



Final Report for the
Cottonwood Creek Exotic
Plant Species Removal
and Revegetation Project
Grant Agreement
#04-065-559-0

Prepared for

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A handwritten signature in black ink, appearing to read 'Lindsay Stallcup'.

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1.0 Summary

This document serves as the Final Report for the Cottonwood Creek Exotic Plant Species Removal and Revegetation Project. The Cottonwood Creek project site is located in the upper Tijuana River Watershed in eastern San Diego County. The project area consisted of two separate locations: (1) from approximately Buckman Springs Road to just above Morena Reservoir; and (2) an approximately two-mile stretch from Barrett Reservoir to State Route 94 (SR-94). Due to time and budgeting constraints, work was only conducted in the Morena Reservoir project area; accordingly, only the Morena Reservoir area will be discussed in this report.

Salt cedar (*Tamarix* sp.) was targeted for removal throughout the project area. Exotic species removal commenced in August 2006 and was completed in November 2006. Salt cedar was manually removed from a total of 55 acres, and a triclopyr-based herbicide was applied to cut stumps. Removal has been highly successful, with greater than an estimated 90 percent of treated salt cedar plants demonstrating no signs of regrowth 16 months following the initial treatment.

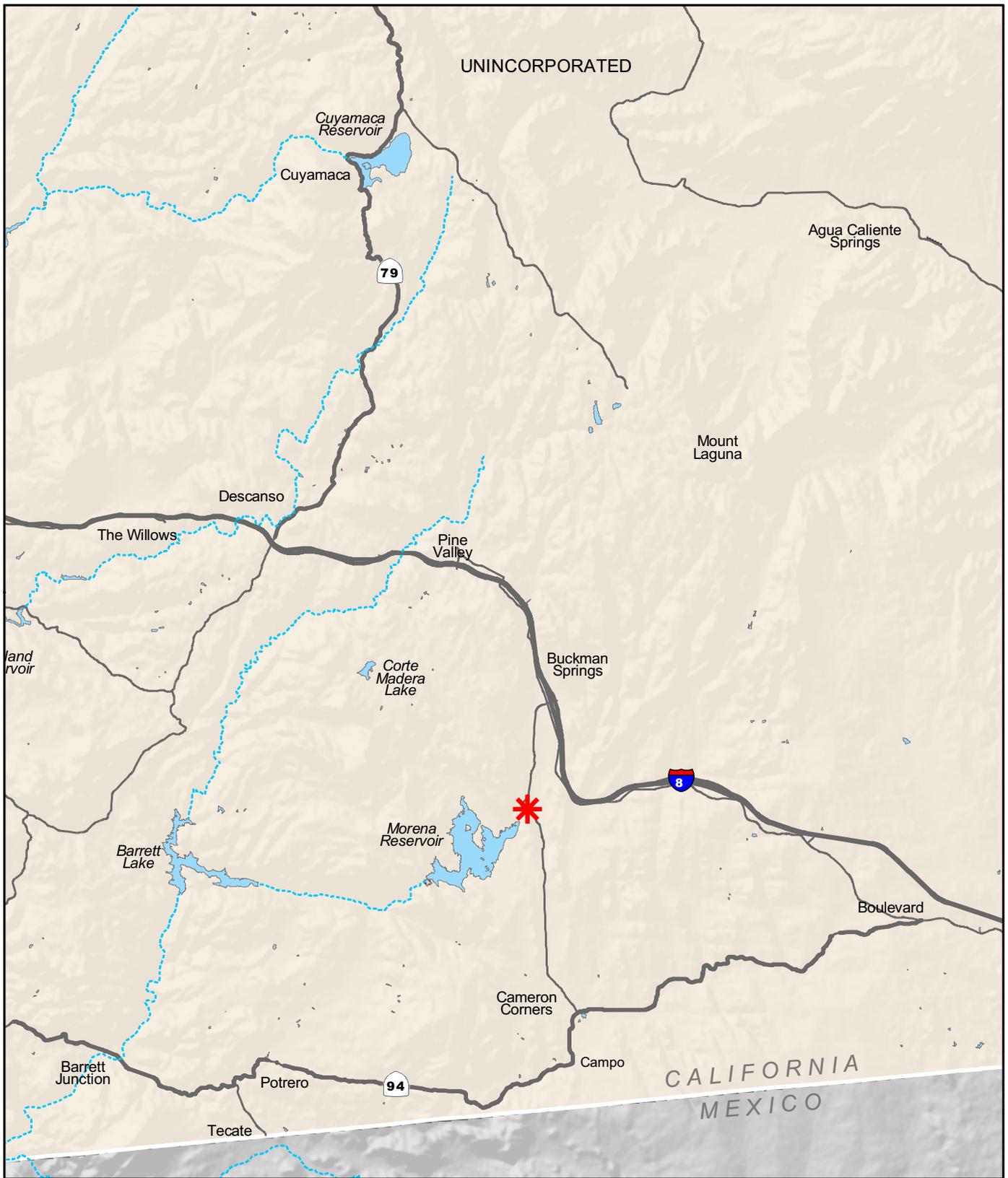
Native species revegetation commenced in February 2007 with the installation of 4,000 seedlings and 850 cuttings of cottonwood (*Populus fremontii*), willow (*Salix* spp.), and mule fat (*Baccharis salicifolia*). Due to low survivorship of these individuals, 4,233 additional plants were installed in the area northeast of Buckman Springs Road in March 2008.

