Sweetwater Reservoir Vernal Pool and Otay Tarplant Restoration Status Report

Performance Period
(September 2007 to March 2009)

Prepared for

Sweetwater Authority
505 Garrett Avenue
Chula Vista, CA 91912
Contact: Pete Famolaro

Prepared by

RECON Environmental, Inc.
1927 Fifth Avenue
San Diego, CA 92101-2358
P 619.308.9333 F 619.308.9334

RECON Number 3967B

June 3, 2009

Meagan Olson
Restoration Biologist

TABLE OF CONTENTS

TABLE OF CONTENTS (cont.)

FIGURES

PHOTOGRAPHS

TABLES

TABLE OF CONTENTS (cont.)

TABLES

APPENDICES

1.0 Summary

This document summarizes maintenance and monitoring activities from September 2007 to March 2009 for the vernal pool and Otay tarplant (*Deinandra conjugens*) restoration project at the Sweetwater Reservoir. The mitigation project includes 2.70 acres of vernal pool complex (vernal pools and associated uplands) restoration and enhancement, and 4.36 acres of Otay tarplant restoration and enhancement. Approximately 8,201 square feet (ft^2) of vernal pool surface area has been restored or enhanced, including 3,929 ft^2 of restored vernal pools. All areas that have been restored and enhanced as part of this mitigation effort are becoming established and are progressing toward the Year 5 final success criteria standards.

2.0 Background

2.1 Project Location

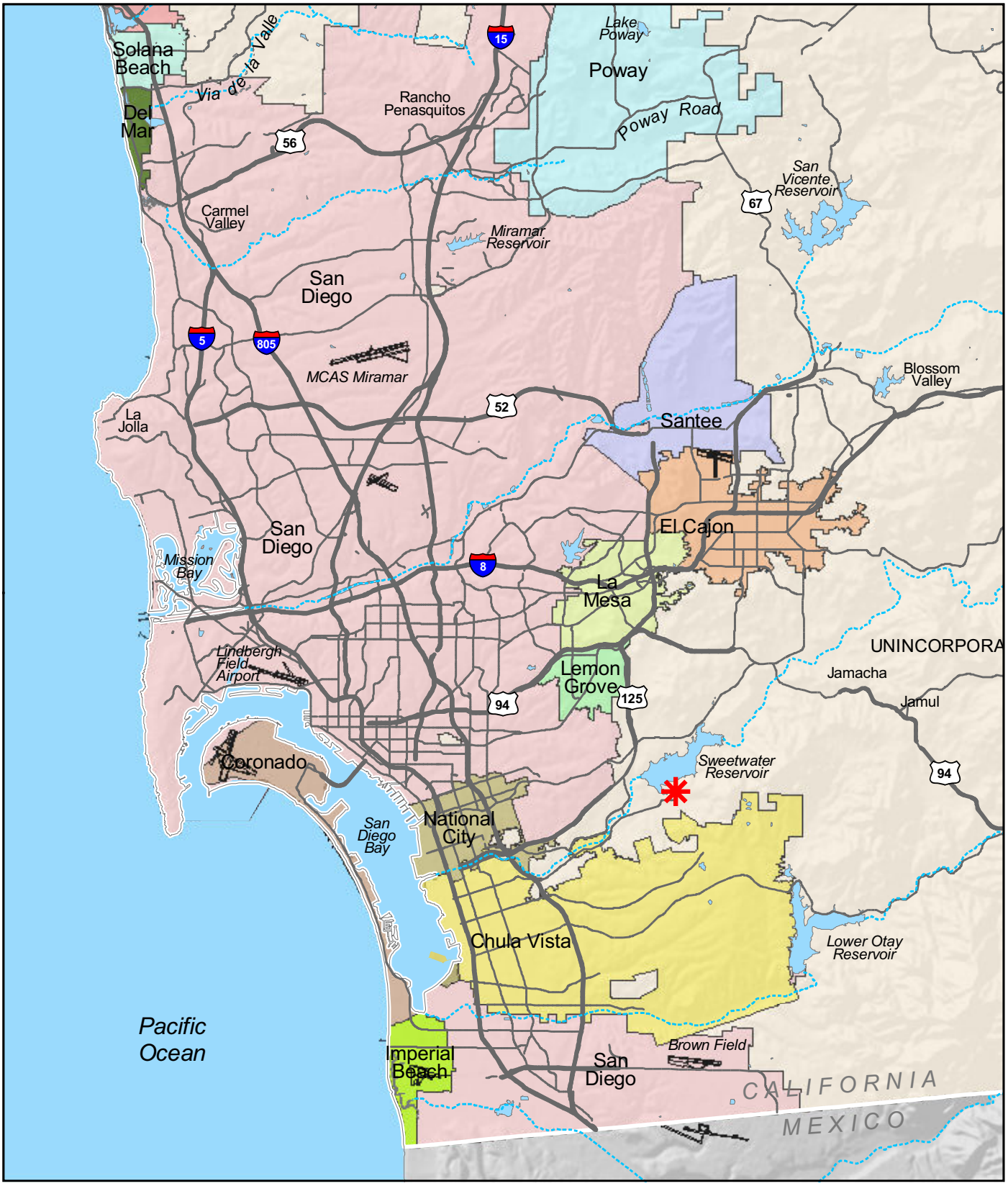
This 7.06-acre Sweetwater Authority vernal pool and Otay tarplant restoration site is located on Sweetwater Authority Property, located north of San Miguel Road and State Route 125, and south and east of Sweetwater Reservoir (Figures 1 and 2).

2.2 Summary of Overall Project

This project is mitigation for impacts to vernal pools and Otay tarplant habitat resulting from a fishing program area developed on the southern portion of Sweetwater Reservoir (McMillan 2001). Restoration of the vernal pool and Otay tarplant habitat began in August 2004. Planned restoration procedures, success criteria, and site conditions prior to restoration are presented in the Restoration and Management Plan for Vernal Pool and Otay tarplant Habitat at the Sweetwater Reservoir (Plan) (McMillan 2001). This document was used to guide all restoration procedures for this project.

