continue their activity thereby creating more freshwater marsh habitat than initially planned. Mitigation acreage goals will still be adequately met. Additionally, as stated in the U.S. Fish & Wildlife Service's Compensation Criteria for Restoration and/or Replacement of Giant Garter Snake Habitat, an essential habitat component for giant garter snake is the availability of emergent, herbaceous wetland vegetation for escape cover and foraging habitat. Therefore, the flooded channel bottom provides excellent potential habitat for giant garter snake. However, if allowing the beaver activity to continue is the preferred alternative, then there will be an increasing need to work with the Sacramento-Yolo Vector Control District to ensure that mosquito infestations do not become problematic. Mosquitofish (*Gambusia affinis*) that feed on the aquatic and larval stages of mosquito,

were caught during dip-net sampling and could help control any possible mosquito infestations. SAFCA will continue to maintain the site until all habitat criteria have been met and the shrubs and trees are established and sustainable.

3.1.5 Other Waters of the U.S.

Photopoints of the RLCCA can be seen in Appendix B. By comparing these photos over time, we can monitor erosion and vegetation recovery. It is evident from these photos that the newly constructed stream banks are stable and there does not appear to be any evidence of erosion.

3.2 Wildlife

Many wildlife species have been recorded at the RLCCA during periodic site visits. The prolonged level of water inundation resulting from the beaver activity has been extremely beneficial to waterfowl species. Large numbers of ducks have been observed feeding within the RLCCA and nesting has also been observed. A baseline quantitative bird survey was conducted just after the oak trees were transplanted in March 2003, and 30 birds of 8 different species were counted. Additional surveys were repeated in March 2005 and September 2007 to see how the site utilization may have changed over time. During these surveys, 17 species and 22 species were detected in 2005 and 2007 (Table 5) respectively indicating an increase in species richness (number of different species in an area). Other species detected during the bird survey were the Black-tailed Jackrabbit, American Beaver, Western Fence Lizard and an unidentified turtle. During a shoreline dip-net survey for aquatic fauna, mosquitofish were captured as well as several tadpoles of unidentified species.

Additional bird species observed during periodic site visits include:

- Barn Swallow (*Hirundo rustica*)
- Black-necked Stilt (*Himantopus mexicanus*)
- Blue-winged Teal (*Anas discors*)
- Brewer's Blackbird (*Euphagus cyanocephalus*)
- Canada Goose (*Branta canadensis*)
- Cinnamon Teal (*Anas cyanoptera*)
- Common Snipe (*Gallinago gallinago*)
- Domestic Duck (*Anas domesticus*)
- Great Egret (*Ardea alba*)
- Greater Yellowlegs (*Tringa melanoleuca*)
- House Finch (*Carpodacus mexicanus*)
- Loggerhead Shrike (*Lanius ludovicianus*)
- Marsh Wren (*Cistothorus palustris*)
- Northern Harrier (*Circus cyaneus*)
- Pied-billed Grebe (*Podilymbus podiceps*)
- Red-tailed Hawk (*Buteo jamaicensis*)
- Snowy Egret (*Egretta thula*)
- Song Sparrow (*Melospiza melodia*)
- Swainson's Hawk (*Buteo swainsoni*)
- Turkey Vulture (*Cathartes aura*)
- Western Kingbird (*Tyrannus verticalis*)
- Western Scrub-Jay (*Aphelocoma californica*)
- White-crowned Sparrow (*Zonotrichia atricapilla*)
- White-tailed Kite (*Elanus leucurus*)
- Yellow-billed Magpie (*Pica nuttalli*)

Other animals and animal sign (scat, tracks, burrows, herbivory damage, etc) observed during periodic site visits have included:

- Muskrat (*Ondatra zibethica*)
- California Meadow Vole (*Microtus californicus*)
- Common Garter Snake (*Thamnophis sirtalis*)

4. Conclusions & Recommendations

All of the habitat types within the RLCCA are becoming well established and are on course to meet year 5 mitigation goals. The freshwater marsh/seasonal wetland habitat was considered successful if it exhibited certain vegetation success criteria (see section 1.4 Habitat Features) by the end of five years following plant installation and after all construction and remedial actions have been completed. These vegetation objectives are close to being met in this habitat type 2007 (year 4) and will continue to be monitored in year 5. SAFCA will also continue to maintain the entire RLCCA site until all habitat criteria have been met and the shrubs and trees are established and sustainable. Annual monitoring efforts will continue to track changes in the vegetation in the other habitat areas to ensure that 5th year mitigation goals are met for the riparian savannah, native oak trees and freshwater marsh/seasonal wetland.