2.0 Introduction

2.1 Project Description

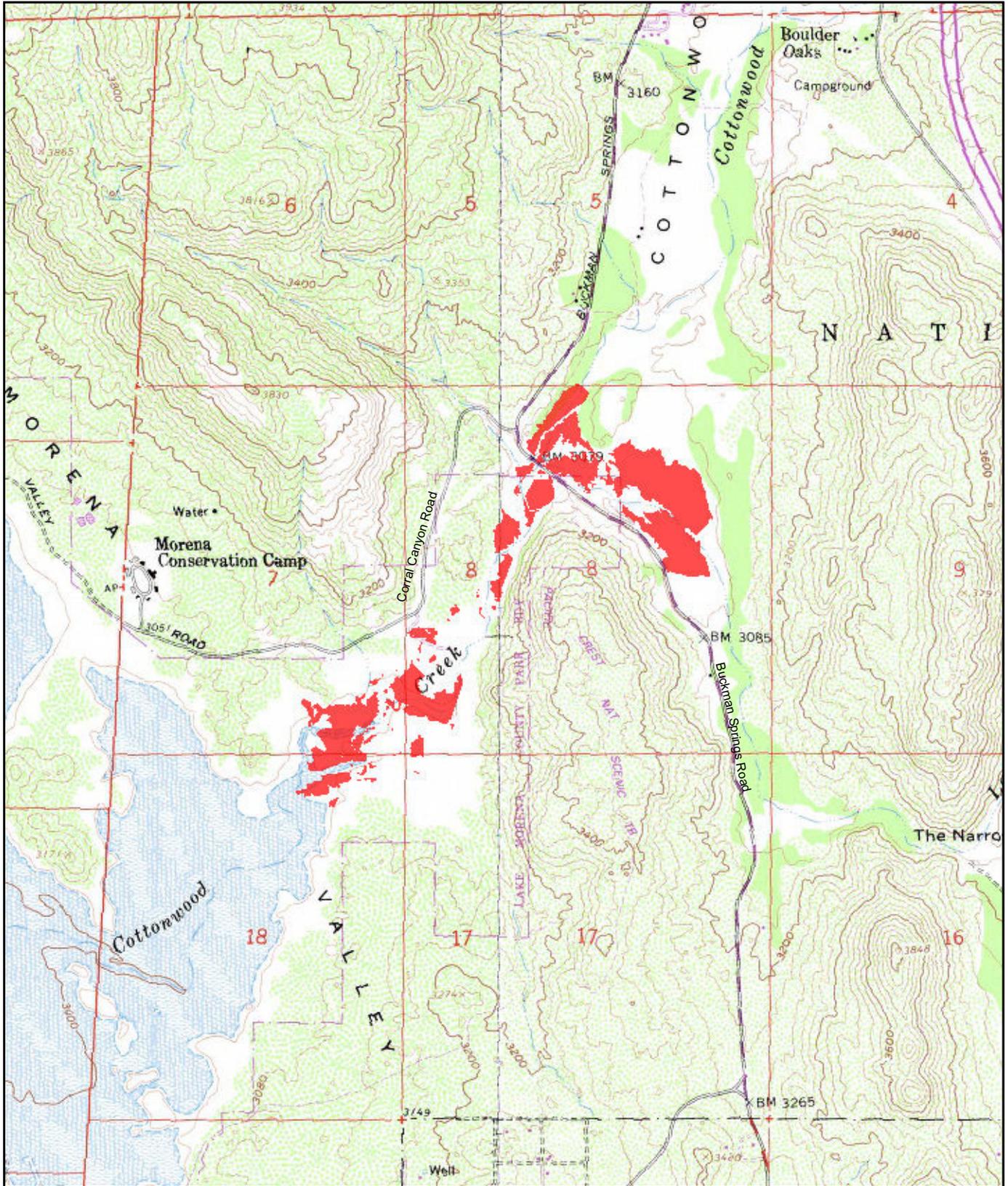
In 2003, the County of San Diego, Department of Public Works (County) applied to the State Water Resources Control Board (SWRCB) for funding to remove two target invasive species, giant reed (*Arundo donax*) and salt cedar (*Tamarix* spp.), from two selected areas of Cottonwood Creek in eastern San Diego County (Figures 1 and 2). The first area was an approximately two-mile stretch from Barrett Reservoir to SR-94. The second area extended from approximately Buckman Springs Road to just above Morena Reservoir. Due to time and budgeting constraints, work was only conducted in the Morena Reservoir project area.

This project was part of the Proposition 13 Watershed Protection Grant Program and was a funding agreement between the SWRCB and the County of San Diego. Grant funding for this project was authorized on February 19, 2004.



 Project Location

FIGURE 1
Regional Location



 Project Boundary

FIGURE 2

Project Location on USGS Map

Cottonwood Creek is located in the upper Tijuana River watershed and is considered to be valuable riparian habitat, with the potential to be enhanced through the removal of exotic species. Thus, the State Water Resources Control Board Clean Water Act has placed the upper, middle, and lower reaches of Cottonwood Creek on the 303(d) monitoring list for exotic vegetation control.