2.3 Responsible Party

Sweetwater Authority
Contact: Mr. Pete Famolaro
Robert A. Perdue Water Treatment Plant
100 Lakeview Avenue
Spring Valley, CA 91977



Project Location

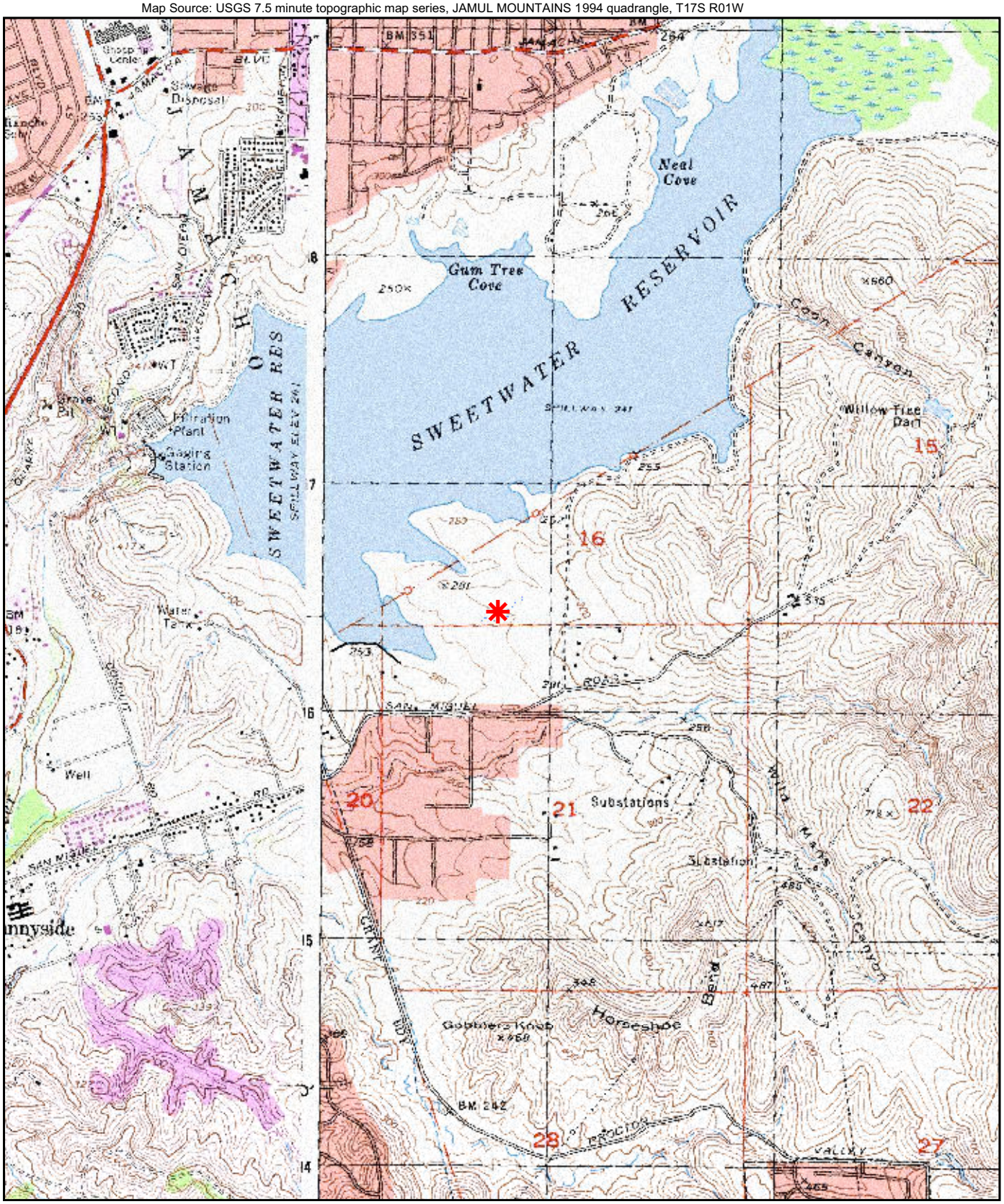
FIGURE 1

Regional Location

RECON

M:\jobs2\3967\common_gis\fig1.mxd 02/12/08

Map Source: USGS 7.5 minute topographic map series, JAMUL MOUNTAINS 1994 quadrangle, T17S R01W



0 Feet 2,000

✱ Project Location

RECON

M:\jobs2\3967\common_gis\fig2.mxd 02/12/08

FIGURE 2

Project Location on USGS Map

Contributors to the data collection and analysis to produce this report are Robert MacAller, Scott McMillan (McMillan Biological Consulting), Mark Dodero, Meagan Olson, and Pete Famolaro (Sweetwater Authority).

2.4 Mitigation Goals and Success Criteria

The goal of this mitigation project is to restore the disturbed areas within the site to native plant communities in order to support Otay tarplant populations and vernal pools and their associated uplands. Quantitative success criteria in the restoration plan were focused on non-native cover values at or below 10 percent (McMillan 2001). More specific targets for vegetation cover and diversity were developed later during the contract proposal phase (McMillan 2004). Although not described in the project permits, these updated quantitative target values describe the measures for success of this restoration project.

2.4.1 Non-Native Cover

Non-native cover should not exceed 10 percent in all areas.

2.4.2 Tarplant/Grassland Cover and Diversity

Native cover in the tarplant/grassland restoration area should be at least 80 percent, with at least 50 percent of the cover represented by Otay tarplant. The remainder of the cover should be represented by the species listed in Table 3 of the Plan. No more than 10 percent of the remaining cover should come from shrubs.

Native cover of the tarplant/grassland restoration area should be made up of at least 25 of the species listed in Table 3 of the Plan.