Over the next maintenance year, special attention will be given to weed control. Because of the limitations of the conservation easement on mowing and herbicide use, some more labor-intensive weed control may be needed utilizing hand pulling and string-trimmers. Continued vigilance should be taken to control the establishment of red sesbania within the stream channel. Irrigation, if done, should be by the “deep watering method,” which consists of a slow, all-day soaking only a few times during the summer dry period. This will be more necessary for the newly planted 15-gallon oaks than the transplants that have become more established at this site. Supplemental to the routine maintenance efforts, there are additional projects that can be undertaken to improve the RLCCA such as the installation of nesting boxes, coarse woody debris, and perching poles.

5. References

- EDAW. 2003. Rio Linda Creek Conservation Area: Conservation Area Management and Maintenance Plan. Prepared for the Sacramento Area Flood Control Agency on October 28, 2003. 31 pp.
- Hansen, Eric. 2004. Personal Communication with Amy van Riessen. November 5, 2004.
- Lichter, John M. 2005. Memo to Peter Buck and Amy van Riessen: Arborist's Update Robla Transplanted Oaks. November 13, 2005. 3 pp.
- USFWS. 1999. Draft Recovery Plan for the Giant Garter Snake (*Thamnophis gigas*). USFWS, Portland, Oregon. 192 pp.
- USFWS. 2002. Formal Consultation on the Proposed Lower Dry Creek and Robla Creek Levee Improvement Project, Sacramento County, California. Regulatory Branch #200000541. Letters issued March 22, 2002 (44 pp) and April 9, 2002 (2 pp).

Appendix A – Wetland Vegetation Monitoring Data

Table 5 - Morning bird survey conducted September 2007 along RLCCA.

Common Name	Scientific Name	Count
American Coot	<i>Fulica americana</i>	1
American Crow	<i>Corvus brachyrhynchos</i>	2
American Goldfinch	<i>Carduelis tristis</i>	1
American Kestrel	<i>Falco sparveius</i>	1
Anna's Hummingbird	<i>Calypte anna</i>	2
Black Phoebe	<i>Sayornis nigricans</i>	3
California Quail	<i>Callipepla californica</i>	1
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	Previous nesting 50+
European Starling	<i>Sturnus vulgaris</i>	8
Great Blue Heron	<i>Ardea herodias</i>	2
Green Heron	<i>Butorides virescens</i>	4
House Wren	<i>Troglodytes aedon</i>	1
Killdeer	<i>Charadrius vociferous</i>	2
Lesser Goldfinch	<i>Carduelis psaltria</i>	3
Mallard	<i>Anas platyrhynchos</i>	20
Mourning Dove	<i>Zenaida macroura</i>	30
Northern Mockingbird	<i>Mimus polyglottos</i>	2
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	13
Ring-necked Pheasant	<i>Phasianus colchicus</i>	3
Rock Pigeon	<i>Columba livia</i>	56
Savannah Sparrow	<i>Passerculus sandwichensis</i>	3
Western Meadowlark	<i>Sturnella neglecta</i>	3
Number of species		22
Total abundance of birds		161

Table 6 - Species list of plants found at RLCCA during wetland vegetation survey (Sept. 17, 2007).

