Status of Habitat Mitigation and Monitoring for

The Rio Linda Creek Conservation Area

Annual Report 2005

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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.

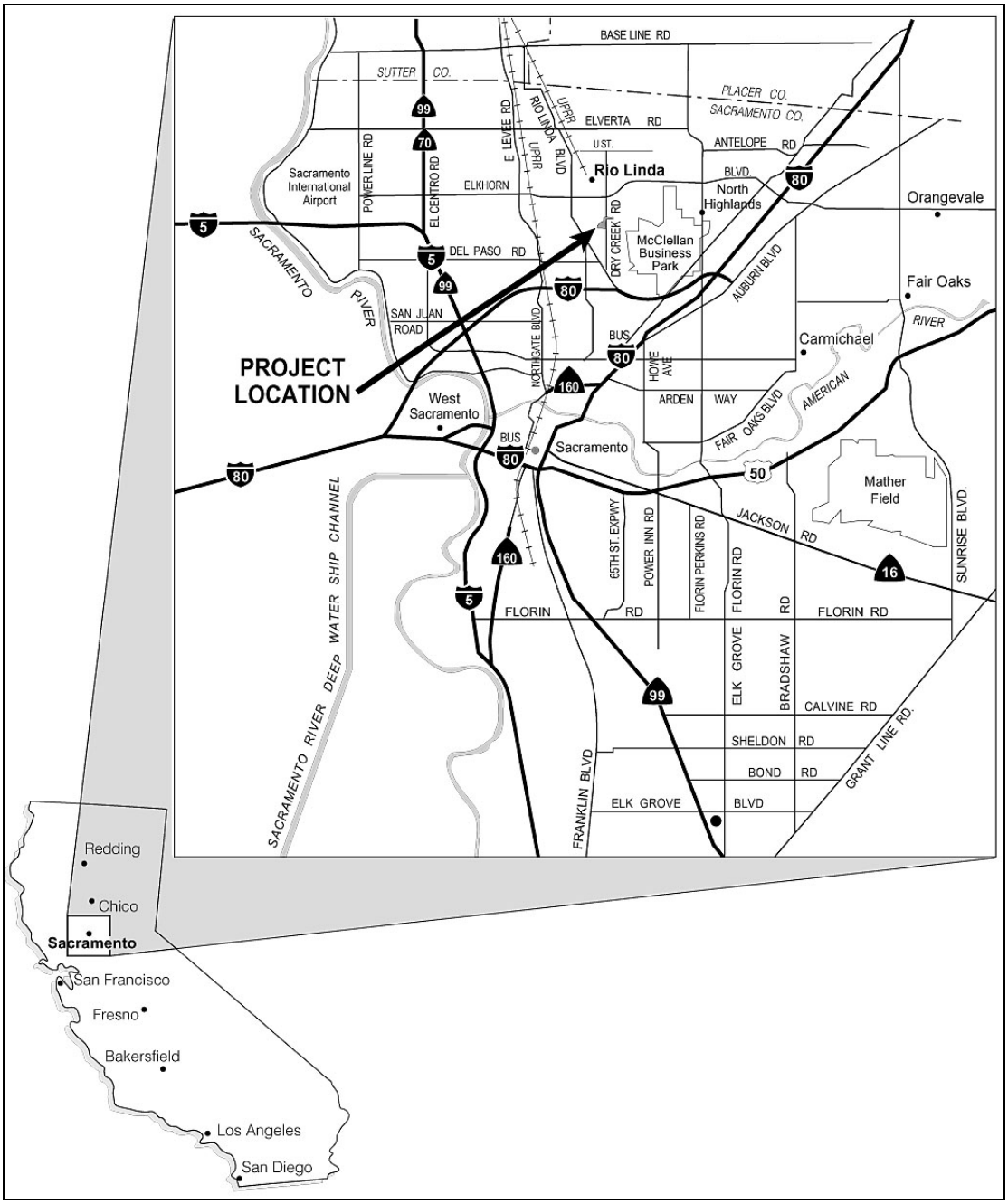

Figure 2 - Location of the Rio Linda Creek Conservation Area.