Non-native, invasive plants pose a major threat to the sensitive riparian ecosystems. They alter vegetation structure, displace native plant species, and degrade habitats for native animal species. Dense stands of invasive species impede natural flow patterns and exacerbate erosion as water is forced to scour new channels. The excessive biomass of non-native, invasive species also creates flood hazards during high flows. Furthermore, the presence of invasive species may result in increased fire frequency and altered soil chemistry. In particular, giant reed (*Arundo donax*) and salt cedar (*Tamarix* sp.) are known to have significantly higher rates of evapo-transpiration than that of native species. Thus, the dominance of these non-native species lowers water availability for other species.

The main goals of this SWRCB-funded project were:

- 1) To remove the invasive plants in two areas of Cottonwood Creek in order to protect valuable riparian habitats on-site as well as the riparian and estuarine habitats invaded by giant reed and salt cedar downstream in the Tijuana River valley;
- 2) To revegetate these areas with native species; thereby improving stream flow, water quality, overall stream health, flood control and habitat quality; and
- 3) To increase public awareness of the problems invasive plants pose to watersheds.

Although the removal of these invasive plant species will ultimately improve water and habitat quality of Cottonwood Creek, it was anticipated that the action of removing the exotics could have a temporary negative effect on the federally endangered arroyo toad (*Bufo californicus*) that inhabits the project area. In addition, the creek supports potential breeding habitat for the federally endangered least Bell's vireo (*Vireo bellii pusillus*) and southwestern willow flycatcher (*Empidonax trailii extimus*). Accordingly, a Biological Assessment (BA) for the project was prepared pursuant to Section 7 of the Federal Endangered Species Act (FESA; Tierra Environmental Services [Tierra] 2005).

2.2 Grant Conditions and Key Personnel

The County engaged Tierra to develop plans for monitoring, invasive plant removal, revegetation, and to compile GPS coordinates and map all invasive plants within the project area. RECON Environmental was hired to provide labor for the revegetation effort, conduct final monitoring and reporting, and provide recommendations regarding

additional plant installation. A list of key personnel involved in the project is provided in Table 1.

**TABLE 1
KEY PROJECT PERSONNEL**

Organization	Personnel	Role
Tierra Environmental	Ed Woch	Project manager
EDAW, Inc.	John Konecny	Arroyo toad consultation and surveys
USFWS	Chris Otahol	Arroyo toad consultation and surveys
US Forest Service	Lance Criley	Brush pile management and fire restrictions
Cottonwood Fire Station	Dawn Tinker	Brush pile management and fire restrictions
California Conservation Corps (CCC)		Hand crew labor for invasive species removal
RECON Native Plants, Inc.		Propagation of plants for revegetation
RECON Environmental		Final monitoring, reporting, hand crew labor for revegetation and supplemental watering

2.3 Project Schedule

Monitoring programs and project implementation were originally scheduled to commence in the fall of 2005, but this start was delayed due to incomplete agency permits. A biological opinion from the U.S. Fish and Wildlife Service (USFWS) was completed on May 22, 2006. Subsequently, the USFS produced a Finding of No Significant Impact (FONSI) and final Environmental Assessment (EA) for their portion of the project area in June of 2006. Revisions and addendums to the Monitoring Plans for Water Quality and Treatment Effectiveness, and to the Exotic Species Removal and Revegetation Plan for this project were made accordingly in June and July 2006.

Significant final revisions to the Exotic Species Removal and Revegetation Plan included the decision to limit herbicide application directly to cut stumps only, with no foliar spraying. The decision to use the cut-stump method greatly reduced the potential for collateral damage to adjacent native plants. The herbicide application season was rescheduled to begin in August 2006 to accommodate the limited growing season at Morena Reservoir, with plans for retreatment in May or June 2007.

Project commencement in August 2006 also coincided with the period of senescence in salt cedar and giant reed, when these target plants are more receptive to translocation of herbicides from leaves and stems to root tissues. This timing ensured the greatest likelihood of treatment success while also accommodating the breeding seasons of sensitive species.

An outline of major project milestones can be found in Table 2.