2.4.3 Vernal Pool Upland Cover and Diversity

Native cover of the uplands surrounding the pools should be at least 85 percent, with at least 10 percent cover represented by Otay tarplant. The remainder of the cover (at least 75 percent) should be represented by species listed in Table 3 of the Plan. No more than 40 percent of the remaining cover should come from shrubs.

Native cover of the vernal pool upland area should be made up of at least 25 of the species listed in Table 3 of the Plan.

2.4.4 Vernal Pool Basin Cover and Diversity

The native cover in the vernal pool basins should be at least 75 percent, represented only by those species listed in Table 4 of the Plan.

2.4.5 Special Requirements for the Vernal Pool Basins

All of the species listed in Table 4 of the Plan should have a cover of at least five percent in at least one of the restored basins.

Toothed downingia (*Downingia cuspidata*) should have a cover of at least five percent in at least five of the restored pools.

Spreading navarretia (*Navarretia fossalis*) should have a cover of at least five percent in all of the restored basins, and should have a cover of at least 25 percent in at least five of the restored basins.

3.0 Plan Implementation

Restoration and enhancement was implemented on existing disturbed land that formerly supported vernal pools and Otay tarplant populations. The physical setting and vegetation conditions were described in the Plan (McMillan 2001). In summary, the site preparation methods included dethatching of weeds and thatch removal, follow-up herbicide spraying to control newly germinated weeds, grading vernal pools, hand seeding, and container planting. A full description of restoration implementation activities is included in the 2007 status report (RECON 2008).

3.1 Maintenance Activities

The focus of maintenance activities during the period included weed control, debris removal, supplemental seeding of vernal pools, and planting in the uplands. These activities are detailed below. The monitoring and maintenance schedule performed from September 2007 through March 2009 is presented in Table 1.

3.1.1 Weed Control

Weed control was a primary concern following vernal pool restoration from the fall of 2007 through the spring 2009. Field crews, ranging in size from three to seven personnel, conducted weed control over 23 separate days. The primary weeds removed from the vernal pools included wild oats (*Avena* sp.), loose-strife (*Lythrum*

hyssopifolium), ryegrass species (*Lolium* spp.), rabbits-foot grass (*Polypogon monspeliensis*), Russian thistle (*Salsola tragus*), and sand spurrey (*Spergularia bocconii*). Upland problem species removed included goosefoot (*Chenopodium* sp.), scarlet pimpernel (*Anagallis arvensis*), mustard (*Brassica nigra),* prickly lettuce (*Lactuca serriola*), wild oats, filaree (*Erodium* spp.), Crete hedypnois (*Hedypnois cretica*), ryegrass, Russian thistle, and brome (*Bromus madritensis*).

Weed species were hand pulled from vernal pool basins. The weeds were bagged and removed from the site. Weeds in the upland areas were sprayed with an herbicide approved for use around aquatic systems or removed using line trimmers (Photograph 1). No herbicide was applied to weeds in the basins. Table 1 provides the maintenance activities and the dates they were performed.

TABLE 1
MAINTENANCE AND MONITORING TASKS
SEPTEMBER 2007 THROUGH MARCH 2009

Date	Task
Jan. 18, 2008	Remedial Planting
Jan. 21, 2008	Remedial Planting Completed
Feb. 29, 2008	Herbicide Application
Mar. 3–4, 2008	Herbicide Application & Line Trimming
Mar. 6–7, 2008	Herbicide Application & Line Trimming
Mar. 12, 2008	Weed Raking & Trash Removal
Mar. 25–28, 2008	Herbicide Application & Line Trimming
Mar. 31 – Apr. 2, 2008	Herbicide Application & Line Trimming
Apr. 7, 2008	Herbicide Application
May 28–30, 2008	Herbicide Application & Hand Pulling within Vernal Pools
Oct. 9–10, 2008	Herbicide Application & Hand Pulling within Vernal Pools
Mar. 4, 2009	Herbicide Application & Hand Pulling
Mar. 10–11, 2009	Herbicide Application & Hand Pulling
Mar. 17, 2009	Herbicide Application & Hand Pulling

3.1.2 Trash Removal

Trash at this site has been negligible due to the fenced property boundary of Sweetwater Reservoir. When encountered, this debris has been collected and removed in conjunction with periodic weeding efforts.

3.1.3 Remedial Planting

Upon recommendation from the project biologist, remedial planting was performed to aid in meeting success criterion for the restoration site. Remedial planting has occurred at several periods by both RECON and Sweetwater Authority (see Table 1). All plant

PHOTOGRAPH 1
Herbicide Treatment,
March 2009

species were chosen based on the species listed in Table 3 of the Plan, as well as species that would do well in clay soils and contribute to desired habitat characteristics and vegetation diversity in grasslands, vernal pool uplands, and vernal pools themselves (Table 2). Planting methods generally followed those described in the Plan.

4.0 Monitoring Methods

Monitoring data has been collected by Scott McMillan to determine the success of the restoration activities to date. Quantitative data is incorporated into this report and a qualitative summary is provided as Appendix A. Representative images of the restoration complex over time are included in Photographs 2–12.

4.1 Tarplant/Grasslands

The tarplant grasslands were monitored for species cover and diversity. A total of two permanent transects were established to monitor grassland conditions, Otay tarplant populations, and exotic species.

4.2 Vernal Pool Uplands

The upland areas surrounding and supporting the vernal pools were also monitored for native and exotic species cover and diversity. One permanent transect was established to monitor these areas.

4.3 Vernal Pools

Vernal pools were surveyed for vernal pool plant and animal species. Surveys for vernal pool fauna were conducted during the aquatic phase of each pool to determine the presence of vernal pool animals. Vernal pool vegetation surveys were conducted within 30 days of the disappearance of standing water. The diversity and cover of vernal pool and non-native species was measured using the Braun-Blanquet cover abundance relevé method (Braun-Blanquet 1932; McMillan 2001). In addition, the pools were monitored for duration of ponding, ponding depth, and for the presence of fairy shrimp.

