

Status of Habitat Mitigation and Monitoring for  
**Magpie Creek Diversion Channel**

*3<sup>rd</sup>* Annual Report 2009

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# 1. Introduction

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## 1.1 Mitigation Project History

The Magpie Creek Diversion Channel (MCDC) was constructed in 1955 and 1956 by the USACE and the State of California as a flood control channel. The purpose of the USACE project was to provide flood control to the local area by diverting flows away from the lower portion of Magpie Creek into this constructed channel. The channel contained few natural features such as a meander pattern, bank development, riffles, pools, and other morphological features (Figure 1) and is constrained by residential development to the south.



**Figure 1 – Old Section of MCDC Prior to Construction**

During 2002, it was observed that the steep slope of the levee along the south side of the MCDC was eroding. Additionally, the channel was dominated by non-native vegetation and the overall habitat value was low. In an effort to improve the habitat quality and stabilize the upper portion of the left bank, SAFCA proposed this enhancement project. SAFCA considered two alternatives for addressing this levee erosion. The first alternative was the construction of a flood wall to stabilize the levee slope. The second alternative, which was selected by SAFCA, was to flatten the slope of the levee and the channel bank. The project included moving the channel away from the steep levee slope, rebuilding a more gradual slope, and revegetating the riparian corridor with native plant species. The overall goals of the project are summarized below:

1. Improve the functions and values of wildlife habitat along this reach of the MCDC
2. Diversify the stream's geomorphic configuration (i.e. meanders, riffles, pools)
3. Increase stream and floodplain interaction
4. Improve bank and slope stability
5. Reduce maintenance needs

Project construction began during September 2006 and the total area disturbed during construction of this project was approximately 5.1 acres. The main project components are summarized below:

- Move the stream channel away from the levee and construct a more natural channel configuration that incorporates meander, riffle and pool features.

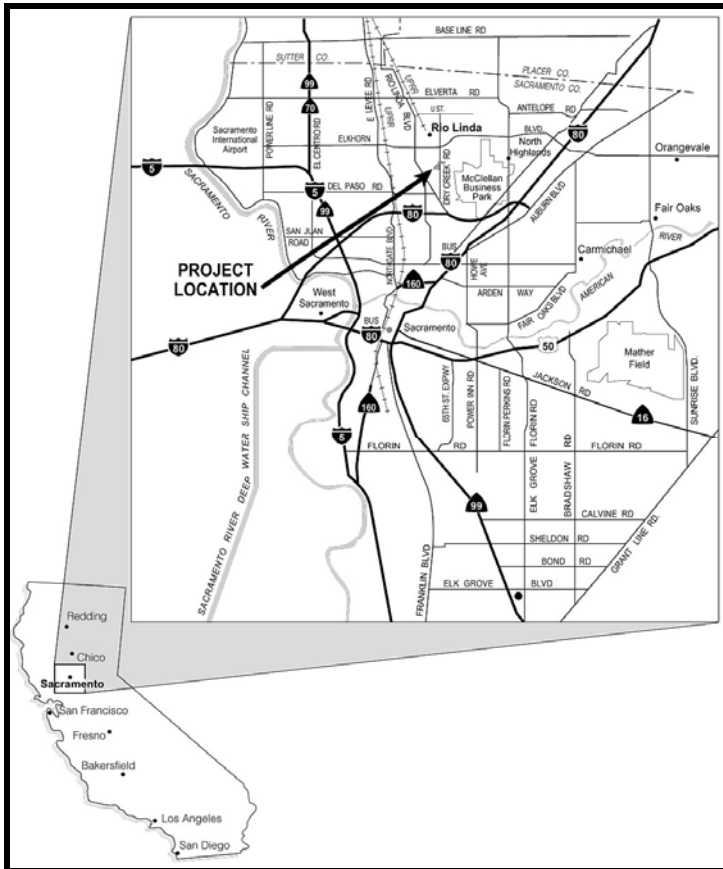
- Reduce the low flow channel width and depth and construct a low floodplain shelf to encourage flows to leave the low flow channel and inundate different levels of the floodplain.
- Revegetate the new channel banks with native trees, shrubs and herbaceous plants.

Other minor project components included the reconstruction of the levee road, the placement of rock within the channel invert below the Dry Creek Road bridge (to approximately 15 feet downstream), the reconstruction of the drainage swale between the levee road and adjacent housing, and the construction of a replacement culvert that conveys water collected in the drainage swale to MCDC (Figure 4 in Appendix B).

## **1.2 Site Description**

The MCDC begins just downstream of Raley Boulevard and ends at the confluence with Robla/Rio Linda Creek. The project site spans the area just downstream of the bridge crossing for Dry Creek Road to the MCDC's confluence with Rio Linda Creek (approximately 1,040 feet of channel). The project location map is depicted in Figure 2. On the north side of the project site is the Rio Linda Creek Conservation Area (RLCCA) which was recently created by SAFCA during the Lower Dry Creek and Robla Creek Levee Improvements Mitigation Project (Mitigation Project) to replace a constructed and degraded section of Robla Creek. The RLCCA is owned by SAFCA and is protected as open space habitat for giant garter snake (*Thamnophis gigas*), a species federally and state-listed as Threatened. A residential area lies south of the project site. Just to the east of the project site is Dry Creek Road and to the west is property owned and operated by SAFCA for flood control purposes.

The small project site includes a stream channel, levee and access roads, narrow floodplain and a non-native grassland with a small group of valley oaks that were transplanted to the site by SAFCA in 2003.