TABLE 2
PROJECT MILESTONES

Date	Milestone
July 15, 2004	Authorized to begin work on Tijuana River Water Invasive Species Removal Project from the State Water Resources Control Board.
October 7, 2004	Consultant hired through competitive procurement to conduct project mapping and planning.
February 2005 to June 2005	GPS locating of invasive species.
April 2005 to July 2005	Protocol surveys completed for arroyo toad, least Bell's vireo, and southwestern willow flycatcher.
August 26, 2005	Detailed maps of invasive species complete.
September 17, 2005	Biological Assessment pursuant to Section 7 of the Endangered Species Act completed.
September 29, 2005	Notice of Intent (NOI) to adopt Mitigated Negative Declaration (MND) for the project.
December 17, 2005	Cottonwood Creek Exotic Plant Species Removal and Native Plant Species Revegetation plan completed.
December 22, 2005	Formal Section 7 consultation with USFWS initiated.
January 11, 2006	County Board of Supervisors adopts MND and approves contract with the CCC for removal and revegetation services.
May 22, 2006	Biological Opinion completed by USFWS. Nationwide 404 Permit issued. Work may begin after toad breeding season (August 15).
August 14-16, 2006	Installation of arroyo toad exclusion fencing.
August 22, 2006	Removal of exotic species begins.
November 3, 2006	Removal of exotic species ends.
November to December 2006	Native cuttings and seedlings were collected by project biologist and RECON Native Plants, Inc. for revegetation efforts.
February 5 to 16, 2007	First round of revegetation; 18 acres of treatment area were planted with 4,000 seedlings and 850 cuttings (cottonwood, willow, and mule fat).
June 26 to July 2, 2007	Follow-up treatment of salt cedar resprouts.
October 21, 2007	Harris Fire begins. Due to high fire danger and the subsequent wildfires in October 2007, no additional invasive species removal was completed during fall 2007.
February 21, 2008	Final monitoring and assessment was carried out by RECON restoration biologists. Supplemental planting was recommended in the area northeast of Buckman Springs Road.
March 10-12, 2008	Supplemental planting (4,233 plants) was completed in a 4-acre area northeast of Buckman Springs Road. Plants were watered on four occasions during March 2008.

3.0 Program Development

3.1 Site Mapping and Access

The County of San Diego identified two areas of salt cedar and giant reed infestation within the upper Cottonwood Creek watershed, and populations of each target species throughout the project area were recorded using a Global Positioning System (GPS). These surveys found that target invasive plant populations at the Morena Reservoir site consisted solely of salt cedar (approximately 95 total acres; Figure 3). In contrast, the Barrett Reservoir site was dominated by salt cedar, but also included large stands of giant reed in the lower portions of the project area near SR-94 (approximately 64 total acres). Due to time and budgeting constraints, work was only conducted in the Morena Reservoir project area.

Potential access points for removal and revegetation activities were delineated in the field during team meetings. Parties attending field meetings included the County of San Diego, Department of Public Works, Tierra Environmental Services, TAIC, California Department of Fish and Game, California Regional Water Quality Control Board, and USFWS. Access points and routes were chosen based on the potential for burrowing arroyo toads in upland areas and routes providing the least impact to these areas.

3.2 Endangered Species Surveys and Consultation

The project area serves as habitat for a number of sensitive species. Focused surveys for the following species were conducted in the spring and summer of 2005:

- Least Bell's vireo (*Vireo bellii pusillus*) were observed in the Barrett Reservoir portion of the project site during focused surveys. The fact that this species had not been detected on-site previously suggests that individuals may be dispersing into this appropriate habitat from other breeding sites nearby.
- Southwest willow flycatcher (*Epidonax traillii extimus*) surveys recorded only one individual near Morena Reservoir despite the existence of suitable habitat throughout the project area.
- Bald eagles (*Haliaeetus leucocephalus*) were not found during focused surveys. This species is an uncommon visitor to San Diego County and nesting has not been recorded in the County since 1936.

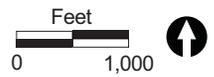
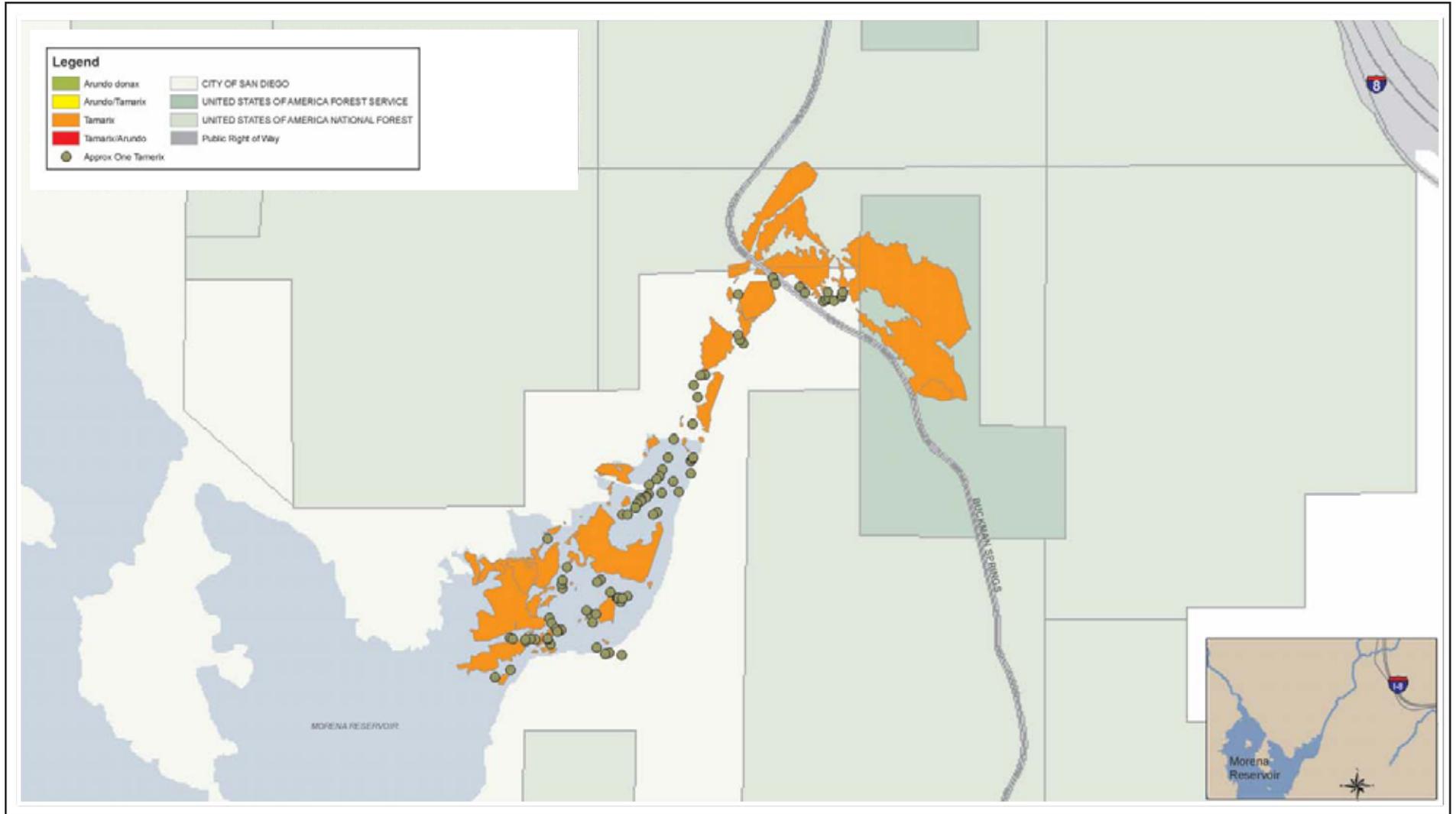


