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September 30, 2014

Mr. Glen Laube  
City of Chula Vista  
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Reference: Year 3 Final Annual Report for the Central City Preserve Otay Tarplant and San Diego Thornmint Restoration and Enhancement Program (SANDAG Grant Number 5001590; RECON Number 5662)

## **Introduction**

This third and final annual report provides background information and summarizes the tasks performed during the third year (September 2013 to August 2014) of the Otay tarplant (*Deinandra conjugens*) and San Diego thornmint (*Acanthomintha ilicifolia*) restoration and enhancement program in the Chula Vista Central City Preserve. Three quarterly reports have previously been prepared by RECON. The information from these reports is summarized below for tasks completed between September 1, 2013 and August 31, 2014. This final annual report also summarizes the results of the relevé vegetation surveys that were conducted in spring 2014 at the treatment sites, as well as the population estimates for Otay tarplant and San Diego thornmint.

The Central City Preserve is in the central portion of the city of Chula Vista, east of Interstate 805, south of State Route 54 and Bonita Road, and north of Otay Lakes Road (Figure 1; see Attachment 1 for all figures and photographs). The Central City Preserve covers approximately 1,350 acres and is subdivided further into four Preserve Management Areas (PMAs) for data management purposes and the development of the Area Specific Management Directives that were prepared in 2004 (Figure 2). Each PMA consists of a number of open space areas, referred to as subunits, which are surrounded by residential development. Each of these subunits was assigned a number to organize and distinguish each distinct survey area (Figure 3). Restoration and enhancement work was performed in PMA 1 subunits 1-1a, 1-1c, and 1-2b. The treatment areas in these three subunits are shown in Figure 3.

## **Otay Tarplant Status and Conservation**

Otay tarplant is federally listed threatened, state listed endangered, and considered a narrow endemic species under the City of Chula Vista Multiple Species Conservation Program (MSCP) Subarea Plan (City of Chula Vista 2003; Photograph 1). It also has a California Native Plant Society (CNPS) Rare plant ranking of 1B.1 (Rare, threatened, or endangered in California and elsewhere; seriously endangered in California) (CNPS 2012). Populations of Otay tarplant are substantially declining throughout San Diego County. Extant populations are threatened by pressures from urban development, habitat disturbance, and invasion of non-native species.

### **San Diego Thornmint Status and Conservation**

San Diego thornmint is federally listed threatened, state listed endangered, and considered a narrow endemic species under the City of Chula Vista MSCP Subarea Plan (City of Chula Vista 2003; Photograph 2). It also has a CNPS Rare plant ranking of 1B.1 (Rare, threatened, or endangered in California and elsewhere; seriously endangered in California) (CNPS 2012). Populations of San Diego thornmint are substantially declining throughout San Diego County. Extant populations are threatened by pressures from urban development, habitat disturbance, and invasion of non-native species, with as many as one-third of historical occurrences believed to be extirpated (CNPS 2012). San Diego thornmint is restricted to clay lens microhabitats, which limits the establishment of new populations due to the lack of such habitat remaining in San Diego (Reiser 2001).

### **Project Goals and Habitat Restoration Methods**

- Restore native grassland and clay lens habit habitat for Otay tarplant, San Diego thornmint, and other MSCP-covered species, including variegated dudleya (*Dudleya variegata*; Photograph 3) and small-flowered morning glory (*Convolvulus simulans*; Photograph 4) in areas currently dominated by weeds.
- Increase the size of Otay tarplant and San Diego thornmint populations.
- Reduce competition with non-native weeds that are invading the native grassland habitat and degrading the rare plant habitat by controlling annual non-native grasses and perennial weed species such as fennel (*Foeniculum vulgare*) and artichoke thistle (*Cynara cardunculus*).
- Increase native grassland habitat by planting purple needlegrass (*Stipa* [= *Nassella*] *pulchra*) in areas currently dominated by non-native grasses and other weeds.

### **2013–14 Rainfall Summary and Ecological Effects**

Between July 1, 2013 and June 30, 2014 (the official rainy season), rainfall in Chula Vista (4.26 inches) was well below normal (which is approximately 10 inches) (Table 1). Rains began in October, when just over one inch of rain fell at the Chula Vista reporting station. Rains in November were below normal, with dry conditions continuing in December, January, and most of February. One heavy rain event did occur between February 27 and March 2, 2014, when 1.49 inches of rain fell. Drier than normal conditions returned after early March and persisted for the rest of the season.