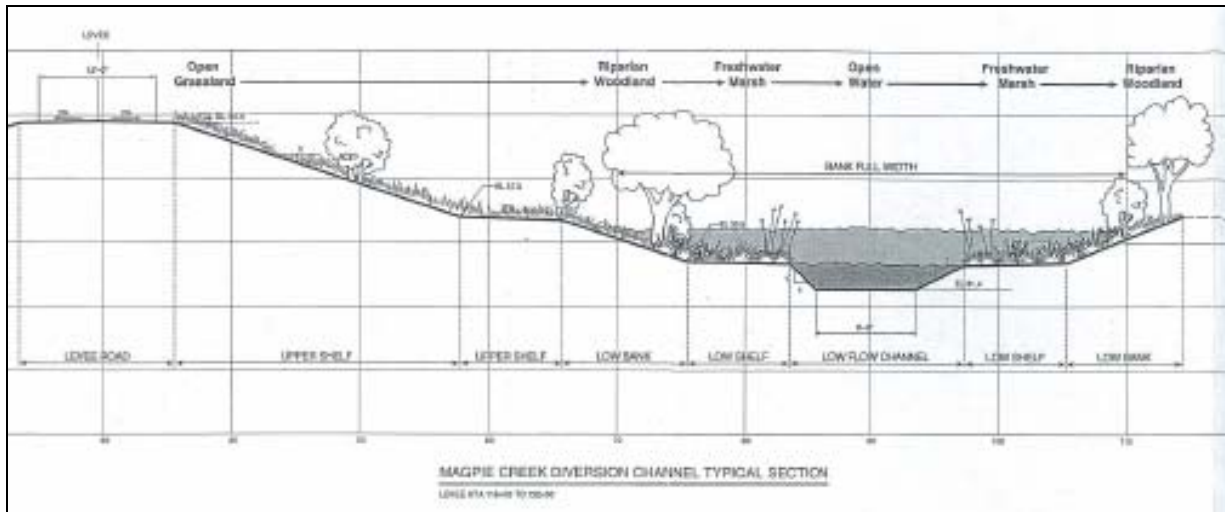
**Figure 2 – Location of the Magpie Creek Diversion Channel.**

### **1.3 Management Responsibility**

SAFCA is financially responsible for achieving the success criteria of required mitigation. SAFCA currently owns a portion of the site along with the Sacramento and San Joaquin Drainage District and American River Flood Control District. SAFCA is committed to maintaining the area as open space in perpetuity. The water flowing in the MCDC is not controlled by any entity but enters the channel from upper Magpie Creek. Water flows in the channel are expected to remain fairly consistent with existing conditions but will likely be reduced following completion of groundwater clean-up efforts at McClellan Business Park in approximately 50 years.

### **1.4 Habitat Features & Goals**

Prior to this enhancement project this section of the riparian corridor was characterized by many non-native weeds, poor water quality, a linear channel with eroding banks and low quality wildlife habitat. The objective of this project was to create a better stream system that offered improved functions and values for the benefit of wildlife and water quality. The MCDC riparian corridor, created by SAFCA, now offers meanders, riffles and pool features, stable stream banks, and a larger floodplain. In addition, the constructed channel was designed to incorporate and maintain a native instream freshwater marsh habitat, a native riparian woodland habitat, as well as an open water habitat (Figure 3) to mitigate for project impacts.



**Figure 3 – Cross Section of MCDC indicating Habitat Locations**

SAFCA is responsible for ensuring that a qualified biologist or restoration ecologist annually monitors the success of the mitigation project until success criteria (Table 1) are met by the end of the 3<sup>rd</sup> (2009) and 5<sup>th</sup> year of monitoring (2011). If results indicate that the success criteria will not be met by the specified timeframe for any community type, adaptive management will be implemented and monitoring may likely be extended beyond the establishment period or until success criteria are met.

**Table 1 – Success Criteria for Habitat Features**

Habitat Type	Required Acreage	Created Acreage	Goal Year	Success Criteria
Freshwater Marsh	0.21	0.4	2009 (Year 3)	30% absolute coverage
				50% relative cover by wetland indicator species
				35% relative cover by native species
Riparian Woodland	0.29	0.4	2011 (Year 5)	50% survival of trees & shrubs growing with good vigor
				25% cover within the OHWM by trees & shrubs
				20% cover above the OHWM by trees & shrubs
Open Water	0.22	0.2	2011 (Year 5)	5 <sup>th</sup> year must meet jurisdictional criteria for other waters of the US

#### 1.4.1 Freshwater Marsh

A freshwater marsh community was designed and installed within the channel and along the stream edges and within the stream's OHWM to offset impacts to freshwater marsh habitat resulting from project implementation. The main objective is the creation of 0.4 acres of self-sustaining vegetation which will more than compensate for the 0.21 acres required for mitigation. Wetland plantings included Barbara sedge (*Carex barbarae*), Baltic rush (*Juncus balticus*) and tule (*Scirpus acutus*). This habitat is expected to help decrease turbidity during high flow events, capture sediments and pollutants as they move through the wetland vegetation, reduce flood water velocities and provide cover for aquatic species such as the giant garter snake (*Thamnophis gigas*).

This habitat will be considered successful at the end of the 3<sup>rd</sup> monitoring year (2009) if the absolute coverage by vegetation is 30%, the relative cover by wetland indicator species (i.e.,

OBL, FACW, or FAC) is greater than 50% and the relative cover by native species (including both wetland indicator and non-wetland indicator species) is at least 35% (Table 1). Additionally, during the 5<sup>th</sup> year the freshwater marsh habitat must be mapped onto an aerial photo and digitized to measure and determine if the required 0.21 acres have been met.