FIGURE 3
Invasive Species at Morena Reservoir Project Area

- Stephen's kangaroo rats (*Dipodomys stephensi*) were not found during focused surveys. Habitat for this species does not occur within the project area.
- Arroyo toad (*Bufo californicus*) adults and juveniles were recorded during focused surveys throughout the project area and the majority of the project area constitutes suitable breeding habitat for this species.
- California red-legged frogs (*Rana aurora draytonii*) were not found during focused surveys. Although this species has been documented within the project area, this is presumed to be a historical record prior to extirpation of this species.
- Quino checkerspot butterflies (*Euphydryas editha quino*) have been recorded immediately south of the Barrett Reservoir site, but surveys did not find any Quino checkerspot in the project area.

3.3 Mitigation Measures and Arroyo Toad Provisions

Project work was scheduled to commence after July 31, 2006, at the end of the breeding season for all endangered species on-site. As a result, limited mitigation measures were required.

The project area constitutes high-quality occupied habitat for the federally endangered arroyo toad (*Bufo californicus*). To ensure that impacts to arroyo toad populations were mitigated, the USFWS required the installation of toad exclusion fencing around invasive species removal work areas (Photograph 1). Silt fencing was installed along all access routes deemed potential upland habitat and within the dry streambed to protect arroyo toads from project disturbance. This species is generally active only during warm nights after rains or with high humidity. As a result, all project work was required to occur during daylight hours and would cease if any rainfall occurred or was likely to occur, as directed by the arroyo toad biologist. All invasive plant removal work for this project occurred outside of the arroyo toad breeding season (after July 31), and suitable breeding habitats and stream channels were devoid of water during the entire salt cedar removal phase.

Consultation regarding arroyo toad fencing was provided by Chris Otahal (USFWS) and John Konecny (EDAW, Inc.). After reviewing the Morena Reservoir site, it was decided that the density of vegetation in some locations limited toad habitat and restricted the installation of toad fencing. The original project plans instructed that fencing be installed around work areas as work occurred. However, this proposal was deemed unfeasible because installation of the fence would cause greater disturbance to native habitat than would localized removal of target plants. Therefore, the USFWS and EDAW suggested the installation of toad exclusion fencing only surrounding high activity corridors leading



PHOTOGRAPH 1
Arroyo Toad Exclusion Fencing Surrounded High-traffic Areas During
Salt Cedar Removal, Cut Salt Cedar Biomass Was Piled in
Predetermined Locations



PHOTOGRAPH 2
Cut Salt Cedar Stumps Were Treated With
Herbicide to Prevent Resprouting

to and from the major areas of salt cedar removal. This revised method would both limit the amount of soil disturbance in valuable habitat, while also concentrating foot and vehicular traffic to existing established ranch roads, trails, and the dry streambed.

The majority of all fencing was situated in the dry streambed where sandy substrate could be used to bury and secure the bottom edge of the fabric. However, in limited portions of uplands, adjacent to previously mentioned ranch roads, the bottom of the fence fabric had to be secured with sandbags.

After each installation of fencing, and prior to commencement of work, a toad biologist surveyed the fence enclosure on three occasions to remove any arroyo toads. Once the fenced area was cleared of toads, work crews continued work within the fenced area. The toad fencing barrier was moved from one area to the next and resurveyed by the toad biologist as removal work was completed in each portion of the project area.

The first section of toad fencing was 6,000 feet long and installed between August 14 and 16, 2006, by the CCC and under the supervision of project manager Ed Woch. Toad biologist John Konecny completed surveys of this toad fence network between August 17 and 20, 2006. The first fence was dismantled and moved upstream between September 17 and 19, 2006. This second installation of fencing totaled approximately 8,000 feet and was surveyed by John Konecny between September 20 and 24, 2006. This second section was dismantled and a final toad fence installation of approximately 1,200 feet was installed between October 21 and 22, 2006. This fencing was surveyed by John Konecny between October 23 and 25, 2006.