Early rains in October triggered the germination of non-native weeds such as annual grasses, black mustard (*Brassica nigra*) and tocalote (*Centaurea mellitensis*). A more detailed description of weed control efforts is given in the maintenance section below. Weed control efforts, changes observed in the native plant growth, and monitoring results were documented through photographs taken at the restoration and enhancement sites.

**TABLE 1**  
**SUMMARY OF RAINFALL DATA BY MONTH AT CHULA VISTA**  
**JULY 1, 2013 – JUNE 30, 2014**

| Month               | Monthly Rainfall<br>(inches) |
|---------------------|------------------------------|
| July                | 0.01                         |
| August              | 0.00                         |
| September           | 0.00                         |
| October             | 1.07                         |
| November            | 0.14                         |
| December            | 0.52                         |
| January             | 0.07                         |
| February            | 0.90                         |
| March               | 1.22                         |
| April               | 0.33                         |
| May                 | 0.00                         |
| June                | 0.00                         |
| Total Precipitation | 4.26 inches                  |

### **Year 3 Tasks Performed from September 2013 through August 2014**

#### ***Seed Collection/Redistribution***

In order to start new populations of San Diego thornmint, a portion of the seed collected in 2011–12 was dispersed by RECON biologists in early December 2012 at seven new locations in PMA subunits 1-2b, 1-1a, and 1-1c. The thornmint seeding areas were small experimental sites. In the fall of 2013 prior to significant rains, San Diego thornmint seed was collected from the 2012 seeding sites and dispersed into immediately adjacent areas that had been intensively weeded during the 2013 growing season. Additional thornmint seed that had been collected from the natural population in previous years was also dispersed around the seeding sites first established in 2012. This additional seed dispersal was intended to increase the size of these newly established populations.

After rainfall events, seeding areas were monitored to determine if germination had occurred, observe the health of the plants, and determine when weeding of the seeded plots needed to be performed. The newly germinated thornmint and tarplant seedlings were visible in January 2014 after the rains that occurred in October 2013 (Photographs 5–6). A more detailed discussion of the seasonal growth and flowering of San Diego thornmint is included in the Discussion section below. In August 2013 additional Otay tarplant seed was collected and immediately dispersed into open areas. Other previously collected native plant seed including Otay tarplant, western blue-eyed-grass (*Sisyrinchium bellum*), osmadenia (*Osmadenia tenella*), purple needlegrass, foothill needlegrass (*Stipa lepida*), variegated dudleya, and shooting star (*Dodecatheon clevelandii*) were redistributed in October within PMA subunits 1-1a, 1-1c and 1-2b.

#### ***Preserve Sign Installation***

RECON biologists periodically checked the condition of the preserve signs and fencing installed in 2012. The protective fencing and preserve signs installed in 2012 have remained intact.

#### ***Maintenance***

##### ***Weed Control***

Two general methods of weed treatment have been used in the restoration and enhancement areas. In areas occupied by natural populations of San Diego thornmint, only dethatching by weed whips and thatch removal was conducted in 2011. Areas with Otay tarplant only (with no thornmint) were dethatched also in fall of 2011, and follow-up spraying of weeds was done in 2012, as well as in winter/spring 2013 and 2014. In some areas with high concentrations of native bulbs, weed whips were used to cut non-natives around the bulbs to avoid spraying those areas.

During the fall of 2013 through spring of 2014 RECON biologists checked the status of weeds within treatment areas to determine the schedule for the restoration crew to conduct herbicide treatment. Early rains in October caused the germination of non-native herbs and grasses, but the cool dry weather through early December limited their growth. Warm and dry conditions developed in late December and into January, which continued the limited weed growth during this time period. Heavier rain occurred in late February and early March, which caused additional weeds to germinate and this triggered the yearly control efforts. In February 2014, prior to spraying, RECON biologists flagged sensitive resources, such as Otay tarplant and San Diego thornmint seedlings, variegated dudleya, and areas with large populations of native bulbs, annuals, and grasses for avoidance (Photograph 7).