#### **1.4.2 Riparian Woodland**

A riparian woodland community, totaling 0.4 acres, was designed and installed along the stream channel to offset 0.29 acres of riparian woodland habitat that was impacted during project implementation. This habitat type is expected to enhance the aquatic habitat by 1) providing improved water quality by shading and cooling the water in the channel, 2) providing a source of litter and downed woody debris for aquatic species and 3) diversifying and improving the riparian habitat for wildlife.

The restoration will be considered successful at the end of the 5<sup>th</sup> monitoring year (2011) if at least 50% of trees and shrubs are alive and growing with good vigor. In addition, trees and shrubs must provide at least 25% cover within the ordinary high water mark (OHWM) and 20% cover above the OHWM (Table 1). This habitat must be mapped and digitized, during the 5<sup>th</sup> and final monitoring survey to measure acreage targeted for mitigation.

#### **1.4.3 Other Waters of the U.S.**

An open water community, totaling 0.2 acres, was designed and installed at MCDC to offset impacted acreage during project implementation. The open water habitat now incorporates geomorphic stream features such as meanders, riffles and pools and is expected to not only increase stream and floodplain interactions but is also expected to provide foraging habitat for aquatic/riparian species.

Success will be determined by the 5<sup>th</sup> monitoring year (2011) if the banks remain stable, if the channel functions to carry water downstream to Robla Creek and if the channel provides open water habitat for aquatic and terrestrial wildlife. In addition MCDC will be required to meet jurisdictional criteria for other waters of the United States (i.e., bed and bank development) at the end of the five-year monitoring period. This habitat must be mapped and digitized, during the 5<sup>th</sup> and final monitoring survey to measure acreage targeted for mitigation.

### **1.5 Wildlife**

Common species of aquatic invertebrates, fish, amphibians, reptiles, birds and mammals were known to or could have utilized MCDC prior to project implementation. It is anticipated that as the vegetation matures and the site develops, wildlife diversity will increase.

## **2. Methods**

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All mitigation features, will be monitored annually for 3-5 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 (see Appendix A: Table 8, Table 9 and Table 10 for a list of the surveyors). The construction of the MCDC channel project was completed in 2006 and the first monitoring year began in 2007. Therefore, the 5<sup>th</sup> and final year of monitoring is expected to be 2011.

## 2.1 Habitat Features

To constitute mitigation acreage, success criteria must be met by the 3<sup>rd</sup> year (2009) following construction of the freshwater marsh, and by the 5<sup>th</sup> year (2011) for the riparian woodland and the open water habitats. If the success 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 5-year period is completed.

### 1.5.1 *Freshwater Marsh*

The freshwater marsh habitat will be considered successful at the end of the 3<sup>rd</sup> monitoring year (2009) if the absolute coverage by vegetation is 30%, the relative cover by wetland indicator species (i.e., OBL, FACW, or FAC) is greater than 50% and the relative cover by native species (including both wetland indicator and non-wetland indicator species) is at least 35% (Table 1). This habitat must be mapped and digitized, during the 5<sup>th</sup> and final monitoring survey, to measure the acreage targeted for mitigation.

To monitor for Freshwater Marsh goals, eight (8) permanent transects were established along MCDC in 2008 and the GPS coordinates were logged (Figure 4 in Appendix B). A tape measure is started two feet in from the outer edge of the low flow channel (along the top of the water surface) and run up the slope 15 feet. A one (1) foot square quadrat is placed every five (5) feet, on the downstream side, along the transect line. All vegetation within the quadrat is identified to species and the approximate amount of cover by each species is noted.

### 1.5.2 *Riparian Woodland*

The riparian woodland will be considered successful at the end of the 5<sup>th</sup> monitoring year (2011) if at least 50% of trees and shrubs are alive and growing with good vigor. In addition, trees and shrubs must provide at least 25% cover within the ordinary high water mark (OHWM) and 20% cover above the OHWM. This habitat must be mapped and digitized, during the 5<sup>th</sup> and final monitoring survey to measure acreage targeted for mitigation.

During 2007 all of the planted trees were monitored and 20% of the shrubs were randomly selected for measurements (as per the Mitigation and Monitoring Plan). 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. Each year a total plant count of each species is conducted (all surviving planted stock and volunteer plants) and compared to the number of planted trees and shrubs to determine the survival rate. In addition to the survival count, all of the tagged trees and shrubs are monitored for vigor<sup>1</sup>, signs of reproduction, height and crown size. All tree trunks with a diameter at breast height (DBH) 1 inch or greater (DBH is summed for single trees with multiple trunks) are also measured.

Monitoring methods were modified in 2008 for sandbar willow and California rose because their multi-stemmed growth form made individual plant counts challenging. The total length of each species clump is measured parallel to the stream channel and the plant count is estimated according to the following criteria: every 3 feet parallel to the stream channel equals one plant. In 2009, additional data was collected to determine the canopy coverage within and

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<sup>1</sup> Good – 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.

above the Ordinary High Water Mark (OHWM). This involved indicating whether the plant was located within or above the OHWM and the length of the canopy growing within or above the OHWM.

### **2.1.1 Other Waters of the U.S.**

For Other Waters of the U.S., the site will be considered successful if the banks remain stable, if the channel functions to carry water downstream to Robla Creek and if the channel provides open water habitat for aquatic and terrestrial wildlife. This habitat must be mapped and digitized, during the 5<sup>th</sup> and final monitoring survey, to measure the acreage targeted for mitigation. Additionally, MCDC will be required to meet jurisdictional criteria for other waters of the United States (i.e., bed and bank development) at the end of the five-year monitoring period.