The integrity of the toad fencing was compromised in a number of locations during the project. The fence was repaired when damage was noted; however, despite the best efforts of the project manager and staff to keep the fence upright, local off-road enthusiasts and equestrians knocked down or cut the fence down on a weekly basis.

4.0 Exotic Species Removal

4.1 Methods

4.1.1 Environmental Conditions

Environmental conditions at the Morena Reservoir project site during most of this period were optimal for invasive plant removal. Temperatures were warm throughout August and September 2006 with very few cold nights below 45° Fahrenheit, which would limit target plant metabolism. During early October 2006, the weather remained mild with some cold nights, but warm, mild days. The exceptions were two periods of Santa Ana

winds which elevated temperatures in late September and mid October. Very few periods of high winds limiting project work were experienced outside of these periods and precipitation was virtually absent. On a very few days in September and on four days in October, the use of chain saws was briefly limited due to elevated fire hazards.

In early and mid October cooler weather caused the target salt cedar plants to turn yellow and lose foliage. Senescence progressed through October spurred by regular cold nights, often near or below freezing. By November, the plants had senesced to the point where continued herbicide application was deemed to be ineffective by the project manager.

The very dry conditions throughout the project ensured that no surface water flowed in Cottonwood Creek during fieldwork and soils were dry and stable throughout the project area. Overall, environmental conditions created no impediment to site access or movement within the work site during the entire work period.

Despite low seasonal rainfall prior to and during implementation of invasive species removal, dense thickets of bull thistle (*Cirsium vulgare*), black mustard (*Brassica nigra*), prickly lettuce (*Lactuca serriola*), and stinging nettle (*Urtica dioica*) were common. Thickets of mule fat (*Baccharis salicifolia*) and willow (*Salix* spp.), both dead and living, were also common throughout the project area.

A second season of invasive species removal had been scheduled between August 20, 2007 and November 2007. However, high fire danger, and the subsequent wildfires that began on October 21, 2007, resulted in the cancellation of additional invasive species removal on this project.

4.1.2 Site Access and Staging

Crew staging occurred along Buckman Springs Road and along Corral Canyon Road, a public unpaved road connecting to Buckman Springs Road (see Figure 2). All vehicles were parked at designated staging areas along these roads. From these staging areas, equipment and materials were transported by hand to the stream channel and work sites via a series of historic ranch roads connecting to the public roads. The majority of these routes were not considered sensitive habitat due to their highly compacted soils and disturbed nature. As a result, the majority of these road paths were not enclosed in toad fencing.

As directed by Chris Otahal (USFWS) and John Konecny (EDAW), other significant foot circulation on-site occurred within the dry streambed. All circulation routes within the streambed and adjacent intersections with upland habitat were enclosed by toad fencing; however, upland toad habitat was not fenced in most areas. At each site access point, John Konecny assessed and recommended the extent of toad fencing needed around the transition between streambed and upland toad habitat.

Wherever possible, other pathways used on-site were created through disturbed areas and exotic vegetation, most often patches of mustard, thistle, and dead annual grasses. Where accessing target plants required crews to walk through native plants, access paths were kept to a maximum width of three feet and foot traffic was limited to the shortest logical access route. All access road paths remained open and navigable for the duration of the project.

4.1.3 Salt Cedar Removal and Herbicide Treatment

Labor for salt cedar removal was provided by CCC hand crews. A brief training seminar was devised by Tierra and provided to CCC work crews by the project manager the first morning of each eight-day work period. The training included information about site topography, habitat types, and environmental parameters affecting the project. Special instruction was also given on the installation and maintenance of toad fencing.

The work schedule of CCC crews consisted of six eight-day work periods, with a one- to four-day break between work periods. Following each work period, one crew would leave and a new crew would arrive on-site. Typically, two crews, totaling approximately 20 workers and 2 supervisors, were allotted for each work period.

Salt cedar removal was accomplished using chainsaws. Each plant was cut to a stump height of approximately 8 to 15 inches using a chainsaw, and biomass was removed (Photograph 2). Pathfinder II™, a triclopyr-based herbicide, was then immediately applied to the cut stump using a backpack sprayer held no further than 8 inches from the target plant. Pathfinder II was chosen because it is effective on woody plants such as salt cedar but does not harm native grasses and sedges. Use of this product was approved by a certified Pest Control Advisor. Herbicide application occurred between 7:30 A.M. and 2:00 P.M. during calm conditions of no more than 5 mph wind to minimize chemical particle drift. No foliar or broadcast spraying occurred in this project.

Herbicide application was conducted by Mr. Rogelio Ramos, a state licensed and County-registered herbicide applicator provided by the CCC. In some instances, Mr. Ramos was not immediately available or was not present on-site. In this case, plants were “pre-cut” to approximately three feet in height, and most of the biomass was removed. When the herbicide applicator became available, the stem was re-cut and herbicide was applied to the freshly cut stump.