Annual weeds were sprayed by RECON crews beginning in February and continuing in March and April 2014 to prevent them from flowering and setting seeds (Photographs 8–9). Glyphosate was used to control most weed species, while fennel was sprayed with a mixture of glyphosate and Garlon. RECON biologists monitored the crew during herbicide application. Both herbicides are approved for use in natural areas by the U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Wildlife (CDFW) and were applied by licensed applicators under the direction of RECON Field Director Ruth Vallejo. Herbicide was used when there was little to no wind present to avoid overspray that may harm native plants. Non-native species that were controlled included black mustard, tocalote, fennel, artichoke thistle, and annual grasses such as wild oats (*Avena* spp.) (Photograph 10).

## **Monitoring Methods**

### ***2014 Sensitive Plant Population Estimates***

Following the third year of follow-up weed control, San Diego thornmint population counts were conducted in April 2014, and Otay tarplant population estimates were completed in late May 2014. Population counts were conducted after it was determined that the maximum number of individuals had emerged for the season and when the majority of the plants were still in flower (Photographs 11–12). In small patches (population in the hundreds), Otay tarplant and San Diego thornmint were counted individually. In large patches (population in the thousands), individuals were counted in sample sub-plots, and then population numbers were estimated based on the size of the patch and the average density within the sub-plots. Population counts were conducted by RECON biologists Anna Bennett and JR Sundberg using these methods. Variegated dudleya population estimates were done by direct count. The variegated dudleya were counted in March 2014 when the greatest number of vegetative plants were visible (Photograph 13). The dudleya flowered in May 2014 (Photograph 14).

### ***Relevé Vegetation Sampling Methods***

Vegetation patch sampling was done using the relevé method. All plant species occurring in each patch were recorded, and the cover of species was estimated. A total of 22 vegetation treatment areas were sampled by RECON biologist Anna Bennett in May 2014. Study plots were located in two types of treatment areas: (1) 19 study plots were dethatched and treated with herbicide and (2) three study plots were dethatched only (in areas supporting natural populations of San Diego thornmint). The results of the vegetation sampling efforts are presented in the Results section below.



## Results

### **2014 Otay Tarplant and San Diego Thornmint Population Estimates**

The results of the 2014 population counts by PMA subunit are shown in detail in Table 2. In the three PMA subunits there were 1,757 Otay tarplant, 215 San Diego thornmint and 2,197 variegated dudleya (Figures 4a–4c).

**TABLE 2  
NUMBER OF OTAY TARPLANT, SAN DIEGO THORNMINT, AND VARIEGATED DUDLEYA  
INDIVIDUALS BY PRESERVE MANAGEMENT AREA SUBUNIT 2014**

| Species             | PMA 1-1a | PMA 1-1c | PMA 1-2b | Total |
|---------------------|----------|----------|----------|-------|
| 2014                |          |          |          |       |
| Otay tarplant       | 782      | 209      | 766      | 1,757 |
| San Diego thornmint | 15*      | 32*      | 168**    | 215   |
| Variegated dudleya  | 0        | 5        | 2,192    | 2,197 |

\*Introduced population

\*\*9 of the 168 were in newly seeded areas.

### **Year 3 Vegetation Relevé Sampling Results**

A total of 24 native and 17 non-native species were recorded in PMA 1-1a; 25 native and 20 non-native species were recorded in PMA 1-1c; and 35 native and 25 non-native species were recorded in PMA 1-2b. Attachment 2 lists the species observed within the restoration and enhancement areas during the relevé sampling. The results of the 2014 relevé surveys are discussed in further detail below. Table 3 lists the results from the 19 treatment areas that were dethatched and spot sprayed with herbicide. Table 4 lists the results from the three treatment areas that were only dethatched. Some representative native plant associates of Otay tarplant and San Diego thornmint observed during the growing season are shown in Photographs 15–17.

**TABLE 3  
TREATMENT—DETHATCH AND SPRAY**

| Vegetation Type                          | Absolute | Relative<br>(Vegetation only) |
|--|----------|-------------------------------|
| Average total cover (shrub & herbaceous) | 21%      | 100%                          |
| Average native cover                     | 10%      | 47%                           |
| Average non-native cover                 | 11%      | 54%                           |
| Average native grass cover               | 4%       | 21%                           |
| Average bulb cover                       | 1%       | 5%                            |
| Average shrub cover                      | 3%       | 15%                           |
| Average bare ground                      | 79%      | -                             |

**TABLE 4  
TREATMENT—DETHATCH ONLY**

| Vegetation Type                          | Absolute | Relative<br>(Vegetation only) |
|--|----------|-------------------------------|
| Average total cover (shrub & herbaceous) | 17%      | 100%                          |
| Average native cover                     | 8%       | 49%                           |
| Average non-native cover                 | 9%       | 51%                           |
| Average native grass cover               | 2%       | 14%                           |
| Average bulb cover                       | 0%       | 2%                            |
| Average shrub cover                      | 3%       | 16%                           |
| Average bare ground                      | 83%      | -                             |