The stream channel will be qualitatively assessed each year until the 5<sup>th</sup> year to determine the condition of the stream channel. Specifically, it will be noted if there is evidence of bed and/or bank scour, sedimentation, erosion, meanders and if there is variation in the width of the channel.

## **2.2 Wildlife**

No performance or success standards have been established for wildlife monitoring. However, there is a requirement that the channel provides open water habitat for aquatic and terrestrial wildlife (see 2.1.1 Other Waters of the US above). Herpetological, mammal, bird and aquatic wildlife surveys will be conducted annually through the 5<sup>th</sup> year to determine the utilization of MCDC by wildlife. In addition, any wildlife observed during regular site visits will be noted.

During herpetological surveys, surveyors walk the banks upstream to downstream looking for reptiles basking in the sun, hiding under rocks or logs and for any tracks or sign. During aquatic surveys, surveyors walk the stream edge downstream to upstream using dipnets to sample for aquatic species. Identification and count of each captured organism is noted. Bird and mammal surveys can be conducted simultaneously during which each bank will be walked. Identification will be determined by site, sound, tracks and/or sign and a total count of each species identified will be recorded.

Photographs will be taken annually through the 5<sup>th</sup> year from permanent locations and will provide photographic documentation of the progress of all restoration and enhancement actions at MCDC.

## **3. Results & Discussion**

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Quantitative and qualitative monitoring has shown that the habitat types are becoming established and the vegetation is growing successfully. The results from surveys conducted in 2009 are presented and discussed below, as well as a discussion of maintenance actions that have and are expected to occur in each habitat. Regular site visits and yearly monitoring will continue to guide the adaptive management strategies implemented at MCDC to ensure successful performance of the site.

### 3.1 Habitat Features

There are three (3) habitat acreage goals that were defined in the USACE-approved Mitigation and Monitoring Plan. In the year 2011, the 5<sup>th</sup> monitoring year, all habitats will be mapped onto an aerial photo and digitized to measure and determine if the required acreages (Table 2) have been met.

**Table 2 – Post-Construction Habitat Acreages**

Habitat Type	Required Acreage	Created Acreage
Freshwater Marsh	0.21	0.4
Riparian Woodland	0.29	0.4
Other Waters of the U.S.	0.22	0.2

#### 3.1.1 Freshwater Marsh

The results from the freshwater marsh survey for the 3<sup>rd</sup> establishment year (Table 3) indicate that the absolute coverage by vegetation increased from 55.0% in 2008 to 63.6% in 2009 and has exceeded the 3<sup>rd</sup> year (2009) performance goal. The relative coverage by wetland indicator species increased from approximately 12% in 2008 to 39% in 2009 but did not reach the 50% cover criteria for wetland indicator species given for this year. The cover by native species declined slightly from approximately 26% in 2008 to 23% in 2009. The complete dataset for the 2009 survey can be seen in Appendix C (Table 11, Table 12, and Table 13) and has been summarized below in Table 3.

**Table 3 – Freshwater Marsh Success Criteria for the MCDC & Survey Results**

Success Criteria	Goal	2008	2009
Total vegetation cover	30%	55.0%	63.6%
Total cover by wetland indicator species	50%	11.7%	38.7%
Total cover by native species	35%	25.8%	22.5%

Regular maintenance during 2009 included the removal of invasive weeds, trash and debris as well as cage installation around native volunteer species to protect them from beaver pruning. In addition to the regular maintenance, the low bench was planted in fall 2009 with 175 plugs of juncus, scirpus and deergrass (*J. effuses*, *J. balticus*, *S. americanus* and *Muhlenbergia rigens*) to enhance the freshwater marsh habitat and help propel us toward meeting the success criteria.

#### 3.1.2 Riparian Woodland

Surveys have been conducted by a SAFCA biologist since 2007 to monitor the progress of the riparian woodland towards meeting the 5<sup>th</sup> year (2011) performance goals for survival, canopy coverage and vigor. The 2009 survey indicates that tree survival rate increased from 108% in 2008 to 113% in 2009 and the shrub survival rate increased from 212% in 2008 to 258% in 2009. The large increase in the survival rate of the shrubs from 2007 to 2009 is attributable to the prolific spread of coyote brush across the site. The combined survival rate of trees and shrubs increased from 161% in 2008 to 187% in 2009 and far exceeds the 5<sup>th</sup> year success criterion of 50% survival (Table 4).

**Table 4 – Plant Survivorship Results**

Species	# Planted	2007	2008	2009
Arroyo Willow	0	N/A (n=4)	N/A (n=4)	N/A (n=4)
Box Elder	63	100% (n=6)	100% (n=63)	100% (n=63)
Gooding's Willow	14	100% (n=14)	93% (n=13)	93% (n=13)
Oregon Ash	40	98% (n=39)	98% (n=39)	98% (n=39)
Red Willow	19	74% (n=14)	68% (n=13)	63% (n=12)
Valley Oak	20	105% (n=21)	105% (n=21)	105% (n=21)
<i>Fremont Cottonwood</i>	0	N/A (n=0)	N/A (n=14)	N/A (n=19)
† Sandbar Willow	0	N/A (n=0)	N/A (n=2)	N/A (n=5)
<b>TREES TOTAL</b>	<b>156</b>	<b>99%</b> (n=155)	<b>108%</b> (n=169)	<b>113%</b> (n=176)
Buttonbush	72	93% (n=67)	89% (n=64)	65% (n=47)
† California Rose	54	91% (n=49)	117% (n=63)	119% (n=64)
Coffeeberry	0	N/A (n=0)	N/A (n=0)	N/A (n=2)
Coyote Brush	39	110% (n=43)	569% (n=222)	800% (n=312)
<b>SHRUBS TOTAL</b>	<b>165</b>	<b>96%</b> (n=159)	<b>212%</b> (n=349)	<b>258%</b> (n=425)
<b>TOTAL</b>	<b>321</b>	<b>98%</b> (n=314)	<b>161%</b> (n=518)	<b>187%</b> (n=601)