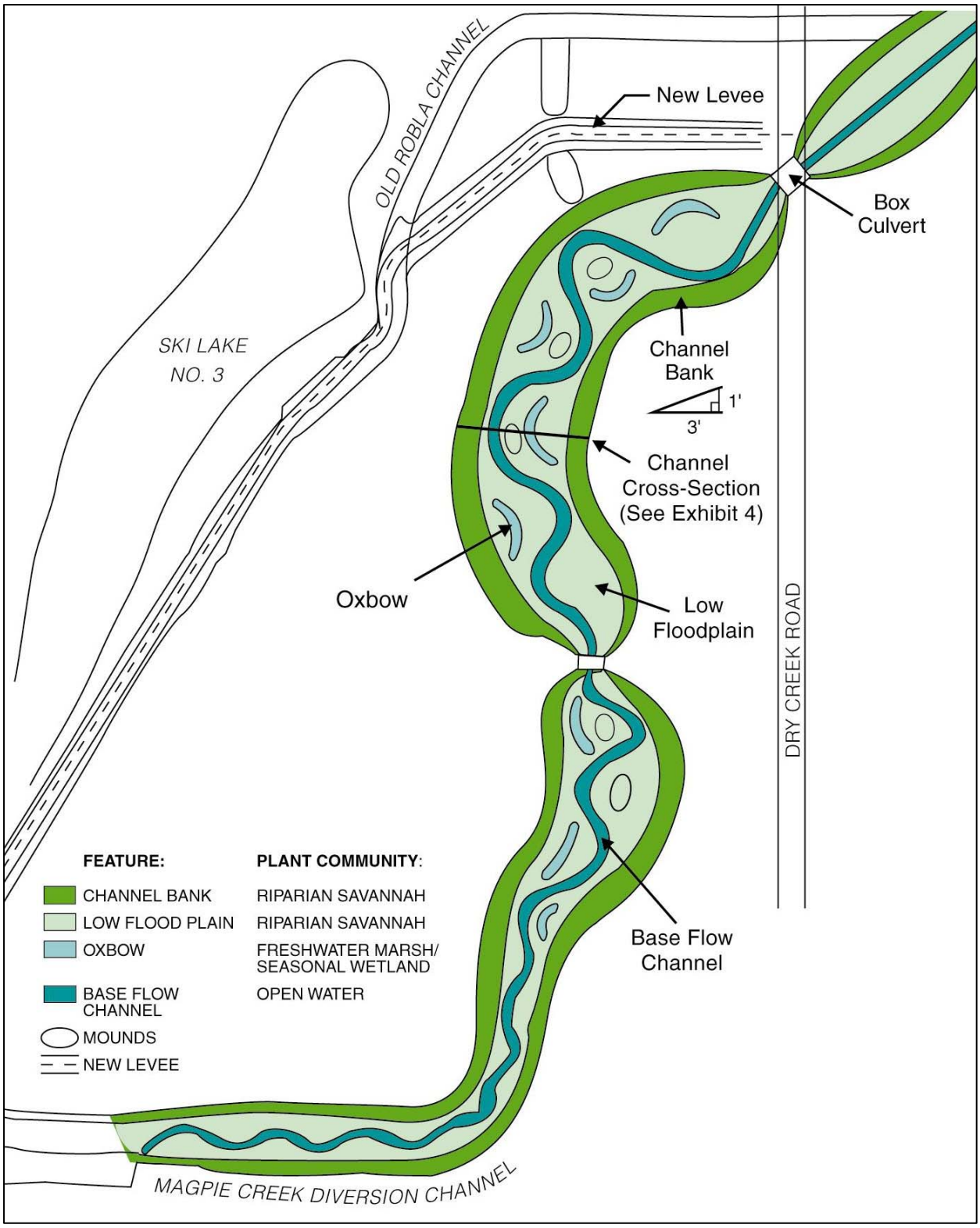

Figure 3 - Site plan for new Rio Linda Creek channel

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 packardi*) – 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.