## **Discussion**

### ***Weed Control Results***

At the start of the project in October 2011, a total of approximately 17.07 acres of dried weedy areas were dethatched using weed whips. All treatments areas were dethatched during the site preparation phase. Two different treatments were used for weed control efforts: (1) dethatching and treatment with herbicide and (2) dethatching and no herbicide use (bulb concentration and thornmint areas). By the end of April 2014, a total of approximately 14.39 acres had been treated with herbicide.

In the dethatch/spray treatment areas, the absolute cover of non-natives was down from 18 percent in 2013 to 11 percent in 2014. This decrease in non-native cover was due to a combination of follow-up weed control and the very dry conditions that prevailed during the 2013–14 rainy season. In the dethatch only areas non-native cover was 9 percent in 2014 compared to 28 percent in 2013. This decrease in non-native cover was due to the low rainfall. In fact many of the non-native grasses died prior to flowering in some of the Rice Canyon thornmint areas (dethatch only sites)

Bulb and shrub cover was similar for the two treatment types both in absolute and relative terms (see Tables 3 and 4). Absolute cover of native species was slightly lower (8 percent) in dethatch only areas compared to dethatch-and-spray areas (10 percent native cover). In 2014 native cover at the treatment sites, both sprayed and not sprayed, showed high variability ranging from as low as less than 1 percent cover to as high as 22 percent. This may be a reflection of past disturbance and previous levels of weed invasion that had crowded out native species. In 2014 bare ground averaged 79 percent for dethatch-and-spray sites and 83 percent for dethatch only sites.

Although a quantitative assessment of non-native cover was not performed prior to the implementation of the project due to budget limitations, anecdotal observations and pre-implementation photographs indicate that non-native cover was very high, likely in the order of 75–80 percent if not higher at some locations.

For the areas occupied by San Diego thornmint that were dethatched only, non-native cover has decreased each year of the project. In 2012 absolute non-native cover was 39 percent, in 2013 it was 28 percent, and in 2014 it was 9 percent. The relevé results indicate that continued progress has been made on weed control during the third year of the project. Although seed of native annuals including Otay tarplant were dispersed throughout the dethatch-and-spray treatment sites the very low rainfall prevented most of the seed from germinating in 2014. We anticipate that a greater portion of the seed will germinate under more favorable rainfall patterns in future years.

### ***Germination and Seasonal Growth of Sensitive Species***

Otay tarplant and San Diego thornmint seedlings germinated during the rainfall events in October 2013 and were observed in the field by early to mid-January 2014. Other sensitive species also responded to the rains of October 2013 including small-flowered morning glory (Photograph 18) and variegated dudleya (Photograph 19). Additional seeds of Otay tarplant germinated during a later rain event in late February and early March, when over 1.25 inches fell (Photograph 20). The flowering period for San Diego thornmint in 2014 started in March and ended in May (Photograph 21). Otay tarplant began flowering in April (Photograph 22) and continued into August.

### ***Population Estimates***

Table 5 compares the population counts from 2011 through 2014. The populations of Otay tarplant and variegated dudleya increased each year from 2011 through 2013. San Diego thornmint increased in 2012 from the 2011 baseline condition, but the total population count decreased from 2012 through 2014. Although there was a year-to-year decrease in the number of thornmint from 2012 through 2014, the number of thornmint in 2013 still surpassed the 2011 baseline population by several thousand plants.

**TABLE 5**  
**NUMBER OF OTAY TARPLANT, SAN DIEGO THORNMINT, AND VARIEGATED DUDLEYA**  
**INDIVIDUALS BY PRESERVE MANAGEMENT AREA SUBUNIT 2011-2014**