† Sandbar willow and California rose were evaluated with a different method beginning in 2008 (see Methods above)

The 2009 survey results for canopy cover (Table 5) indicate that the combined tree and shrub canopy coverage across 0.4 acres of riparian woodland habitat increased from a total of 16.9% in 2008 to 32.5% in 2009 (a miscalculation occurred during shrub cover extrapolation for 2007 and 2008 and was therefore misreported in those years). Since only 20% of shrubs were measured, the data was extrapolated to simulate 100% of shrub canopy coverage. The survey in 2009 was slightly modified to collect data to evaluate progress towards meeting the 5<sup>th</sup> year (2011) cover criteria for 25% cover within the ordinary high water mark (OHWM) and 20% cover above the OHWM. The analysis of the collected data indicates that cover within the OHWM is 19.3% and cover above the OHWM is 13.2% (Table 5). Based on rate of increase of cover over the entire riparian habitat since 2007, it is likely that we will meet the cover requirements by 2011.

**Table 5 – Percent Canopy Cover over the Riparian Woodland Habitat (0.4 acres)**

SPECIES	Total Cover Within & Above OHWM			2009	
	2007	2008	2009	Within OHWM	Above OHWM
Arroyo Willow	0.3%	0.4%	0.9%	0.9%	
Box Elder	1.4%	3.4%	8.7%	6.0%	2.7%
Gooding's Willow	0.8%	1.7%	3.1%	3.1%	
Oregon Ash	0.7%	1.1%	3.1%	1.8%	1.3%
Red Willow	1.2%	1.6%	2.7%	2.7%	
Valley Oak	0.4%	0.9%	2.0%	0.1%	2.0%
Sandbar Willow		0.4%	0.7%	0.7%	
<b>Tree Total</b>	<b>4.8%</b>	<b>9.5%</b>	<b>21.3%</b>	<b>15.3%</b>	<b>6.0%</b>
Button Bush	0.8%	1.0%	3.0%	1.0%	2.0%
Coyote Bush	1.4%	3.0%	4.5%	0.5%	4.0%
California Rose*	2.4%	3.4%	3.7%	2.5%	1.2%
<b>Shrub Total</b>	<b>4.6%</b>	<b>7.4%</b>	<b>11.2%</b>	<b>4.0%</b>	<b>7.2%</b>
<b>Grand Total</b>	<b>9.4%</b>	<b>16.9%</b>	<b>32.5%</b>	<b>19.3%</b> (Goal = 25%)	<b>13.2%</b> (Goal = 20%)

\*100% of California Rose Shrubs were evaluated beginning in 2008 but only 20% were evaluated in 2007 (see Methods above).

During monitoring surveys, data is also collected to determine the average diameter at breast height (DBH) of trees, the average height of the plants, and the average vigor of plants even though there are no associated performance goals with these variables (Table 6). The results for the average DBH of the trees increased from 0.2 inches in 2008 to 1.4 in 2009. The average tree and shrub height results indicate trees increased in height from an average of 5.5 feet in 2008 to an average of 7.3 feet in 2009, shrubs increased from an average of 3.8 feet in 2008 to an average height of 4.2 feet in 2009, and the combined tree and shrub average height increased from 5.0 feet in 2008 to 6.3 feet in 2009. The average vigor of all plants at MCDC remains high indicating a very vigorous plant community (Table 6).

**Table 6 – Mean Vigor, Height and DBH of Sampled Trees and Shrubs**

SPECIES	DBH (inches)			Height (ft.)			Vigor <sup>2</sup>		
	2007	2008	2009	2007	2008	2009	2007	2008	2009
Arroyo Willow	0.25 (n=1)	0.3 (n=1)		6.8	6.8	10	4.8	5	4.3
Box Elder		0.1 (n= 8)	1.4 (n=11)	4.7	6.2	8	4.9	4.8	4.8
Gooding's Willow		0.2 (n=1)	1.7 (n=3)	5.2	6.9	9.1	5	5	5
Oregon Ash			1.0 (n=1)	3.9	4.6	6.1	4.8	5	4.9
Red Willow				5.3	5.6	7	4.9	4.9	5
Valley Oak				4	4.3	5.6	4.9	4.7	5
<b>Tree Total</b>	<b>0.25</b>	<b>0.2</b>	<b>1.4</b>	<b>4.6</b>	<b>5.5</b>	<b>7.3</b>	<b>4.9</b>	<b>4.9</b>	<b>4.8</b>
Button Bush	n/a	n/a	n/a	2.5	2.7	3.8	4.7	5	5
California Rose	n/a	n/a	n/a	3.2	4	4.2	5	5	5
Coyote Bush	n/a	n/a	n/a	3.5	4.8	4.9	5	5	5
<b>Shrub Total</b>	<b>n/a</b>	<b>n/a</b>	<b>n/a</b>	<b>3.0</b>	<b>3.8</b>	<b>4.2</b>	<b>4.9</b>	<b>5.0</b>	<b>5.0</b>
<b>Grand Total</b>	<b>0.25</b>	<b>0.2</b>	<b>1.4</b>	<b>4.3</b>	<b>5.0</b>	<b>6.3</b>	<b>4.9</b>	<b>5.0</b>	<b>4.9</b>

Maintenance within the riparian woodland has included hand weeding and herbicide events as well as cage maintenance and trash and debris removal. During the spring of 2009 the slopes were seeded with a mix that included common gumplant (*Grindelia camporum*), tomcat clover (*Trifolium wildenovii*), purple clarkia (*Clarkia purpurea*), mugwort (*Artemisia douglasiana*), annual lupine (*Lupinus bicolor*) and California aster (*Aster chilensis*) but the success of this action has yet to be determined.