5.0 Results and Discussion

Vernal pool and grassland/tarplant habitat are being successfully restored at the Sweetwater Reservoir site. Eleven pools with approximately 8,291 ft^2 of vernal pool

TABLE 2
SUPPLEMENTAL PLANTING AND SEEDING
(Monitoring Period September 2007-March 2009)

SPECIES	COMMON NAME	UNIT	QTY.
RECON (January 2008)			
Artemisia californica	California sagebrush	1 gallon	15
Eriogonum fasciculatum	California buckwheat	1 gallon	15
Isomeris arborea	Bladderpod	1 gallon	15
Mimulus aurantiacus	Bush monkeyflower	1 gallon	20
Rhus integrifolia	Lemonadeberry	1 gallon	2
Viguiera laciniata	San Diego sunflower	1 gallon	15
Yucca schidigera	Mohave yucca	1 gallon	10
Allium haematochiton	Red skinned onion	4 inch	500
Bloomeria crocea	Golden star	4 inch	500
Brodiaea jolonensis	Dwarf brodiaea	4 inch	100
Chlorogalum parviflorum	Soap plant	4 inch	250
Dichelostemma capitatum	Blue dicks	4 inch	500
Bothriochloa barbinodis	Cane bluestem	Rose Pot	50
Calystegia macrostegia	California morning glory	Rose Pot	50
Dudleya variegata	Variegated dudleya	Rose Pot	200
Nassella lepida	Foothill needlegrass	Rose Pot	500
Nassella pulchra	Purple needlegrass	Rose pot	500
Sisyrinchium bellum	Blue-eyed grass	Rose pot	500
RECON (February 2008)			
Deschampsia danthonioides	Annual hairgrass	Seed	2-3 oz
Epilobium pygmaeum	Smooth Boisduvalia	Seed	3 oz
Juncus bufonius	Toad rush	Seed	2 oz
Lepidium latipes	Dwarf peppergrass	Seed	3 oz
Navarretia fossalis	Spreading Navarretia	Seed	1 oz
Pilularia americana	American pillwort	Seed	1.5 oz
SWA (February 2008)			
Grindelia camporum var. *bracteosum*	Gumplant	4 inch	500
SWA (December 2008)			
Castilleja exserta	Owl's clover	Seed	5 lbs
Centaurium venustum	Canchalagua	Seed	3 oz
Holocarpha virgata ss. elongata	Graceful tarplant	Seed	5 lbs
Lasthenia californica	Goldfields	Seed	3 lbs
Navarretia hamata	Hooked navarretia	Seed	3 lbs
Plantago erecta	California plantain	Seed	50 lbs
SWA (January 2009)			
Opuntia prolifera	Cholla	Cuttings	6
Lessingia filaginifolia	Common California aster	1 gallon	60
TOTAL		67 lbs. seed	4,308 plants

PHOTOGRAPH 2
Looking East, Prior to Restoration, August 2004

PHOTOGRAPH 3
Looking East, Two Years Following Vernal Pool Grading, October 2007

PHOTOGRAPH 4
Looking East, Three Years Following Vernal Pool Grading, March 2009

PHOTOGRAPH 5
Looking South, Prior to Restoration, August 2004

PHOTOGRAPH 6
Looking South, Six Months Following Vernal Pool Grading, March 2006

PHOTOGRAPH 7
Looking South, Three Years Following Vernal Pool Grading, March 2009

PHOTOGRAPH 8
Looking West, Prior to Restoration, August 2004

PHOTOGRAPH 9
Looking West, Six Months Following Vernal Pool Grading, March 2006

PHOTOGRAPH 10
Looking West, Three Years Following Vernal Pool Grading, March 2009

PHOTOGRAPH 11
Typical Vernal Pool, Six Months Following Grading,
March 2006

PHOTOGRAPH 12
Typical Vernal Pool, Three Years Following Grading,
March 2009

surface area have been restored or enhanced within the restoration site (Figure 3), and an Otay tarplant population and native grasslands are making progress toward restoration goals. Of the 11 restored vernal pools, six were newly restored pools with an approximate surface area of 3,929 ft^2, exceeding the requirement of 900 ft^2 of vernal pool surface area restoration.

During the 2007 to 2008 rainfall year, all pools ponded for one to five weeks (Table 3). These pools had a maximum ponding depth between 1.5 and 6.0 inches. San Diego fairy shrimp (*Branchinecta sandiegonensis*) were observed in eight of the eleven ponded basins (see Table 3; Figure 4). It is anticipated that, over time, all of the pools should support San Diego fairy shrimp.

The 2008 to 2009 rainfall year resulted in all pools being ponded for most of the winter. The extensive length of ponding was beneficial in reducing the weed species (Appendix A).

TABLE 3
2008 SWEETWATER RESERVOIR RESTORATION VERNAL POOLS
FAIRY SHRIMP AND HYDROLOGY DATA

Fairy Shrimp And Hydrology	**VP 1**	**VP 2**	**VP 3**	**VP 4**	**VP 5**	**VP 6**	**VP 7**	**VP 8**	**VP 9**	**VP 10**	**VP 11**
Number of Weeks Ponded	4	4	5	2	3	2	3	2	2	1	3
Maximum Depth (Inches)	5.5	6.0	5.5	3.5	3.0	4.0	6.0	2.5	2.5	1.5	4.0
San Diego Fairy Shrimp Present	yes	yes	yes	no	yes	yes	yes	yes	yes	no	no

The results of qualitative and quantitative analyses and a comparison to the success criteria are included below.

5.1 Tarplant/Grasslands

Following three years of intensive weed control and two years following planting and seeding, the upland Otay tarplant and grassland restoration area is progressing towards meeting the success criteria (Tables 4–6; Photographs 13–14).

5.1.1 Non-native Cover

Non-native plant cover was 17.5 percent. Although lower than the 21 percent cover for 2007, it is still above the final year success criteria of no more than 10 percent.