| Species             | PMA 1-1a | PMA 1-1c | PMA 1-2b | Total   |
|---------------------|----------|----------|----------|---------|
| <b>2011</b>         |          |          |          |         |
| Otay tarplant       | 7,107    | 92       | 33,731   | 40,930  |
| San Diego thornmint | 0        | 0        | 8,542    | 8,542   |
| Variiegated dudleya | 0        | 0        | 15       | 15      |
| <b>2012</b>         |          |          |          |         |
| Otay tarplant       | 11,930   | 297      | 125,323  | 137,550 |
| San Diego thornmint | 476*     | 140*     | 32,200   | 32,816  |
| Variiegated dudleya | 0        | 0        | 75       | 75      |
| <b>2013</b>         |          |          |          |         |
| Otay tarplant       | 19,817   | 1,961    | 132,423  | 154,201 |
| San Diego thornmint | 322*     | 350*     | 12,568   | 13,240  |
| Variiegated dudleya | 0        | 0        | 1,127    | 1,127   |
| <b>2014</b>         |          |          |          |         |
| Otay tarplant       | 782      | 209      | 766      | 1,757   |
| San Diego thornmint | 15*      | 32*      | 168**    | 215     |
| Variiegated dudleya | 0        | 5        | 2,192    | 2,197   |

\*Introduced population

\*\*9 of the 168 were in newly seeded areas.

The baseline population estimate conducted prior to implementation in 2011 showed a total of approximately 40,930 Otay tarplant, 8,542 San Diego thornmint, and 15 variegated dudleya individuals. San Diego thornmint and variegated dudleya were only observed in PMA subunit 1-2b (Rice Canyon). Otay tarplant was found in all three PMA subunits (1-1a, 1-1c, and 1-2b).

In 2014 a total of 1,757 Otay tarplant, 215 San Diego thornmint, and 2,197 variegated dudleya individuals were estimated to be in the treatment areas. The locations of the Otay tarplant, San Diego thornmint, and variegated dudleya populations are shown on Figures 4a through 4c. The small populations of thornmint in PMA subunits 1-1a and 1-1c were in areas seeded by the project biologists. In PMA subunit 1-2b (Rice Canyon) 9 of the 168 thornmint individuals were in newly seeded areas. In 2014 the thornmints in all three PMA subunits that were seeded, totaled 56 plants in the newly created populations. Even though conditions were very dry, the thornmint still produced seed that looked well-formed and viable (Photograph 23)

Populations of two of the monitored sensitive species, Otay tarplant and San Diego thornmint decreased in 2014 due to the extremely dry conditions this year. The first germination event occurred in October 2013 when small numbers of tarplant and thornmint began their seasonal growth. As mentioned previously, additional tarplant seedlings germinated in late February and early March from the highest rainfall event of the season. But all these late germinating seedlings died prior to flowering after conditions dried later in the month of March and persisted through the rest of the growing season.

In contrast to tarplant and thornmint, variegated dudleya showed increases each year of the project. This was due to a combination of greater visibility of the plants after the thatch was removed and recruitment of new individuals from the soil seed bank. In addition to this population increase in Rice Canyon, a small population of dudleya in PMA subunit 1-1c was rediscovered in Year 3. These dudleya were originally found in 2003 during the baseline biological inventories for the Central City Preserve.

The dispersal of native seeds including the Otay tarplant, San Diego thornmint, and variegated dudleya into the intensively weeded open areas should increase the size of the populations once adequate rain falls in future seasons.

### ***Native Grass Establishment***

Qualitative observation of the native grass growth in the third year (2014) of the project indicated that many of the planted grasses probably died due the extremely dry conditions although scattered individuals of the planted grasses still survived into the 2014 season (Photograph 24).

### ***Repeat Photographs***

A series of repeat photographs were taken during the project to depict the changes that have occurred since implementation. The photo pairs in Photographs 25–40 show the project sites prior to dethatching in fall 2011 and the same sites again during the 2014 season. Although growth of Otay tarplant and San Diego thornmint were limited by very low rainfall in 2014, the weeding program has created large areas of open ground that can support these species in the future. The seeding dispersal program implemented for this project will also increase the area occupied by tarplant and thornmint in subsequent years.

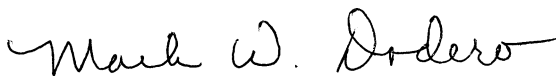
### ***Long-term Maintenance Recommendations***

Recommended long-term management activities include weed control through spraying of non-native annuals such as mustards, filaree, tocalote, and grasses, using a glyphosate-based product. Over the long term, monitoring for potential reinvasion of fennel and artichoke thistle should be conducted periodically. If levels of fennel and artichoke thistle begin to increase, we recommend that control methods (i.e., spraying) should be implemented as funding becomes available.