4.1.4 Biomass Organization and Removal

The original work plan called for removal of salt cedar biomass for off-site burning. However, during the course of the project this was deemed unnecessary in most cases by Lance Criley (USFS). Therefore, much of the biomass generated by exotic species

removal was used to form small- to medium-sized brush piles, which can serve as valuable cover for small mammals, reptiles, and birds.

The remaining biomass was used to create several large debris piles for later on-site burning. Mr. Criley recommended three suitable locations for the large brush piles. All of these sites were found in the southwestern (downstream) portion of the project area and within large open fields occupied exclusively by herbaceous exotic weeds and away from shrubs and trees. Typically, these burn piles were 12 feet wide and between 25 and 100 feet long. In one other area, northeast of the Buckman Springs Road Bridge, a number of 15- to 20-foot round burn piles were created, as directed by Mr. Criley and Dawn Tinker (USFS). In all locations, these burn piles were located at least 50 feet away from any living or dead trees and shrubs, or were surrounded by a 10-foot-wide bare area or very short annual herbs. These debris piles will be burned later by the USFS during damp, cool, winter weather.

4.2 Monitoring

Monitoring before and during the removal of salt cedar from the Morena Reservoir project area was conducted by the project biologist, Ed Woch, who was also present during the initial revegetation effort in February 2007. Monitoring during these phases focused on supervision of personnel to ensure that species removal, herbicide application, and planting procedures were implemented appropriately. Photodocumentation of the treatment areas occurred throughout the process.

RECON biologists Robert MacAller and Lindsay Stallcup visited the Morena Reservoir area on February 21, 2008, to assess the effectiveness of invasive species removal efforts. Photographs of the treatment areas were also taken at this time.

4.3 Results

Exotic plant removal was completed on an approximate total of 55 acres at the Morena Reservoir project area. No work occurred at the Barrett Reservoir site. Retreatment of returning salt cedar individuals occurred from June 26 to July 2, 2007.

The herbicide treatment of salt cedar in the Morena Reservoir area was highly effective (Photographs 3-6). The vast majority (estimated greater than 90 percent) of individuals that were cut and painted with herbicide demonstrated no evidence of regrowth 16 months following treatment. The remaining individuals (approximately 10 percent) had small resprouts and would benefit from re-treatment with herbicide.

Pre-project water quality monitoring and bioassessment were scheduled to occur immediately before project startup and directly after this phase of project work was



PHOTOGRAPH 3
Project Area in September 2005, Prior to Salt Cedar Removal and Revegetation, Looking Upstream from Buckman Springs Road Bridge



PHOTOGRAPH 4
Project Area in March 2008, Following Salt Cedar Removal and Revegetation, Looking Upstream from Buckman Springs Road Bridge



PHOTOGRAPH 5
Project Area in September 2005, Prior to Salt Cedar Removal and
Revegetation, Looking South from Staging Area on
Buckman Springs Road



PHOTOGRAPH 6
Project Area in March 2008, Following Salt Cedar Removal and
Revegetation, Looking South from Staging Area on
Buckman Springs Road

completed. None of this monitoring occurred because Cottonwood Creek was been completely dry with no surface flows between June 2006 and November 2007.

4.4 Discussion

The CCC crews effectively removed and treated salt cedar within 55 acres in the Morena Reservoir area. No work was completed in the Barrett Reservoir project area. Treatment of resprouting salt cedar occurred from June 26 to July 2, 2007.

After reviewing the work completed and the challenges encountered, the original goal for invasive species removal (95 acres in the Morena Reservoir area and 64 acres near Barrett Reservoir) may have been overly optimistic. A variety of challenges slowed the anticipated pace of work throughout the project. In particular, lower-than-expected productivity by CCC crews and insufficient presence of an herbicide applicator on-site slowed progress. In addition, difficult terrain, difficulty of access, and vandalism of silt fencing presented additional challenges in the invasive species removal process.

5.0 Revegetation

Plant propagules, including approximately 4,300 large (24- to 48-inch-long) naturally established seedlings, were collected within the project area during November and December 2006. These seedlings were held at RECON Native Plants, Inc. (RNP) for outplanting in February 2007. RNP also prepared approximately 7,000 four-inch cottonwood (*Populus fremontii*), willow (*Salix* spp.), and mule fat (*Baccharis salicifolia*) cuttings by rooting them in cone-shaped containers. Additional unrooted cuttings of the same species were collected on-site by the supervising biologist and planted by hand crews at the time of the February 2007 planting.

Planting was carried out by hand crews from RECON, and occurred in two phases. The first planting effort took place in February 2007 and was overseen by project manager Ed Woch. Approximately 4,850 plants were installed at this time. Following a monitoring visit in February 2008, RECON recommended that the County install additional plant material to fill in areas where salt cedar was removed, focusing on the area northeast of Buckman Springs Road. The second planting effort in March 2008, which included the installation of an additional 4,233 plants, was overseen by Lindsay Stallcup of RECON.

5.1 Planting Effort in February 2007

The initial planting effort commenced on February 5, 2007 and was completed on February 16, 2007. Approximately 18 acres of floodplain at the Morena Reservoir site were revegetated during this phase of work (Figure 4).