### 3.1.5 Other Waters of the U.S.

The stream channel has been qualitatively assessed annually since 2007 and there have been no signs of major erosion, sedimentation, or bank and bed scour. However, some locations along the shoreline have remained bare and plants have failed to colonize these areas. During fall 2009, wetland plants and willow cuttings were installed to help enhance the wetland habitat and encourage some sedimentation along these bare areas. Fixed photopoints have been taken

<sup>2</sup>Good (5)– plants are healthy with large green leaves, and less than 10% yellow leaves

Good-fair (4)– plants have 10-25% yellow leaves but otherwise look healthy

Fair (3)– plants have 25-50% yellow leaves and are looking stressed

Fair-poor (2)– plants have 50-75% yellow leaves, are drying out and looking stressed

Poor (1)– plants have more than 75% yellow leaf, are losing leaves, dried out, and looking very stressed

annually to record the growth and success of MCDC over time and can be seen in Appendix D. Observations of aquatic wildlife and terrestrial wildlife during surveys indicate that SAFCA is currently meeting the 5<sup>th</sup> year performance goals for the open water habitat (see 3.2 Wildlife below).

### 3.2 Wildlife

Wildlife surveys have been conducted annually since 2007 for birds, mammals, reptiles and aquatic wildlife to monitor how site utilization changes over time. The total number of bird species observed increased from the 4 species observed in 2008 to 13 species in 2009 (Table 7). During the official mammal survey, beaver scat was detected but there was no evidence to indicate the use of the site by other mammals. However, voles have been seen in the upland area that is technically considered to be part of the Rio Linda Creek Conservation Area and it is more than likely that they utilize parts of MCDC at times as well. There were no reptile observations during the 2009 survey. The 2009 shoreline dip-net surveys indicate that the open water habitat continues to be utilized by frogs (adult and juvenile), damselfly nymph, various other aquatic insects, crawfish, and a few different species of fish.

**Table 7 – Morning bird survey conducted September 2007, August 2008, and July 2009**

Common Name	Scientific Name	2007	2008	2009
American Crow	<i>Corvus brachyrhynchos</i>	2		
Anna's Hummingbird	<i>Calypte anna</i>		1	
Black Phoebe	<i>Sayornis nigricans</i>	2	1	1
California Quail	<i>Callipepla californica</i>		1	
Domestic Duck	<i>Anas sp.</i>	4		
Green Heron	<i>Butoroides virescens</i>		1	1
Mourning Dove	<i>Zenaida macroura</i>	4		8
Spotted Sandpiper	<i>Actitis macularius</i>	1		
Western Meadowlark	<i>Sturnella neglecta</i>	1		2
Yellow-billed Magpie	<i>Pica nuttalli</i>	2		
Northern Mockingbird	<i>Mimus polyglottos</i>			8
House Sparrow	<i>Passer domesticus</i>			4
American Kestrel	<i>Falco sparverius</i>			1
European Starling	<i>Sturnus vulgaris</i>			1
Mallard	<i>Anas platyrhynchos</i>			2
Red-winged Blackbird	<i>Agelaius phoeniceus</i>			14
House Finch	<i>Carpodacus mexicanus</i>			4
Western Scrub-jay	<i>Aphelocoma californica</i>			2
Brown-headed Cowbird	<i>Molothrus ater</i>			4

## 4. Conclusions & Recommendations

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The riparian woodland habitat and the open water habitat within MCDC are progressing toward establishment and toward meeting 5<sup>th</sup> year (2011) performance criteria. The freshwater marsh habitat did not meet the 3<sup>rd</sup> year (2009) performance criteria for cover by wetland indicator species or cover by native species. Although these goals were not met, measures were implemented during the fall of 2009 to augment the freshwater marsh and help propel this habitat toward meeting the performance criteria. SAFCA will continue to monitor the freshwater marsh habitat until the performance criteria are met. SAFCA will continue to maintain the MCDC site until all habitat criteria have been met and until the trees and shrubs are self sustaining. Annual monitoring efforts will continue to track changes in the various habitats and adaptive management strategies will continue to be utilized to help ensure that 3<sup>rd</sup> and 5<sup>th</sup> year mitigation goals are met.

Over the next year, general maintenance activities will include regular trash and debris removal, weed control and irrigation for plants in the riparian savannah. Supplemental to routine maintenance efforts, SAFCA will also be scheduling some additional plantings in the freshwater marsh to enhance the coverage by native and wetland indicator species. Additional plantings will also occur along the shoreline to encourage the establishment of native wetland indicator species to augment the freshwater marsh habitat at MCDC.

## 5. References

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EDAW. 2005. Mitigation and Monitoring Plan for the Magpie Creek Diversion Channel Enhancement Project. Prepared for the Sacramento Area Flood Control Agency on February 10, 2005.