These management recommendations are consistent with the Area-Specific Management Directives (ASMD) for Preserve Management Area 1 that includes Rice and surrounding canyons where this grant work was performed (RECON 2004). As called for in the ASMD for PMA 1, monitoring of Otay tarplant and San Diego thornmint populations in the Chula Vista Central City Preserve can be accomplished by qualified biologists when they are working in the preserve. Incidental observations of tarplant and thornmint should be mapped and reported in the annual report list of sensitive species.

If you have any questions regarding the Otay tarplant and San Diego thornmint habitat restoration and enhancement program, do not hesitate to call me at (619) 308-9333, extension 115.

Sincerely,



Mark Dodero  
Senior Biologist

MWD:eab

Enclosures

### **References Cited**

California Native Plant Society (CNPS)

2012 Inventory of Rare, Threatened, and Endangered Plants of California (8<sup>th</sup> Edition).

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2003 Multiple Species Conservation Plan Subarea Plan. February.

RECON

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Reiser, C. H.

2001 *Rare Plants of San Diego County*. Aquifer Press, Imperial Beach, CA.

### **Contributors to this Report**

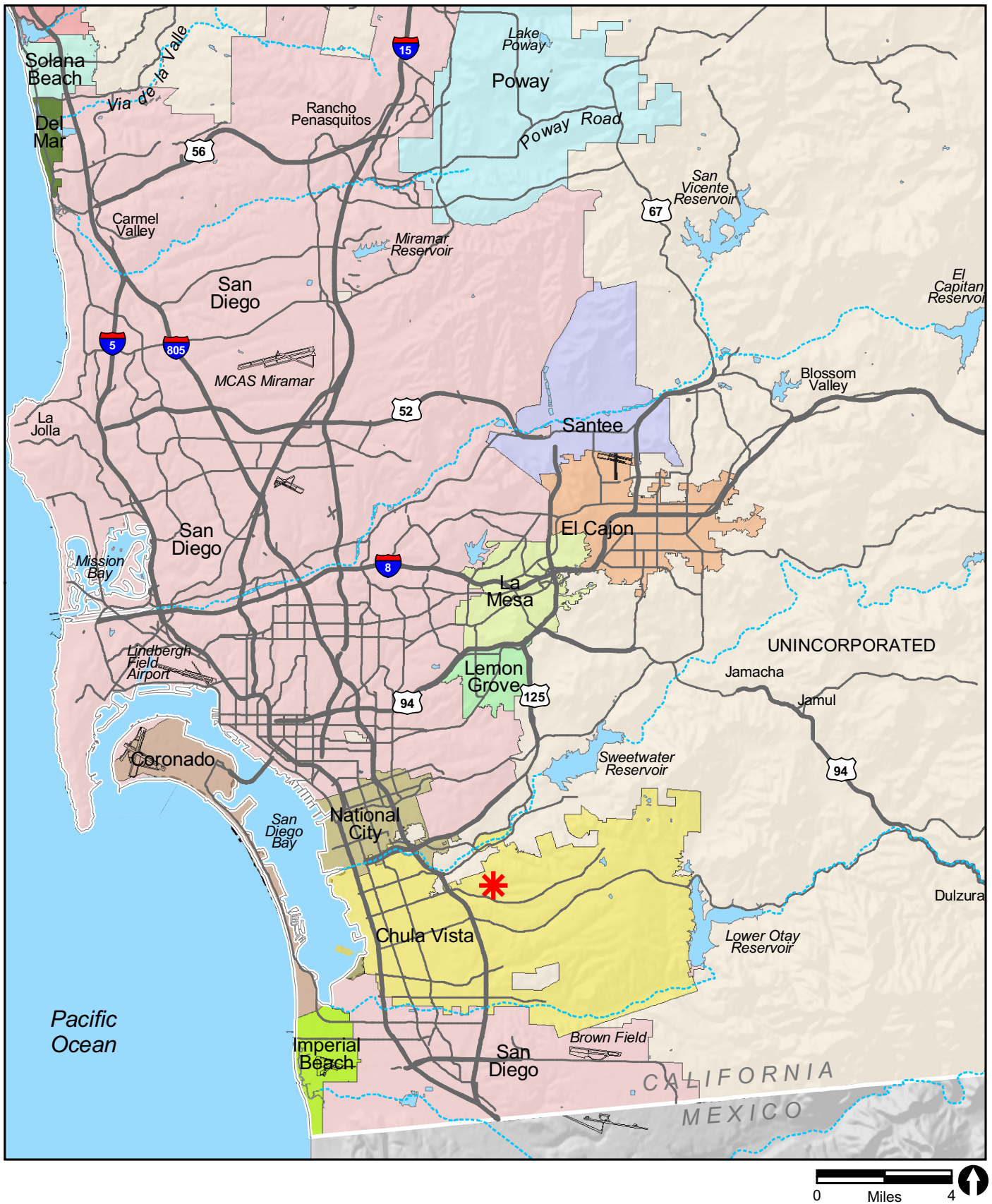
RECON biologists that conducted field surveys, analyzed data, and provided photographs included Anna Bennett, Cailin O'Meara, JR Sundberg, and Mark Doderio. Graphics and Production staff included Sean Bohac and Chris Nixon.