Image source: Copyright GlobeXplorer, LLC, All Rights Reserved (flown January 2008)

0 Feet 100

Restoration and Enhancement Area Boundary

Restored Vernal Pools

Enhanced Vernal Pools

FIGURE 3

Vernal Pool Restoration Area

RECON

M:\jobs2\3967\common_gis\fig3.mxd 03/31/09

Image source: Copyright GlobeXplorer, LLC. All Rights Reserved (flown January 2008)

0 Feet 100

Restoration and Enhancement Area Boundary

Ponded 2008

Restored/Enhanced Vernal Pools

San Diego Fairy Shrimp Present

RECON

M:\jobs2\3967\common_gis\fig4.mxd 03/18/09

FIGURE 4

Vernal Pool Ponding
and Fairy Shrimp Results

Intensive weed control activities will continue for the remainder of the maintenance and monitoring period to achieve this goal.

During the 2008 to 2009 season, weed presence in the tarplant area has been high due to above-average rainfall levels. Lamb's quarter (*Chenopodium album*) has become a particular problem and has been present in greater abundance compared to past years (see Appendix A).

5.1.2 Native Cover and Diversity

Native tarplant and grassland species accounted for 64.5 percent of the cover in the tarplant/grassland restoration area, a 5.5 percent increase from the previous year. This level of native plant cover is on target for achieving 80 percent cover after five years. Approximately 21 percent of the total cover is represented by Otay tarplant. It is anticipated that Otay tarplant cover will increase as non-native plants are controlled; however, intense weed control of non-native weeds and common tarplant is necessary in order to meet success criteria. Additionally, reseeding of the tarplant/grassland area with Otay tarplant may be necessary. Approximately 9 percent of the cover was represented by shrubs, which is below the 10 percent requirement.

The native cover of the tarplant grassland area is currently comprised of 23 species listed in Table 3 of the Plan (see Table 1). Supplemental planting and seeding was performed in the winter of 2007–2008, and it is anticipated that with another year of growth, the goal of 25 species will be achieved.

5.2 Vernal Pool Uplands

Following three years of intensive weed control and two years following planting and seeding, the vernal pool upland area is progressing towards meeting the success criteria (Tables 7–9; Photographs 15–16).

5.2.1 Non-native Cover

Non-native plant cover was 13 percent. Although lower than the 15 percent cover for 2007, it is still above the final year success criteria of no more than 10 percent. Intensive weed control activities will continue for the remainder of the maintenance and monitoring period to achieve this goal.

For 2008, the two northernmost pools have the highest concentration of non-native species. It is recommended that careful weed control be implemented within these pools (see Appendix A).

TABLE 4
2008 VEGETATIVE COVER OF THE SWEETWATER RESERVOIR FOR TARPLANT/NATIVE GRASSLAND RESTORATION AREA

Native Species	Percent Cover
Bloomeria crocea	
- common goldenstar	1.5
Convolvulus simulans	
- small-flowered morning-glory	10.5
Dienandra conjugens	
- Otay tarplant	21.0
Dienandra fasciculata	
- common tarplant	9.0
Eremocarpus setigerus	
- dove weed	1.0
Isocoma menziesii	
- coastal goldenbush	5.5
Lotus scoparius	
- deerweed	3.5
Mirabilis californica	
- coastal wishbone plant	2.5
Nasella pulchra	
- purple needlegrass	10.0
TOTAL	**64.5**

TABLE 5
2008 EXOTIC VEGETATIVE COVER OF THE SWEETWATER RESERVOIR FOR TARPLANT/NATIVE GRASSLAND RESTORATION AREA

Non-native Species	Percent Cover
Anagalis arvensis	
- scarlet pimpernel	4.0
Avena spp.	
- wild oats	0.5
Erodium spp.	
- filaree	19.0
Hedypnois cretica	
- Crete Hedypnois	0.5
Lolium spp.	
- rye grass	1.0
Salsola tragus	
- tumbleweed	1.0
Bromus madritensis	
- rip-gut grass	0.5
TOTAL	**17.5**

TABLE 6
2008 VEGETATIVE COVER SUMMARY OF THE SWEETWATER RESERVOIR FOR TARPLANT/NATIVE GRASSLAND RESTORATION AREA

Cover	Percent Cover
Rock/cobble and bare ground	18.0
Native vegetation	64.5
Non-native vegetation	17.5
TOTAL	**100**

PHOTOGRAPH 13
Tarplant/Grasslands Area with Small-flowered Morning Glory (*Convolvulus simulans*) and Otay Tarplant (*Deinandra conjugens*), March 2009

PHOTOGRAPH 14
Tarplant/Grasslands Area with Warty Spurge (*Euphorbia spathulata*) and Otay Tarplant (*Deinandra conjugens*), March 2009

TABLE 7
2008 VEGETATIVE COVER OF THE SWEETWATER RESERVOIR VERNAL POOL UPLAND RESTORATION AREA

Native Species	Percent Cover
Baccharis pilularis - coyote brush	5.0
Bloomeria crocea - common goldenstar	0
Brodiaea jolonensis - mesa Brodiaea	3.0
Dienandra conjugens - Otay tarplant	15.0
Dienandra fasciculata - common tarplant	8.0
Eremocarpus setigerus - dove weed	2.0
Isocoma menziesii - coastal goldenbush	1.0
Juncus acutus - southwestern spiny rush	7.0
Nasella pulchra - purple needlegrass	12.0
Rhus integrifolia - lemonade berry	11.0
TOTAL	**68.0**

TABLE 8
2008 EXOTIC VEGETATIVE COVER OF THE SWEETWATER RESERVOIR VERNAL POOL UPLAND RESTORATION AREA

Non-native Species	Percent Cover
Avena spp. - wild oats	1.0
Erodium spp. - filaree	7.0
Hedypnois cretica - Crete Hedypnois	1.0
Lolium spp. - rye grass	2.0
Salsola tragus - tumbleweed	1.0
Bromus madritensis - rip-gut grass	1.0
TOTAL	**13.0**