## Appendix A – Surveyors

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**Table 8 – 2007 Monitors**

Name	Title	Affiliation	Duties
Lizette Crosbie	Natural Resource Specialist (Biologist)	SAFCA	Data Collection and Reporting
KC Sorgen	Natural Resource Intern (CSU, Sacramento)	SAFCA	Data collection and reporting
Desiree Davenport	Natural Resource Intern (Sacramento City College)	SAFCA	Data collection
Kelly McJunkin	Natural Resource Intern (UC, Davis)	SAFCA	Data collection

**Table 9 – 2008 Monitors**

Name	Title	Affiliation	Duties
Lizette Crosbie	Senior Natural Resource Specialist (Biologist)	SAFCA	Data Collection and Reporting
KC Sorgen	Natural Resource Specialist (Biologist)	SAFCA	Data Collection and Reporting
Gina Disney	Natural Resource Intern (CSU, Sacramento)	SAFCA	Data collection
Gabby Bohrer	Natural Resource Intern (CSU, Sacramento)	SAFCA	Data collection

**Table 10 – 2009 Monitors**

Name	Title	Affiliation	Duties
KC Sorgen	Natural Resource Specialist (Biologist)	SAFCA	Data Collection and Reporting
Sarah Somers	Natural Resource Intern (UC, Davis)	SAFCA	Data collection
Caitlin Talkington	Natural Resource Intern (UC, Davis)	SAFCA	Data collection

## Appendix B – Project Features

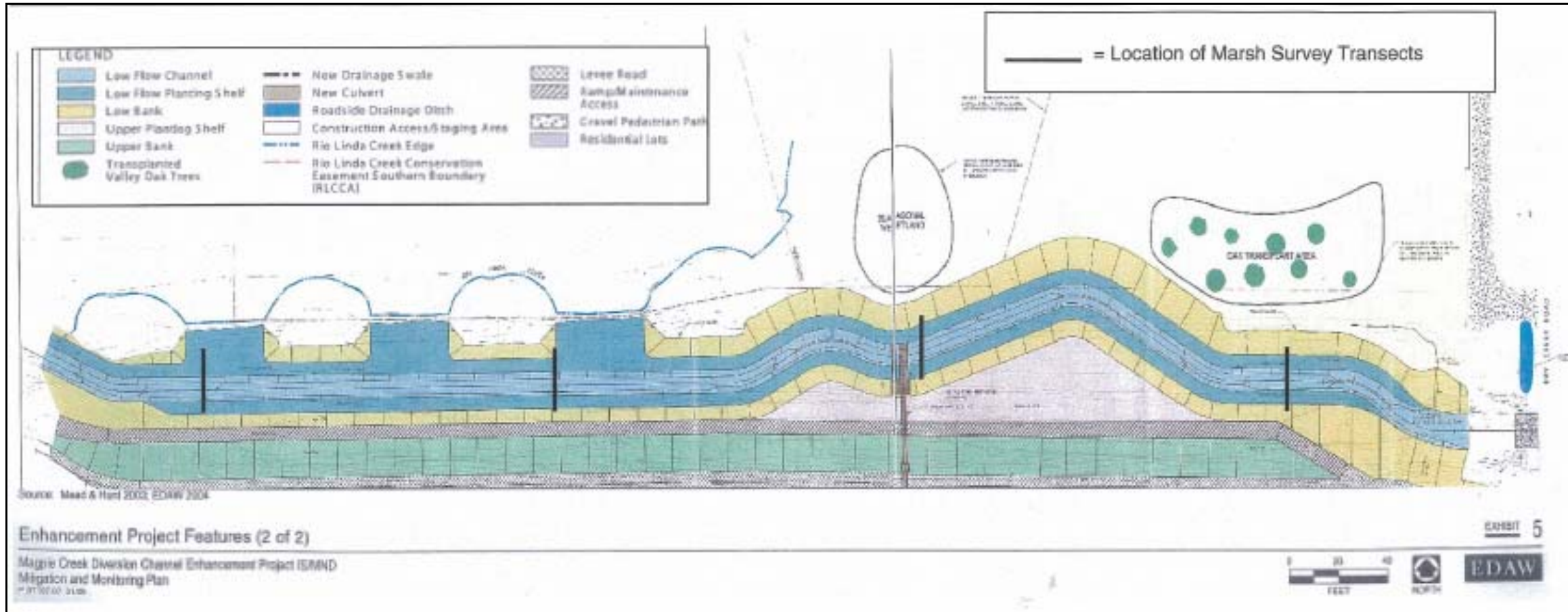


Figure 4 – Project Features and the Locations of the Transects for Marsh Surveys

## Appendix C – Wetland Vegetation Monitoring Data

Table 11 – Species List of Plants found at MCDC during the Freshwater Marsh Survey (6/30/09)