## **ATTACHMENTS**

**ATTACHMENT 1**  
**Figures and Photographs**

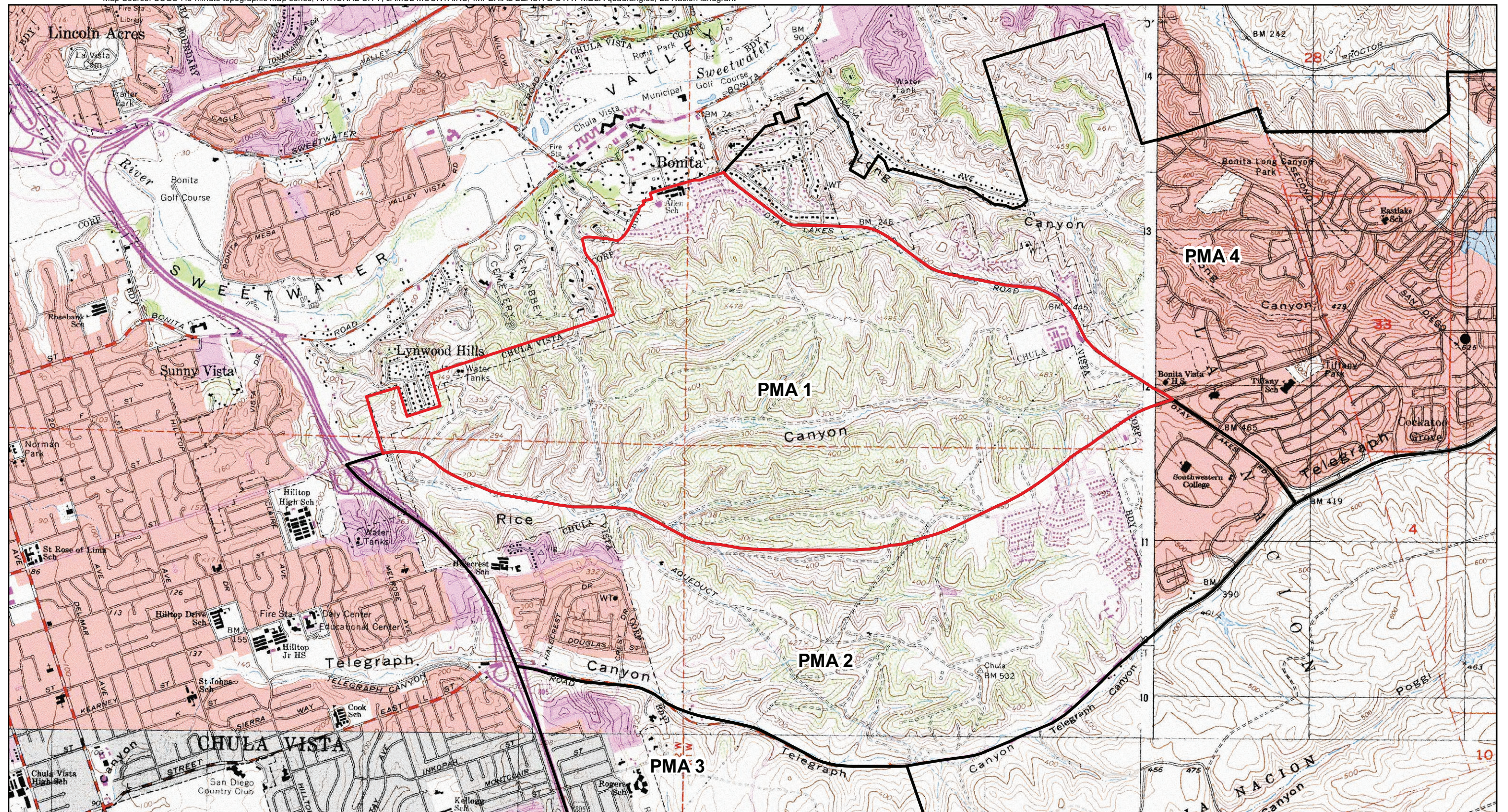
## Figures





 Project Location