Soil surveys conducted at the end of January 2007 revealed moderate soil moisture at a depth of approximately 15 inches, despite low rainfall. This moisture regime limited plantings to those plants with sufficient root mass to exploit the soil moisture at this depth. Initial revegetation activities were initiated in February 2007 to take advantage of cooler temperatures and in anticipation of additional rainfall.

RECON field crews, under the supervision of biologist Ed Woch from Tierra Environmental Services, installed approximately 4,850 plants throughout the 18-acre restoration area. The plants comprised a mix of species and included approximately 4,000 seedlings and 850 unrooted stem-cuttings (Table 3). The seedlings included cottonwood, mule fat, and mixed willow species, at a ratio of approximately two cottonwoods per one willow or mule fat. The unrooted cuttings were collected on-site by the supervising biologist and included a mix of willows, mule fat, and cottonwoods.

TABLE 3
LIST OF SPECIES PLANTED AT COTTONWOOD CREEK IN FEBRUARY 2007

Scientific Name	Common Name	Description	Approximate Quantity
<i>Populus fremontii</i>	Cottonwood	Seedling	2,100
<i>Salix</i> spp.	Mixed willow species	Seedling	1,000
<i>Baccharis salicifolia</i>	Mule fat	Seedling	900
Mixed species		Unrooted stem cutting	850
TOTAL			4,850

5.2 Planting Effort in March 2008

A second planting effort concentrated in the area upstream of the Buckman Springs Bridge (Figure 5). This area, comprising approximately four acres, was determined to have a higher probability of plant survivorship because it was accessible by a water truck parked along Buckman Springs Road for supplemental watering. In addition, the upstream location is beneficial, as it will likely result in the distribution of native seeds to other, downstream parts of the project area.

Planting commenced on March 10, 2008, and was completed on March 12, 2008. RECON field crews installed 4,233 container plants (Table 4; Photographs 7-9).



FIGURE 4
Revegetated Areas at Morena Reservoir Project Area



- Supplemental Planting Area
- Staging Area

FIGURE 5
Supplemental Planting Areas (March 2008)



PHOTOGRAPH 7
RECON Crews Installed 4,233 Additional Container Plants in March 2008
in a 4-acre Area Upstream from Buckman Springs Road



PHOTOGRAPH 8
RECON Crews Installed 4,233 Additional Container Plants in March 2008
in a 4-acre Area Upstream from Buckman Springs Road



PHOTOGRAPH 9
Area South of Cottonwood Creek Following Planting in March 2008



PHOTOGRAPH 10
Areas Planted in March 2008 Were Hand-watered Using Hose
Connected to a Water Truck

Supplemental watering by water truck occurred on four occasions following planting in order to aid plant establishment (Photograph 10).

TABLE 4
LIST OF SPECIES PLANTED AT COTTONWOOD CREEK IN MARCH 2008

Scientific Name	Common Name	Quantity
<i>Salix laevigata</i>	Red willow	1,096
<i>Salix lasiolepis</i>	Arroyo willow	690
<i>Salix gooddingii</i>	Black willow	800
<i>Salix</i> spp.	Mixed willow species	100
<i>Baccharis salicifolia</i>	Mule fat	1,192
<i>Populus fremontii</i>	Cottonwood	355
TOTAL		4,233

5.3 Monitoring Results

RECON biologists Robert MacAller and Lindsay Stallcup visited the Morena Reservoir area on February 21, 2008, to assess the effectiveness of revegetation efforts. The purpose of this monitoring visit was to determine survivorship of plants installed in the revegetation areas. Photographs of the treatment areas were also taken at this time.

During the February 2008 monitoring visit, very little survivorship of the cuttings and plants that were installed in February 2007 was observed. In the areas immediately adjacent to Buckman Springs Road, there was less than 1 percent survivorship. Approximately 0.5 to 1.0 mile downstream from Buckman Springs Road, survivorship appeared to be slightly higher, with approximately 5 percent of individuals surviving, including several cottonwoods. Plants that survived, however, have demonstrated little or no growth. The low rates of survivorship and growth observed are most likely due to lack of rainfall in the months following plant installation.

There is currently no evidence of natural recruitment by native plants in areas where target species removal occurred. The appearance of the restored areas at the time of monitoring was similar to their appearance following target species removal, and prior to revegetation.

6.0 Conclusions and Recommendations

Exotic species removal occurred within 55 acres in the Morena Reservoir area. The herbicide treatment was highly effective, with over 90 percent of the cut stumps showing

no signs of regrowth. Within the area from which salt cedar was removed, little or no recruitment by native species has been observed.

In February 2007, 18 acres within the exotic species removal area were planted with approximately 4,850 native riparian plants as part of the revegetation effort. Unfortunately, the container plants installed in February 2007 demonstrated very low survivorship due to lack of expected rainfall in the months following planting. Supplemental planting was recommended by RECON restoration biologists during a monitoring visit in February 2008. In March 2008, RECON crews installed 4,233 additional container plants within four acres upstream of Buckman Springs Road. The additional plants were hand watered using hoses connected to a water truck on four occasions following planting to aid in plant establishment.

7.0 References Cited

Tierra Environmental Services (Tierra)

- 2005 Exotic Plant Species Removal and Native Plant Species Revegetation Plan for Cottonwood Creek, Prepared in Support of the Tijuana River Watershed Invasive Species Removal Project.