Species	Common Name	Native/non-Native	Indicator Species
<i>Acer negundo</i>	Boxelder	Native	FACW
<i>Amaranthus albus</i>	Prostrate pigweed	Non-Native	FACU
<i>Avena fatua</i>	Wild oat	Non-Native	Unknown
<i>Baccharis pilularis</i>	Coyote brush	Native	Unknown
<i>Carex barbarae</i>	Santa Barbara sedge	Native	FACW
<i>Chamaesyce nutans</i>	Eyebane	Native	NI
<i>Convolvulus arvensis</i>	Bindweed	Non-Native	
<i>Cynodon dactylon</i>	Bermuda grass	Non-Native	FAC
<i>Cyperus eragrostis</i>	Tall Flatsedge	Native	FACW
<i>Elymus glaucus</i>	Blue Wildrye	Native	FACU
<i>Epilobium ciliatum</i>	Willow-herb	Native	FACW
<i>Galium sp.</i>	Bedstraw	Native	
<i>Leymus triticoides</i>	Beardless wildrye	Native	FAC
<i>Lolium perenne ssp. multiflorum</i>	Italian Ryegrass	Non-Native	FAC
<i>Ludwigia peploides ssp. montevidensis</i>	Floating primrose	Non-Native	OBL
<i>Mentha pulegium</i>	Pennyroyal	Non-Native	OBL
<i>Muhlenbergia rigens</i>	Deergrass	Native	FACW
<i>Nassella pulchra</i>	Purple needlegrass	Native	
<i>Oenothera biennis</i>	Common Evening Primrose	Native	FACU
<i>Paspalum dilatatum</i>	Dallisgrass	Non-Native	FAC
<i>Picris echioides</i>	Ox-tongue	Non-Native	FAC
<i>Polygonum sp.</i>	Knotweed	Unknown	OBL
<i>Polypogon monspeliensis</i>	Rabbitsfoot grass	Non-Native	FACW
<i>Populus fremontii</i>	Cottonwood	Native	FACW
<i>Potamogeton foliosus</i>	Leafy pondweed	Native	OBL
<i>Rosa californica</i>	California wildrose	Native	FAC
<i>Salix gooddingii</i>	Gooding's Willow	Native	OBL
<i>Salix laevigata</i>	Red Willow	Native	OBL
<i>Schoenoplectus acutus</i>	Hardstem bulrush	Native	OBL
<i>Sonchus oleraceus</i>	Annual sow thistle	Non-Native	NI
<i>Taeniatherum caput-medusae</i>	Medusa head	Non-Native	NI
<i>Unidentified grass</i>	(blank)	Unknown	
<i>Verbena bonariensis</i>	Purpletop vervain	Non-Native	FACW
<i>Veronica anagallis-aquatica</i>	Water speedwell	Native	OBL
<i>Xanthium strumarium</i>	Cocklebur	Native	FAC

**Table 12 – Percent Cover of each Quadrat by Species Type (6/30/09)**

<b>Transect #</b>	<b>Quadrat #</b>	<b>Native</b>	<b>Non-Native</b>	<b>Unknown</b>	<b>Total</b>
1L	1	0	0	0	0
	2	0	69	6	75
	3	10	3	130	143
	4	25	15	36	76
1R	1	3	3	10	16
	2	5	3	3	11
	3	0	2	80	82
	4	3	41	56	100
2L	1	42	0	0	42
	2	0	60	32	92
	3	20	40	5	65
	4	25	27	1	53
2R	1	90	0	10	100
	2	45	75	0	120
	3	55	18	30	103
	4	105	50	0	155
3L	1	60	25	0	85
	2	10	3	75	88
	3	7	5	53	65
	4	70	13	15	98
3R	1	0	0	0	0
	2	15	0	10	25
	3	0	4	1	5
	4	0	5	45	50
4L	1	65	15	0	80
	2	0	75	0	75
	3	0	60	15	75
	4	0	25	25	50
4R	1	45	0	0	45
	2	0	10	5	15
	3	10	0	20	30
	4	10	0	5	15
<b>Grand Total</b>		<b>22.5</b>	<b>20.2</b>	<b>20.9</b>	<b>63.6</b>

**Table 13 – Percent cover by wetland indicator type (6/30/09)**

Transect #	Quadrat #	Non-Indicator Species			Wetland Indicator Species				Unk	Grand Total
		FACU	NI	Total	OBL	FAC	FACW	Total		
1L	1	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	69	0	69	6	75
	3	5	0	5	0	3	5	8	130	143
	4	0	0	0	0	35	0	35	41	76
1R	1	0	1	1	10	5	0	15	0	16
	2	3	0	3	0	0	5	5	3	11
	3	0	0	0	0	0	0	0	82	82
	4	0	3	3	0	40	0	40	57	100
2L	1	0	0	0	2	0	40	42	0	42
	2	0	0	0	0	60	0	60	32	92
	3	0	0	0	0	35	5	40	25	65
	4	5	0	5	0	7	0	7	41	53
2R	1	0	0	0	20	0	80	100	0	100
	2	5	0	5	50	25	40	115	0	120
	3	10	0	10	0	15	23	38	55	103
	4	0	0	0	0	50	100	150	5	155
3L	1	0	0	0	60	5	20	85	0	85
	2	10	0	10	0	3	0	3	75	88
	3	0	0	0	0	5	0	5	60	65
	4	5	0	5	50	3	10	63	30	98
3R	1	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	10	5	15	10	25
	3	0	0	0	0	4	0	4	1	5
	4	0	0	0	0	5	0	5	45	50
4L	1	0	0	0	35	0	45	80	0	80
	2	0	5	5	0	70	0	70	0	75
	3	0	0	0	0	60	0	60	15	75
	4	0	0	0	0	25	0	25	25	50
4R	1	0	0	0	0	0	45	45	0	45
	2	0	0	0	0	10	0	10	5	15
	3	0	0	0	5	0	5	10	20	30
	4	0	0	0	10	0	0	10	5	15
<b>Average</b>		1.3	0.3	<b>1.6</b>	7.6	17.0	13.4	<b>37.9</b>	24.0	<b>63.6</b>

## Appendix D – Photopoints

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**Photopoint 1 – October 2007**



**Photopoint 1 – August 2008**



**Photopoint 1 – August 2009**



**Photopoint 2 – October 2007**



**Photopoint 2 – August 2008**



**Photopoint 2 – August 2009**



**Photopoint 3 – October 2007**



**Photopoint 3 – August 2008**



**Photopoint 3 – August 2009**