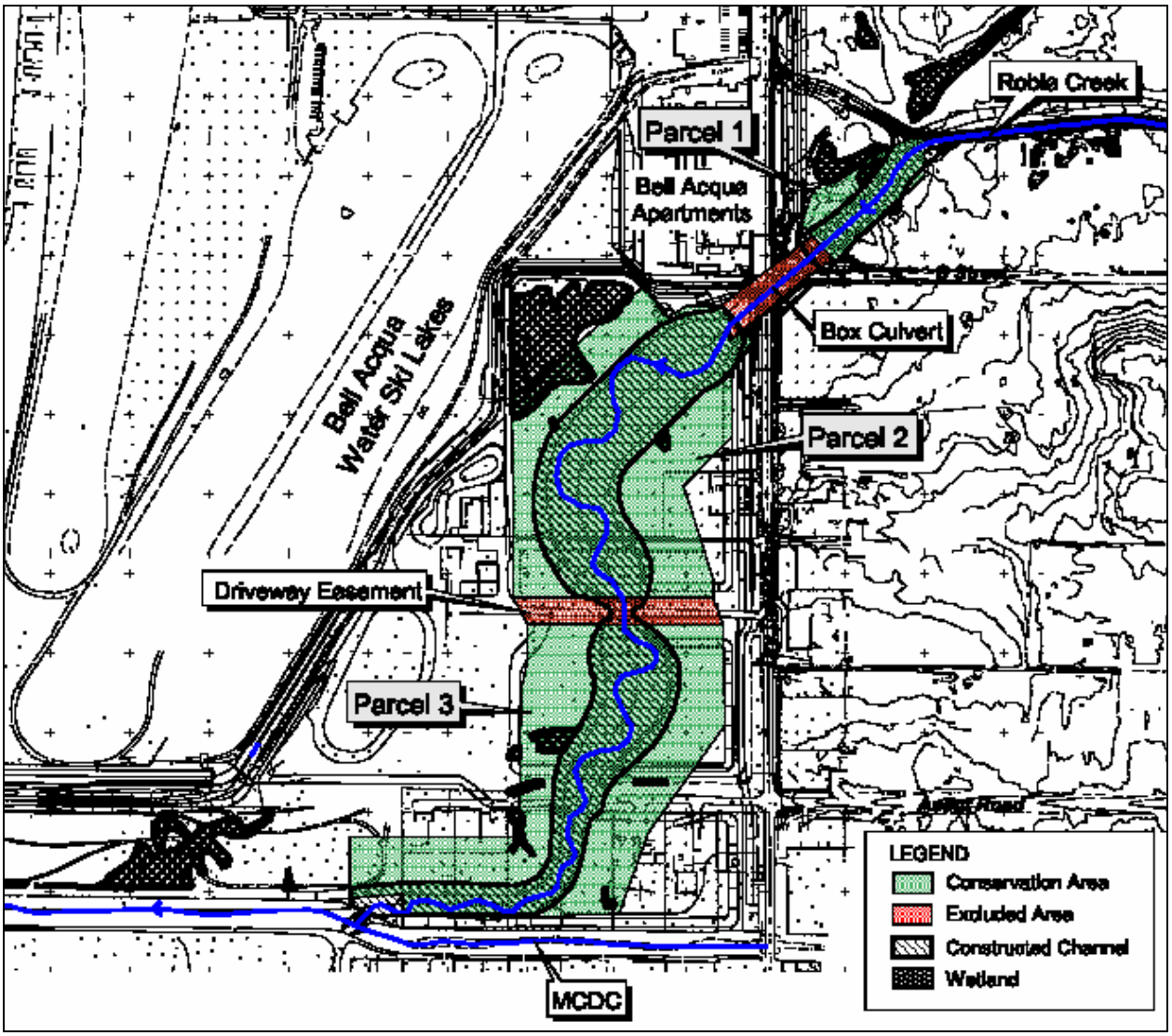

Figure 4 - Limits of the Rio Linda Creek Conservation Area.

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 years 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 (V*ulpia 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 3 to 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 2005 is considered the second year of monitoring.

2.1 Habitat Features

To constitute mitigation acreage, success criteria must be met by the 3rd year following construction of the freshwater marsh, and by the 5th year for 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), and if the tree and shrub canopy is at least 25% total cover in planted floodplain, low bank, and bench areas within the floodplain or 20% cover in bank and bench areas above the ordinary high water mark. Native volunteer trees and shrubs may be included in the overall survival count.