TABLE 9
2008 VEGETATIVE COVER SUMMARY OF THE SWEETWATER RESERVOIR FOR VERNAL POOL UPLAND RESTORATION AREA

Cover	Percent Cover
Rock/cobble and bare ground	19.0
Native vegetation	68.0
Non-native vegetation	13.0
TOTAL	**100**

PHOTOGRAPH 15
Vernal Pool Uplands Area with Coast Barrel Cactus (*Ferocactus viridescens*) and Foothill Needlegrass (*Nassella lepida*), March 2009

PHOTOGRAPH 16
Vernal Pool Uplands Area with Native Vegetation, March 2009

5.2.2 Native Cover and Diversity

Native species accounted for 68 percent of the cover in the upland area supporting the vernal pools, an increase of six percent from the previous year. This level of native plant cover is on target for achieving 80 percent cover after five years. Approximately 15 percent of this is represented by Otay tarplant, which meets the success criteria and is a five percent increase from the previous year. Approximately 24 percent of the total cover is represented by shrubs, within the 40 percent maximum, meeting the requirement.

The native cover of the vernal pool upland area is currently comprised of 27 species listed in Table 3 of the Plan, exceeding the success criteria of 25 species.

5.3 Vernal Pool Basins

Cover of native vernal pool indicator species was approximately 60 percent, on track to meet the 75 percent cover requirements by Year 5 (Table 10). Additional native plant species, though not necessarily vernal pool species, present in the vernal pools are shown in Table 11. Exotic species cover averaged less than six percent (Table 12). A summary of vegetative cover is presented in Table 13.

For 2008, it is anticipated the vernal pool indicator species cover will be higher than in previous years. Due to the high rainfall levels, all pools were filled for most of the winter, which resulted in low levels of weed species. However, two pools near the northern end of the project site have weed levels that require treatment (Appendix A).

5.3.1 Special Requirements

The 14 species listed in Table 4 of the Plan are required to have a cover of 5 percent in at least one of the vernal pools. As of spring 2008, five species meet this requirement (see Table 10): pygmy weed (*Crassula aquatica*), with 5 percent cover in pool 8; spikerush (*Eleocharis macrostachya*), with 5 percent or greater cover in pools 2, 8, 9, 10, and 11; toad rush (*Juncus bufonius*) with 5 percent cover in pools 3 and 4; adobe popcorn flower, with 5 percent or greater cover in pools 1, 2, 3, 4, 5, and 11; and woolly marbles (*Psilocarphus brevissimus*), with 5 percent or greater cover in pools 2, 3, 5, 6, 7, and 10.

The goal for toothed downingia was a cover value of at least 5 percent in five of the restored basins. Three years after seeding, this species had 1 percent cover in four basins (basins 1, 2, 3, and 4; see Table 10). Additional seed was collected and introduced into the remaining basins and it is anticipated that in future years this criterion will be achieved.

TABLE 10
2008 VEGETATIVE COVER OF THE SWEETWATER RESERVOIR VERNAL POOLS
(percent cover)

NATIVE INDICATOR SPECIES	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9	VP 10	VP 11
Callitriche marginata - water starwort	1		1	1	1	1		1	1	1	1
Crassula aquatic - pygmy weed	2	2	1	1	1	1	1	5	1	1	1
Deschampsia danthonioides - annual hairgrass		3		1				1	1		
Downingia cuspidata - Downingia	1	1	1	1							
Eleocharis macrostachya - spikerush		5	1	1	1			30	75	15	5
Epilobium pygmaeum - smooth boisduvalia	1	1	1			2	1		1	1	
Juncus bufonius - toad rush	3	3	5	5	2	1	3	1	2	1	3
Navarretia fossalis - spreading navarretia							1				
Plagiobothrys acanthocarpus - adobe popcorn flower	65	65	5	60	5		3	1	3	1	17
Psilocarphus brevissimus - woolly marbles	1	5	55	2	65	45	25	4	2	5	4
Verbena bracteata - Verbena				4		2	1				1
TOTAL	**77**	**85**	**70**	**76**	**75**	**57**	**35**	**43**	**86**	**25**	**32**

TABLE 11
2008 ADDITIONAL VEGETATIVE COVER OF SWEETWATER RESERVOIR VERNAL POOLS
(percent cover)

OTHER NATIVE SPECIES	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9	VP 10	*VP 11*
Baccharis pilularis - coyote brush								9			
Dienandra fasciculata - common tarplant	1	7	15	1	1		1				2
Eremocarpus setigerus - dove weed	1	5	7	1		2	1	1			3
Nasella pulchra - purple needlegrass										7	
TOTAL	**2**	**12**	**22**	**2**	**1**	**2**	**2**	**10**	**0**	**7**	**5**

TABLE 12
2008 EXOTIC VEGETATIVE COVER OF THE SWEETWATER RESERVOIR VERNAL POOLS
(percent cover)

NON-NATIVE SPECIES	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9	VP 10	VP 11
Avena spp. - wild oats							1		1		
Lythrum hyssopifolium - loosestrife	2	3	1	5	2	5	3	5	1	2	3
Lolium spp - rye grass					1				1	2	1
Polypogon monspeliensis - annual beard grass											
Salsola tragus - tumbleweed										2	
Spergularia bocconii - sand spurrey	2	2	1	2	3		2	2	3		3
TOTAL	**4**	**5**	**2**	**7**	**6**	**5**	**5**	**7**	**5**	**6**	**7**

TABLE 13
2008 VEGETATIVE COVER SUMMARY OF THE SWEETWATER RESERVOIR VERNAL POOLS
(Percent Cover)

COVER*	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9	VP 10	VP 11
Rock/cobble and bare ground**	10	10	20	20	30	40	60	35	15	65	75
Native indicator species	77	85	70	76	75	57	34	43	86	25	32
Other native species	2	12	22	2	1	2	2	10	0	7	5
Non-native species	4	5	2	7	6	5	5	7	5	6	7
TOTAL	**79**	**95**	**92**	**78**	**76**	**59**	**36**	**53**	**86**	**32**	**38**

* Absolute vegetative cover ** Not counted in vegetative cover

The goal for spreading navarretia was a cover value of at least 5 percent in all of the restored basins. This species only occurred in one of the pools in the spring of 2007 (basin 7; see Table 10). Seed was applied by the Sweetwater Authority in the winter of 2007 and 2008, and it is anticipated that in future years this criterion will be achieved.