Species	Common Name	Native/ nonnative/ unknown	Indicator Species
Algae	Algae	N/A	OBL
<i>Amsinckia lycopsoides</i>	Tarweed fiddleneck	Native	UPL*
<i>Avena fatua</i>	Wild oats	Nonnative	FAC
<i>Avena</i> sp.	Wild oats	Unknown	
<i>Bidens laevis</i>	Bur marigold	Nonnative	OBL
<i>Brassica nigra</i>	Mustard	Nonnative	NI
<i>Bromus diandrus</i>	Ripgut grass	Nonnative	NI
<i>Bromus hordeaceus</i>	Soft brome	Nonnative	NI
<i>Bromus madritensis</i>	Foxtail chess	Nonnative	NI
<i>Chenopodium berlandieri</i>	Pitseed goosefoot	Nonnative	NI
<i>Chenopodium murale</i>	Nettle-leaf Goosefoot	Nonnative	FACU-
<i>Cicuta maculata</i>	Water hemlock	Native	OBL
<i>Cyperus eragrostis</i>	Tall flatsedge	Native	FACW
<i>Echinochloa crus-galli</i>	Barnyardgrass	Nonnative	FACW
<i>Eschscholzia californica</i>	California poppy	Native	NI
<i>Evi (aster)??</i>	Unknown	Unknown	
<i>Geranium dissectum</i>	Cranesbill geranium	Nonnative	NI
<i>Gnaphalium palustre</i>	Cudweed	Native	FACW
<i>Lactuca</i> sp.	-	Native	U
<i>Leersia oryzoides</i>	Rice Cutgrass	Native	OBL
<i>Leptochloa fascicularis</i>	Bearded sprangletop	Native	OBL
Annual litter	-	Unknown	
<i>Lolium multiflorum</i>	Italian Ryegrass	Nonnative	FAC*
<i>Ludwigia peploides</i>	Waterprimrose	Native	OBL
<i>Medicago lupulina</i>	Yellow trefoil	Nonnative	FAC
<i>Medicago polymorpha</i>	Burclover	Nonnative	FACU-
<i>Oenothera biennis</i>	Evening primrose	Nonnative	NI
<i>Paspalum dilatatum</i>	Dallisgrass	Nonnative	FAC
<i>Plantago major</i>	Plantain	Nonnative	FAC
<i>Polygonum lapathifolium</i>	Curlytop Knotweed	Native	OBL
<i>Polygonum persicaria</i>	Lady's Thumb	Nonnative	FACW
<i>Polygonum</i> sp.	-	Unknown	
<i>Polypogon monspeliensis</i>	Annual rabbitsfoot grass	Nonnative	FACW+
<i>Raphanus sativus</i>	Radish	Nonnative	UPL
<i>Rumex crispus</i>	Curly Dock	Nonnative	FACW-
<i>Salix exigua</i>	sandbar willow	Native	FACW
<i>Symphotrichum subulatum</i>	Eastern annual saltmarsh aster	Native	FACW
<i>Taeniatherum caput-medusa</i>	Medusa head	Nonnative	NI
<i>Tragopogon dubius</i>	Western salsify	Nonnative	NI
<i>Trifolium</i> sp.	Clover	Unknown	
<i>Typha latifolia</i>	Common cattail	Native	OBL
<i>Verbena bonariensis</i>	Verbena	Nonnative	FACW
<i>Vicia benghalensis</i>	Purple Vetch	Nonnative	NI
<i>Vulpia</i> sp.	Fescue	Unknown	

Table 7 - Percent cover of quadrants by species type (Wetland vegetation survey on Sept. 17, 2007).

Quadrat Number	Percent Cover Native Species	Percent Cover Nonnative species	Percent Cover Unidentifiable	Total Percent Cover
1L1	0	40	0	40
1L2	0	2	98	100
1L3	6	5	89	100
1L4	0	20	80	100
1L5	1	8	91	100
1L6	0	100	0	100
1L7	20	80	0	100
1L8	0	80	20	100
1R1	80	15	5	100
1R2	30	65	5	100
1R3	100	0	0	100
1R4	0	70	30	100
1R5	0	60	40	100
2L1	25	27	0	52
2L2	75	5	20	100
2L3	1	12	87	100
2L4	0	1	99	100
2L5	4	10	86	100
2L6	0	10	90	100
2L7	0	95	5	100
2L8	45	45	0	90
2L9	90	0	0	90
2L10	30	0	0	30
2L11	15	0	80	95
2L12	5	0	95	100
2L13	0	70	23	93
2L14	0	80	20	100
2R1	45	30	25	100
2R2	15	0	85	100
2R3	10	0	90	100
2R4	6	0	94	100
2R5	0	1	99	100
2R6	0	35	65	100
2R7	20	45	35	100
2R8	0	4	96	100
2R9	10	7	83	100
2R10	5	43	52	100
2R11	0	45	55	100
2R12	0	0	100	100
2R13	15	5	80	100
2R14	15	60	25	100
2R15	0	80	20	100
2R16	0	80	20	100

Quadrat Number	Percent Cover Native Species	Percent Cover Nonnative species	Percent Cover Unidentifiable	Total Percent Cover
2R17	0	100	0	100
3L1	18	17	7	42
3L2	0	5	95	100
3L3	0	100	0	100
3L4	0	100	0	100
3R1	35	5	30	70
3R2	70	30	0	100
3R3	0	55	45	100
3R4	5	3	92	100
3R5	40	10	50	100
3R6	0	0	0	0
4L1	0	70	0	70
4L2	15	15	70	100
4L3	70	0	30	100
4L4	0	95	5	100
4L5	0	65	35	100
4L6	60	45	0	100
4L7	25	0	25	50
4L8	21	21	58	100
4L9	90	10	0	100
4L10	74	26	0	100
4L11	70	15	0	85
4L12	0	25	75	100
4L13	4	96	0	100
4L14	0	98	2	100
4R1	33	12	30	75
4R2	27	7	61	95
4R3	20	5	75	100
4R4	0	35	65	100
Average Percent Cover	33	40	55	93

Table 8 - Percent cover by wetland indicator type (Wetland vegetation survey on Sept. 17, 2007).