The created riparian savannah community was monitored this year in the late summer after the initial planting of the trees and shrubs. Although the MMP only prescribed that 20% of the plants were surveyed, all the plants were counted by species and monitored for vigor (dead=0, poor=1, poor-fair=2, fair=3, fair-good=4 or good=5)[1]. 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. Once trees are sufficiently developed, canopy cover by trees and shrubs will be determined by aerial photograph interpretation, or a field based method, such as line transects.

[1] Good rating is given when 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 leave, are losing leaves, dried out, and looking very stressed.

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.

All of the planted and transplanted valley oak trees were monitored for survival beginning in the late summer following the planting season. Observations of each tree were recorded for height, vigor (dead=0, poor=1, poor-fair=2, fair=3, fair-good=4 or good=5) and sign of propagation.

Soil moistures were also recorded in the first year of monitoring to ensure that the irrigation system was functioning properly and that the oaks were receiving adequate moisture. Based on this information, we determined that it would be best to conduct a deep watering event 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 3 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
- Total cover by native species (including both wetland indicator and non-wetland indicator species will be at least 35%.

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, 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 to see how site utilization may have changed over time. 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 2005 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 should be mapped and recalculated in proceeding monitoring years to ensure acreage goals are being met.

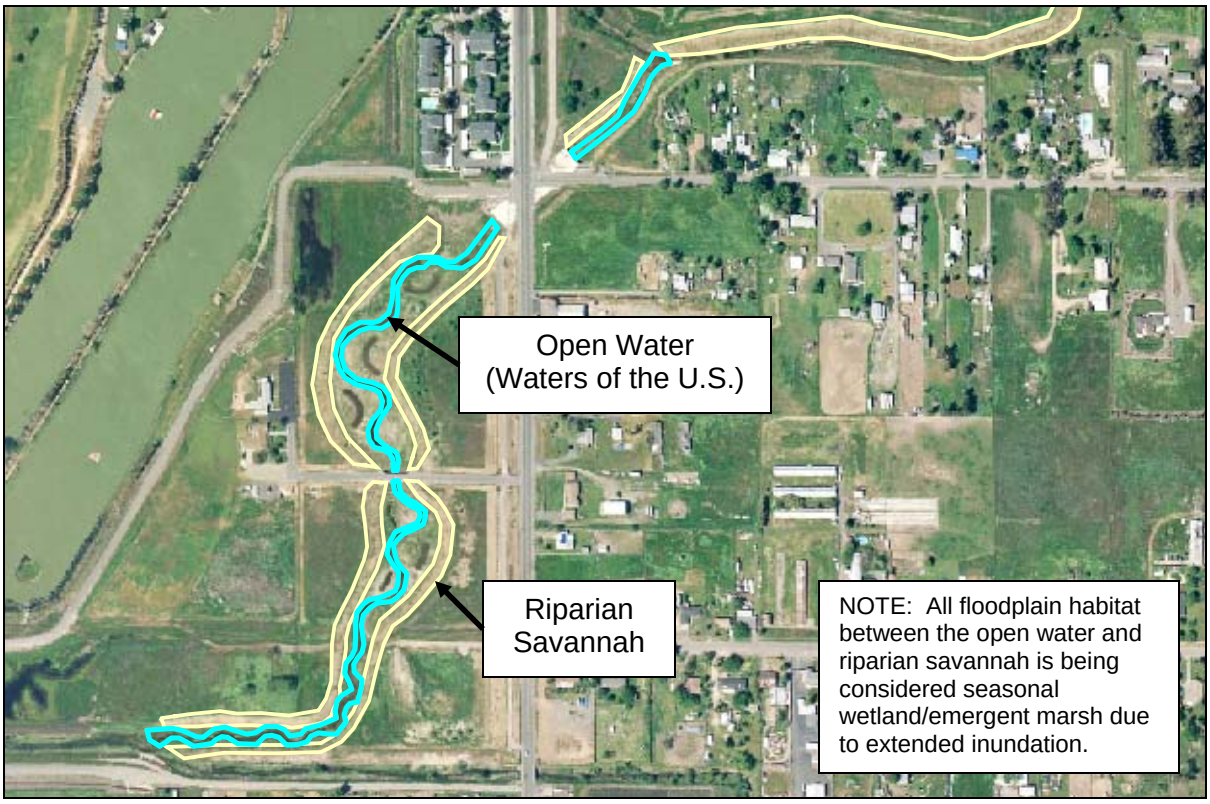

Figure 6 - Habitat areas delineated on 2004 aerial photo.