6.0 Burrowing Owl Recovery

Artificial burrows were installed by Sweetwater Authority prior to planting in 2006 and are an integral component of the habitat restoration project. A summary update of burrowing owl use and cooperative burrowing owl recovery efforts by the San Diego National Wildlife Refuge, which adjoins the Sweetwater site, is provided as Appendix B.

7.0 Conclusion

The restoration and enhancement of 2.70 acres of vernal pool complex and 4.36 acres of Otay tarplant is being successfully implemented at the Sweetwater Reservoir mitigation site. Site preparation through intensive weed control began in the fall of 2004, followed by vernal pool grading in the fall of 2005, seeding in early 2006, and planting in early 2007. Supplemental planting and seeding of the vernal pools and their associated uplands has also occurred at various times since initial planting. Weed control has continued throughout the project.

During monitoring in the spring of 2008, San Diego fairy shrimp were observed in eight of the eleven basins that ponded. Cover of native plant species within the uplands is at appropriate levels for this stage of the restoration process. Plant diversity increased through supplemental planting in the winter of 2007–2008. Although the current diversity does not meet success criteria, it is expected that diversity will increase over future growing seasons. In addition, weed levels were slightly higher than the final success criteria, and continued weed control efforts will be needed to achieve the success criteria. It is recommended that weed visits be performed every two weeks to help actively control the weed population and they should be concentrated in the tarplant/grasslands area and the two northern pools (see Appendix A).

Cover of vernal pool indicator species was also at appropriate levels for this stage in the restoration process. Cover levels for target species, including toothed downingia and spreading navarretia, is expected to increase over future growing seasons. Inclusion of artificial burrows into the restoration site by Sweetwater Authority and collaborative efforts by the neighboring San Diego National Wildlife Refuge has shown a direct benefit toward recovery of the burrowing owl in the vicinity of Sweetwater Reservoir.

Cover within the Otay tarplant/grasslands area is progressing well; however, a greater cover of Otay tarplant is needed in order to achieve project success. Currently, the Otay tarplant is being outcompeted by non-native plants and common tarplant. Intensive control of both native and non-native species may be necessary before the restoration area is successful.

8.0 References Cited

Braun-Blanquet, J.
1932 Plant Sociology: The Study of Plant Communities. McGraw-Hill, New York.

McMillan Biological Consulting
2004 Requirements for Vegetation Cover and Diversity. Attachment to Request for Proposal, Restoration and Management Plan for Vernal Pool and Otay Tarplant Habitat. Sweetwater Authority. January 16.

2001 Restoration and Management Plan for Vernal Pool and Otay Tarplant Habitat at the Sweetwater Reservoir. December 14.

RECON
2008 Sweetwater Reservoir Vernal Pool and Otay Tarplant Restoration Status Report. February 15.

APPENDIXES

APPENDIX A

QUALITATIVE MONITORING REPORT
Sweetwater Authority Fishing Program Restoration
March 24, 2009

McMillan Biological Consulting

On March 2nd and March 3rd of 2009, Scott McMillan conducted a qualitative monitoring visit of the Sweetwater Authority Fishing Program Area Restoration site. During this site visit, Mr. McMillan recorded qualitative data on the status of the restoration site, including assessment of the invasive weed levels, native vegetative growth, and the status of the vernal pools. The results of this monitoring visit are discussed below:

1. Status of the Otay Tarplant Area and Other Upland Areas:

The invasive weed level at the Restoration Site is at a critical level. With the above average rains that we have had during the 2008-2009 rainfall season, there has been a substantial level of weed germination and development.

The portion of the site (western area of Restoration Site) dedicated to the restoration of Otay tarplant has a substantial outbreak of weeds. Most of the developing invasive plants have not flowered or set seed, so there is ample opportunity to address this problem. Although there a number of invasive weeds coming up in this area, the following species are of greatest concern:

- *Chenopodium album* (lamb's quarter)
- *Brassica nigra* (black mustard)
- *Erodium* spp. (filaree)

Although this area of the restoration site has had problems with *Brassica* in past seasons, the development of the *Chenopodium* is unprecedented for this site. Clearly, the *Brassica* and *Chenopodium* are the greatest issue in this area, especially the *Chenopodium*, which is growing in and amongst the developing populations of tarplant.

Despite the invasive weed problem in this area, the native vegetation is also very healthy, with Otay tarplant, common tarlant, small-flowered morning glory, reticulate-seed spurge, blue dicks, and early onion germinated and developing throughout this area. In many areas, the populations of native species are adjacent to, or are overlapping with the invasive weeds.

RECOMMENDATIONS:

For the Otay tarplant area and other upland areas of the site, an aggressive program of herbicide application is recommended. If weed control measures are taken soon, most of the invasive weeds will be killed before they can set seed. This herbicide application

should be done using detailed application methods, where each plant is individually sprayed to avoid overspray on the native species. Other methods that should be considered is the use of herbicide sponges, wands, or gloves, where the herbicide is applied through contact directly to the individual weeds.

The entire upland area should be sprayed as soon as possible (RECON crews have initiated this work on March 4th), with repeat spraying at a minimum of every two weeks until herbicide has been applied to all of the weeds coming up this year. After two weeks, it should be obvious which plants were hit during earlier weed control visits so that the subsequent visits can concentrate on the weeds that have been missed. Herbicide application crews should be aware of the native species to avoid and should concentrate on the three invasive weeds listed above.