Quadrat Number	Non-wetland indicators			Wetland Indicators									Unknown Indicator Status Litter	TOTAL PERCENT COVER
	UPL	NI	Total	FAC	FAC-	FAC*	FAC+	FACW	FACW-	FACW+	OBL	Total		
1L1		15	15	50				4			1	55	0	70
1L2			0					20	10			30	70	100
1L3			0					70				70	30	100
1L4	80		80	5							10	15	5	100
1L5			0	20	5				40			65	35	100
1L6	5		5	20		5		55	5		10	95	0	100
1L7			0								50	50	25	75
1L8		1	1					20		5	16	41	58	100
1L9			0	10				90				100	0	100
1L10			0					78		22		100	0	100
1L11			0					85				85	0	85
1L12		25	25									0	75	100
1L13	72	4	76	3		21						24	0	100
1L14	10	88	98									0	2	100
1R1			0	10							85	95	5	100
1R2			0	10				35			50	95	5	100
1R3			0					100				100	0	100
1R4			0	20		50						70	30	100
1R5		40	40			20						20	40	100
2L1		3	3	7				7			18	32	7	42
2L2			0	5								5	95	100
2L3	25		25	25		50						75	0	100
2L4	33		33	34		33						67	0	100
2R1			0					25			50	75	25	100
2R2			0								15	15	85	100
2R3			0								10	10	90	100
2R4			0								6	6	94	100
2R5			0					1				1	99	100
2R6		25	25					10				10	65	100
2R7		20	20					25			20	45	35	100
2R8		1	1	1				1		1		3	96	100
2R9		5	5					2			10	12	83	100

Quadrat Number	Non-wetland indicators			Wetland Indicators									Unknown Indicator Status Litter	TOTAL PERCENT COVER
	UPL	NI	Total	FAC	FAC-	FAC*	FAC+	FACW	FACW-	FACW+	OBL	Total		
2R10		10	10	3				30			5	38	52	100
2R11	20		20					5			20	25	55	100
2R12			0									0	100	100
2R13			0					15			5	20	80	100
2R14			0			10		15	50			75	25	100
2R15			0			80						80	20	100
2R16			0			80						80	20	100
2R17		50	50	25		25						50	0	100
3L1		25	25					2			25	27	0	52
3L2			0					5			75	80	20	100
3L3	1	1	2	5					5		1	11	87	100
3L4			0					1				1	99	100
3L5	5	5	10					4				4	86	100
3L6	5		5					5				5	90	100
3L7			0					95				95	5	100
3L8			0					45			45	90	0	90
3L9			0								90	90	0	90
3L10			0								30	30	0	30
3L11			0								15	15	80	95
3L12			0								5	5	95	100
3L13		10	10			60						60	23	93
3L14			0	80								80	20	100
3R1			0								70	70	30	100
3R2		10	10					20			70	90	0	100
3R3			0	55								55	45	100
3R4	6	2	8									0	92	100
3R5		42	42	3		5						8	50	100
3R6			0									0	0	0
4L1			0					40				40	0	40
4L2			0					2				2	98	100
4L3			0						5		6	11	89	100
4L4	0	10	10		5				5			10	80	100
4L5	0	1	1		1	5			1			7	91	99
4L6	0	50	50			50						50	0	100

Quadrat Number	Non-wetland indicators			Wetland Indicators									Unknown Indicator Status Litter	TOTAL PERCENT COVER
	UPL	NI	Total	FAC	FAC-	FAC*	FAC+	FACW	FACW-	FACW+	OBL	Total		
4L7		5	5			75					20	95	0	100
4L8	5		5	75								75	20	100
4R1			0					15			60	75	30	105
4R2			0					2			32	34	61	95
4R3	5		5					20				20	75	100
4R4			0	5		30						35	65	100
Average Cover			10									43	41	94

Appendix B – Photopoints



June 2003



July 2005



July 2006



October 2007



June 2003



July 2005



July 2006



October 2007



June 2003



July 2005



July 2006



October 2007



June 2003



July 2005



July 2006



October 2007



June 2003



July 2005



July 2006



October 2007



June 2003



July 2005



July 2006



October 2007



June 2003



July 2005



July 2006



October 2007



June 2003



July 2005



July 2006



October 2007



October 2003



July 2005



July 2006



October 2007