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.

3.1.2 Riparian Savannah

The planted vegetation in the riparian savannah areas has been very successful. On average, the trees and shrubs have had an 87% establishment rate after two years of monitoring (see

Table 2). Baseline height and health information was not collected immediately after planting, but qualitative observations showed that the plants were growing at a vigorous rate. The health indices recorded for the plants averaged out to 4.81, which indicates that on average they are in fair to good condition. The California rose and coffeeberry plants were all showing evidence of fruiting.

Table 2 - Monitoring summary of vegetation in riparian savannah habitat type.

		2004 Monitoring			2005 Monitoring		
Species	**# Planted**	**Plant Count**	**% Survival**	**Mean Vigor***	**Plant Count**	**% Survival**	**Mean Vigor***
TREES TOTAL	***383***	***429***	***112%***	***3.96***	***353***	***92%***	***4.97***
Box Elder	27	27	100%	4.74	32	119%	5.00
Oregon Ash	18	17	94%	4.94	18	100%	5.00
Fremont Cottonwood	30	71	237%	2.82	29	97%	5.00
Valley Oak	91	81	89%	4.93	80	88%	5.00
Interior Live Oak	58	50	86%	4.96	50	86%	5.00
Arroyo Willow	51	62	122%	3.29	27	53%	5.00
Gooding's Willow	13	27	208%	1.67	23	177%	4.91
Red Willow	60	67	112%	4.40	34	57%	4.76
Sandbar Willow	35	27	77%	3.59	60	171%	5.00
SHRUBS TOTAL	***667***	***609***	***91%***	***4.63***	***557***	***84%***	***4.71***
Buttonbush	49	48	98%	5.00	37	76%	5.00
California Rose	195	195	100%	4.64	222	114%	4.27
Coffeeberry	116	99	85%	3.69	58	50%	5.00
Coyote Bush	204	199	98%	4.86	178	87%	5.00
Mulefat	103	68	66%	5.00	62	60%	5.00
TOTAL	***1050***	***1038***	***99%***	***4.35***	***910***	***87%***	***4.81***

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

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.

3.1.3 Oak Trees

In 2005, an assessment of the oaks was conducted by Tree Associates Professional Consulting Arborists (Lichter 2005). South and west of the berm, all of the transplanted trees are in good-excellent health except one tree in fair and two trees in fair-good condition. South of the road and north of the berm, two of the trees have developed from root suckers of dead transplants, and are in fair/good and excellent health. To the north of the road, the transplants are in fair to excellent health. The trees are recovering from last year as evidenced by their improved vigor, foliar color and size, density and lack of new borer activity.

There were several empty basins in the upland areas that are on the irrigation system but did not have trees in them. These basins were planted with 15-gallon valley oaks and sycamores in the spring of 2005. 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 are growing vigorously from near or below the base of the trunks. In most cases, there was soil covering the rootball of the trees, which can be damaging to them. One valley oak and two sycamores are dead. It is believed that because the irrigation needs of the spring-planted containerized trees are much greater during their first spring until their root systems become established, especially compared to the older transplanted trees on the irrigation system, then the new trees became drought stressed. The drought stressed trees were then attacked by

the opportunistic flatheaded borer, which partially girdled the trunks of the trees, restricting flow of water and sugars. The trees rooted into soil at a depth which was sufficiently moist between irrigation cycles and the trees grew below the girdled portion of the stem, resulting in the now visible watersprouts and suckers.