2. Status of Vernal Pool Areas:

Unlike the upland areas of the Restoration Site, the Vernal Pools do not have an invasive weed problem this season. With the above average rains this season, the pools have been filled most of the winter, including during the March 3rd visit. This ponding has a very beneficial affect of killing most invasive weed species. There are a few invasive weeds that are coming up in the pools, but these are in low numbers and are not a serious problem for the pools. The pools do have scattered individuals of *Lythrum*, *Avena*, and *Hordeum*, but in most of the pools these species are very low in number. In most cases, the effort to remove these few individuals would cause more damage than benefit.

The native vernal pool plant species are germinating and developing very well in the pools in the Restoration Site. Qualitative estimate of the potential cover that will be achieved this year indicate that the cover will be higher than in any previous season, with invasive weed cover lower than in previous seasons.

RECOMMENDATIONS:

The two pools at the very north end of the Restoration Site should be included in the weed control efforts, as they currently have *Avena* and *Hordeum* that is growing along the edges where the pool has dried down and the weeds can be killed with little or no threat to the vernal pools.

Methods to address the weeds along the edges of these two pools should not include herbicide spraying, but should be limited to direct herbicide application (sponge, wand, or glove), or by hand weeding. This weed control should be conducted in conjunction with the upland weed control, but will probably not require too many repeat visits to address.

3. Other Recommended Tasks to Work on in 2009

Other task that are recommended for 2009 include the following:

- If necessary, dethatch areas where dead weed growth has accumulated. The need for this task will be addressed later in the season after weed control effort are complete.
- Collect and redistribute a portion of Otay tarplant seed into the western areas where it is not well established. This should be done in the summer of 2009, after the tarplant has achieved seed set. Care should be taken to only collect and redistribute Otay tarplant since both this species and common tarplant occur within the restoration area. (Sweetwater staff will work with the California Department of Fish and Game to determine if this activity is permitted under the current restoration plan before proceeding).
- Initiate discussion with the Fish and Wildlife Service (and possibly the California Department of Fish and Game) about getting permission to inoculate the Sweetwater vernal pools with other species that are currently not found on-site but would be appropriate to establish and contribute to the value and success of the restoration effort, including the federally listed San Diego button celery. This task will be undertaken by McMillan Biological Consulting in coordination with Sweetwater Authority.

APPENDIX B

Sweetwater Reservoir Burrowing Owl Recovery Update

Peter Famolaro, Sweetwater Authority
April 29, 2009

Sweetwater Authority (SWA) installed 15 artificial burrows within the Sweetwater Reservoir vernal pool and Otay tarplant (*Dienandra conjugens*) restoration site in December 2006 prior to the initial planting effort (SWA 2007). In September 2007, the San Diego National Wildlife Refuge (SDNWR) installed an additional 10 artificial burrows on their immediately adjacent Shinohara parcel which was initiating vernal pool/grassland restoration similar to the SWA site. The combined SWA-SDNWR burrow complex contains 25 artificial burrows and has been regularly monitoring by SWA and SDNWR staff. Where no burrowing owls (*Athene cunicularia*) were found on either the site or surrounding vicinity prior to installation of the artificial burrows, the burrow complex now supports four pair and up to two unpaired individuals.

Burrowing owls quickly colonized the initial SWA burrows in 2007, including successful nesting. By August 2007, up to eight adult and two fledglings burrowing owls were detected using the SWA site by August 2007 (SWA 2007). Burrowing owl activity on the SWA site declined progressively after this initial breeding season concurrent with an increase in herbaceous vegetative cover, namely tarplant (mixed *Dienandra fasciculata* and *D. conjugens*), and the availability of newly-installed burrows on the adjoining SDNWR site. In an effort to reduce non-native weed seed bank, the SDNWR site has been maintained relatively free of annual herbaceous growth, and recorded burrowing owl use would suggest the burrowing owls show preference to these more open habitat conditions.

Although sporadic, burrowing owls continue to utilize the SWA property and the artificial burrows, as evidenced by droppings, pellets, and/or burrowing owl observations. Up to three individual burrowing owls were regularly seen on the SWA site and these burrow entrances through winter 2008-2009, but only one individual was detected on site as of March 2009. None of the recent occurrence of the SWA site has resulted in pair bonding or nesting use as compared to the SDNWR property where all four pairs currently reside. Recent nesting activity has occurred only on the SDNWR site, where a successful clutch was produced in 2008, and two pair were actively nesting as of March 2009 (J. Martin [SDNWR] and P. Famolaro, pers. obs.).

Despite the lower densities of burrowing owls and lack of current breeding use on the SWA property, the installation of the initial 15 artificial burrows has been an integral component of the vernal pool and Otay tarplant recovery effort and a significant contribution to burrowing owl recovery for the combined SWA-SDNWR burrowing owl complex. At a minimum, these burrows are functioning as additional refugia for current SDNWR resident burrowing owls and possible wintering habitat for migrating individuals. SWA will continue to monitor use of these artificial burrows and discuss adaptive management recommendations with the wildlife agencies.

In coordination with the California Department of Fish and Game (CDFG), SWA cleared the dried remains of annual herbaceous vegetation within a 25' radius of each burrow mound in January 2009. This practice will be continued at the end of each growing season to maintain openness of the artificial burrow mounds and tunnel entrances. Additionally, *D. fasciulata* seed will be collected in an effort to reduce cover of this species to more natural levels. *D. conjugens* seed will be collected only as necessary to increase distribution of this species to other portions of the site (McMillan Biological 2009).

Photo 1: View of SWA site looking west, densely covered with mixed tarplant species, April 29, 2007

References:

Sweetwater Authority. 2007. Sweetwater Reservoir Burrowing Owl Recovery Project Summary. Prepared by P. Famolaro. September 24.

McMillan Biological Consulting. 2009. Qualitative Monitoring Report, Sweetwater Authority Fishing Program Restoration. March 24.