For the newly planted trees, the following maintenance actions were recommended by the Tree Associates (Lichter 2005) and they will be implemented as felt necessary:

- Prune the newly planted trees to below the borer-girdled stem where possible and select a dominant sprout and prune remaining sprouts.
- Consider installing a tree shelter to hasten height growth and protect shoot from weedeaters and herbivores.
- Remove soil over rootballs.
- Improve the irrigation system as needed to comply with requirements below.
    - Install a drip irrigation system with emitters on 18-inch centers under and beyond the canopy of the trees. At any given time, the emitters should be present to the full extent of a circular area with a center point at the tree trunk and radius of 1.5X the maximum drip line radius.
- Ensure that irrigation system is functioning properly.
- Monitor trees for irrigation needs in the spring. Irrigation may be needed once significant rain (>0.5") has not fallen for three weeks.
- Monitor trees for disease, insect activity.
- Maintain a weed free area covered with woodchip mulch of 4" deep within tree basins.
- Insecticides are not effective against borer larvae under the bark and, as the trees recover, their resistance to borers will increase. However, a persistent insecticide applied (either systemically or to the canopy and trunk) in the spring may help to control certain species of borers. Consider working with a pest control advisor/applicator to identify, monitor and treat for borers as the trees recover.

3.1.4 Freshwater Marsh/Seasonal Wetland

The freshwater marsh/season wetland habitat will be considered successful if it exhibits certain vegetation success criteria by the end of 3 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 3. The summarized data shows that by the second year of establishment, all success criteria are being met.

Table 3 - Freshwater marsh/seasonal wetland success criteria for the RLCCA and 2005 survey results.

Success Criteria	Goal	2005 Survey
Total vegetation cover	30%	65%
Total cover by wetland indicator species	50%	62%
Total cover by native species	35%	37%

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 then 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.

Maintenance in the wetland areas has included periodic hand-pulling of red sesbania from the stream channels to prevent the downstream spread of this highly invasive weed. There has also been periodic flood debris removal and occasional maintenance of beaver exclusion fencing.

3.1.5 Other Waters of the U.S.

Photopoints of the RLCCA can be seen in Appendix A. 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 levels of inundation resulting from the beaver activity has been extremely beneficial to waterfowl species. Large numbers of ducks have been observed nesting and feeding within the RLCCA. A baseline quantitative bird survey was conducted just after the oak trees were transplanted in March 2003, and 30 birds were counted of 8 different species. This survey was repeated in March 2005 to see how the site utilization may have changed over time (see Table 4). The survey indicates an increased utilization by bird species of the project area with 185 birds of 17 different species recorded.

Table 4 - Afternoon bird survey conducted March 2005 along RLCCA.

Common Name	Species Name	Count
Pied-billed grebe	*Podilymbus podiceps*	1
Great egret	*Ardea alba*	2
Green heron	*Butorides virescens*	1
Mallard	*Anas platyrhynchos*	9
Domestic duck	*Anas domesticus*	1
White-tailed kite	*Elanus leucurus*	1
Swainson's hawk	*Buteo swainsoni*	1
Ring-necked pheasant	*Phasianus colchicus*	3
American coot	*Fulica americana*	1
Common snipe	*Gallinago gallinago*	1
Mourning dove	*Zenaida macroura*	4
Black phoebe	*Sayornis nigricans*	1
Cliff swallow	*Petrochelidon pyrrhonota*	110
American crow	*Corvus brachyrhynchos*	2
Savannah sparrow	*Passerculus sandwichensis*	5
Red-winged blackbird	*Agelaius phoeniceus*	30
Western meadowlark	*Sturnella neglecta*	12
Number of species		17 species
Total abundance of birds		185 birds

Bird species seen around the site during site visits include:

- Pied-billed Grebe (*Podilymbus podiceps*)
- Green Heron (*Butorides virescens*)
- Great Blue Herons (*Ardea herodias*)
- Great Egret (*Ardea alba*)
- Snowy Egret (*Egretta thula*)
- Canada Goose (*Branta Canadensis*)
- Mallard (*Anas platyrhynchos*)
- Cinnamon Teal (*Anas cyanoptera*)
- Blue-winged Teal (*Anas discors*)
- Turkey Vulture (*Cathartes aura*)
- Northern Harrier (*Circus cyaneus*)
- White-tailed Kite (*Elanus leucurus*)
- Red-tailed Hawk (*Buteo jamaicensis*)
- American Kestrel (*Falco sparverius*)
- California Quail (*Callipepla californica*)
- Ring-necked Pheasant (*Phasianus colchicus*)
- American Coot (*Fulica americana*)
- Killdeer (*Charadrius vociferous*)
- Black-necked Stilt (*Himantopus mexicanus*)
- Greater Yellowlegs (*Tringa melanoleuca*)
- Mourning Dove (*Zenaida macroura*)
- Rock Dove (*Columba livia*)
- Black Phoebe (*Sayornis nigricans*)
- Western Kingbird (*Tyrannus verticalis*)
- Loggerhead Shrike (*Lanius ludovicianus*)
- Western Scrub-Jay (*Aphelocoma californica*)
- Yellow-billed Magpie (*Pica nuttalli*)
- American Crow (*Corvus brachyrhynchos*)
- Cliff Swallow (*Petrochelidon pyrrhonota*)
- Barn Swallow (*Hirundo rustica*)
- Marsh Wren (*Cistothorus palustris*)
- Northern Mockingbird (*Mimus polyglottos*)
- European Starling (*Sturnus vulgaris*)
- Savanna Sparrow (*Passerculus sandwichensis*)
- White-crowned Sparrow (*Zonotrichia atricapilla*)
- Song Sparrow (*Melospiza melodia*)
- Western Meadowlark (*Sturnella neglecta*)
- Red-winged Blackbird (*Agelaius phoeniceus*)
- Brewer's Blackbird (*Euphagus cyanocephalus*)
- House Finch (*Carpodacus mexicanus*)
- Swainson's Hawk (*Buteo swainsoni*)
- Domestic Duck (*Anas domesticus*)
- Common Snipe (*Gallinago gallinago*)

Other animals and animal sign (burrows, herbivory damage, etc) have included:

- Black-tailed Jackrabbit (*Lepus californicus*)
- Muskrat (*Ondatra zibethica*)
- American Beaver (*Castor canadensis*)
- 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 exceeding mitigation goals. Annual monitoring efforts should continue to track changes in the vegetation and note use by wildlife.

Over the next maintenance year, special attention needs to 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. Frequent watering not only encourages crown and root rot, it also results in the growth of ineffective shallow roots near the surface, wasting the tree's energy resources.

Supplemental to the routine maintenance efforts, there are additional projects that can be undertaken to improve the RLCCA. Consideration may also be given to the installation of nesting boxes.

5. References

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USFWS. 1999. Draft Recovery Plan for the Giant Garter Snake (*Thamnophis gigas*). USFWS, Portland, Oregon. 192 pp.

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Appendix A – Wetland Vegetation Monitoring Data

Table 5 - Species list of plants found at RLCCA during wetland vegetation survey (Aug. 8, 2005)

Species Name	Common Name	Native or Nonnative	Wetland Indicator
Aira caryophyllea	Silver hairgrass	NN	NI
Alisma plantago-aquatica	Waterplantain	N	OBL
Aster subulatus var ligulatus	Annual water-aster	N	FACW
Cicuta douglasii	Western water hemlock	N	OBL
Bidens laevis	Bur marigold	N	OBL
Cyperus esculentus	Nutsedge	NN	FACW
Echinochloa crus-galli	Barnyardgrass	NN	FACW
Epilobium brachycarpum	Willow herb	N	UPL
Juncus acutus	Spiny rush	N	FACW
Juncus effusus pacificus	Common rush	N	FACW+
Juncus mexicanus	Mexican rush	N	FACW
Juncus phaeocephalus	Brown-headed rush	N	FACW
Juncus xiphioides	Iris-leaved rush	N	OBL
Leersia oryzoides	Rice cut grass	N	OBL
Leptochloa fascicularis	Bearded sprangletop	N	OBL
Lolium multiflorum	Italian ryegrass	NN	-
Lotus scoparius	Deerweed	N	-
Ludwigia peploides	Waterprimrose	N/NN	OBL
Mentha spicata	Spearmint	NN	OBL
Paspalum dilatatum	Dallisgrass	NN	FAC
Plantago lanceolata	Narrowleaf plantain	NN	FAC-
Polygonum hydropiperoides	Swamp smartweed	N	OBL
Polygonum lapathifolium	Curlytop knotweed	N	OBL
Polypogon monspeliensis	Annual rabbitsfoot grass	NN	FACW+
Rumex crispus	Curly dock	NN	FACW-
Sesbania punicea	Red sesbania	NN	-
Tragopogon pratensis	Goat's Beard	NN	-
Typha latifolia	Common cattail	N	OBL
Verbena bonariensis	Verbena	NN	FACW
Xanthium strumarium	Common cocklebur	N	FAC+

Table 6 - Percent cover of quadrats by species type (Wetland vegetation survey on Aug. 8, 2005)

Quadrant Number	Native species	Nonnative species	Grand Total
1L10	20%	70%	90%
1L20	35%	45%	80%
1L30	21%	26%	47%
1L40	15%	65%	80%
1R10	5%	40%	45%
1R20	85%	100%	185%
1R40	20%	45%	65%
2L10	20%	55%	75%
2L20	35%	26%	61%
2L30	20%	30%	50%
2L40	15%	30%	45%
2L50	5%	10%	15%
2R10	42%	25%	67%
2R20	0%	10%	10%
2R30	45%	10%	55%
2R40	10%	40%	50%
3L10	50%	0%	50%
3L20	75%	10%	85%
3R10	40%	40%	80%
3R20	70%	0%	70%
3R40	60%	20%	80%
4L10	20%	30%	50%
4L20	50%	25%	75%
4L30	20%	35%	55%
4L50	20%	0%	20%
4L60	80%	0%	80%
4R10	65%	10%	75%
4R20	65%	5%	70%
4R40	75%	0%	75%
Grand Total	37%	28%	65%

Table 7 - Percent cover by wetland indicator type (Wetland vegetation survey on Aug. 8, 2005)

	Non-wetland Indicators			Wetland Indicators									GRAND TOTAL
Quadrant Number	UPL	NI	TOTAL	FAC	FAC-	FAC*	FAC+	FACW	FACW-	FACW+	OBL	TOTAL	
1L10			**0%**					50%		30%	10%	**90%**	**90%**
1L20			**0%**					40%		40%		**80%**	**80%**
1L30		5%	**5%**		1%			21%		20%		**42%**	**47%**
1L40		15%	**15%**		5%			45%		15%		**65%**	**80%**
1R10		15%	**15%**		15%			5%		10%		**30%**	**45%**
1R20			**0%**	10%				20%		70%	85%	**185%**	**185%**
1R40			**0%**		15%			20%		20%	10%	**65%**	**65%**
2L10			**0%**					45%		10%	20%	**75%**	**75%**
2L20			**0%**			5%		50%		1%	5%	**61%**	**61%**
2L30			**0%**					35%		15%		**50%**	**50%**
2L40		20%	**20%**					5%		10%	10%	**25%**	**45%**
2L50		3%	**3%**		5%					2%	5%	**12%**	**15%**
2R10			**0%**	5%				30%			32%	**67%**	**67%**
2R20			**0%**								10%	**10%**	**10%**
2R30			**0%**					5%			50%	**55%**	**55%**
2R40			**0%**					40%			10%	**50%**	**50%**
3L10			**0%**							25%	25%	**50%**	**50%**
3L20			**0%**					5%			80%	**85%**	**85%**
3R10			**0%**	10%				30%			40%	**80%**	**80%**
3R20			**0%**								70%	**70%**	**70%**
3R40			**0%**					20%			60%	**80%**	**80%**
4L10			**0%**					25%	5%		20%	**50%**	**50%**
4L20			**0%**					25%			50%	**75%**	**75%**
4L30			**0%**					10%			45%	**55%**	**55%**
4L50			**0%**								20%	**20%**	**20%**
4L60	20%		**20%**				10%				50%	**60%**	**80%**
4R10			**0%**					10%			65%	**75%**	**75%**
4R20			**0%**					5%		50%	15%	**70%**	**70%**
4R40			**0%**							20%	55%	**75%**	**75%**
Average Cover			**3%**									**62%**	**65%**

Appendix B – Photopoints

June 2003

June 2004

July 2005

June 2003

June 2004

July 2005

June 2003

June 2004

July 2005

June 2003

June 2004

July 2005

June 2003

June 2004

July 2005

June 2003

June 2004

July 2005

June 2003

June 2004

July 2005

June 2003

June 2004

July 2005

October 2003

June 2004

July 2005