# Preserve Management Areas

- PMA 1
- Other PMAs

FIGURE 2

Project Location on USGS Map



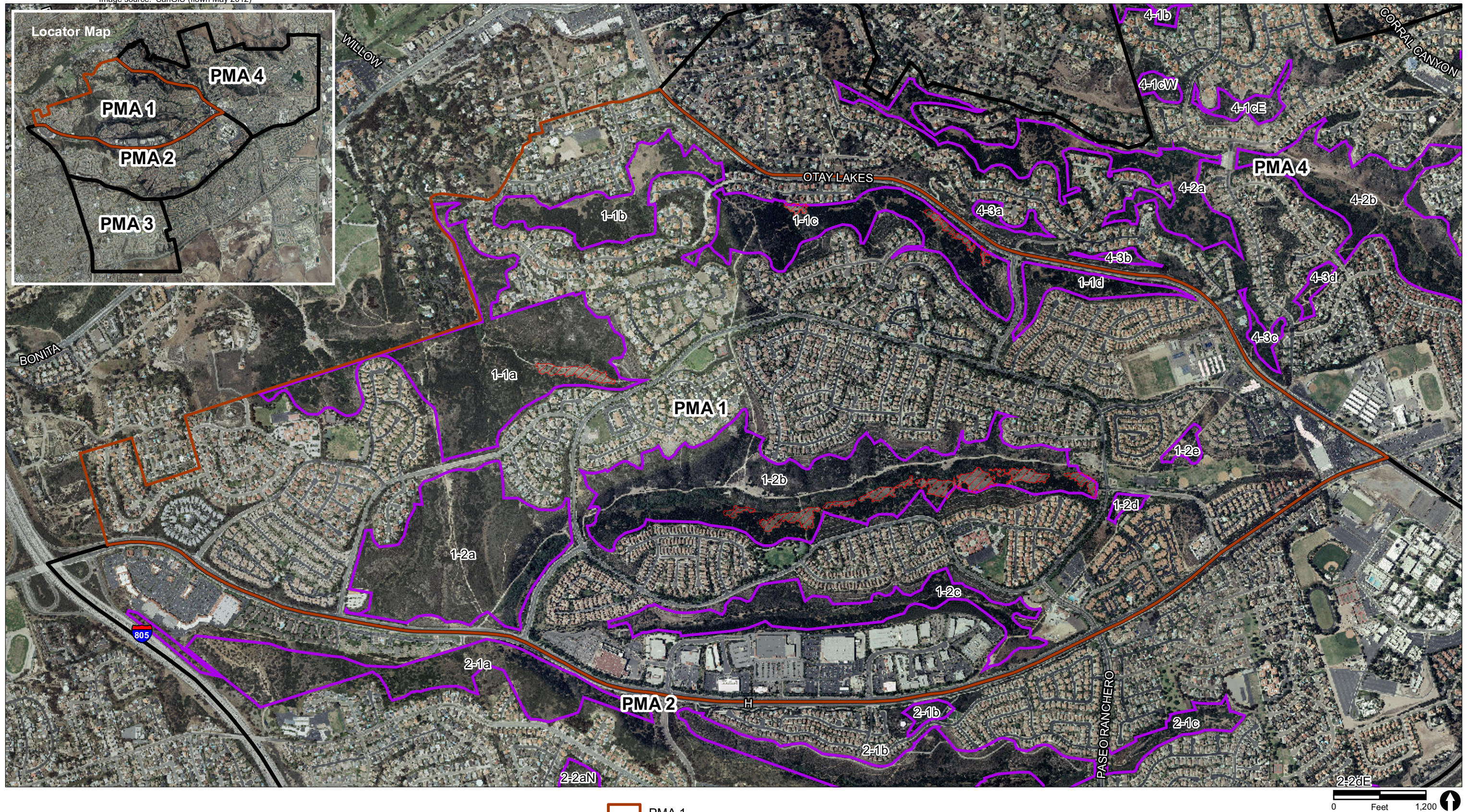
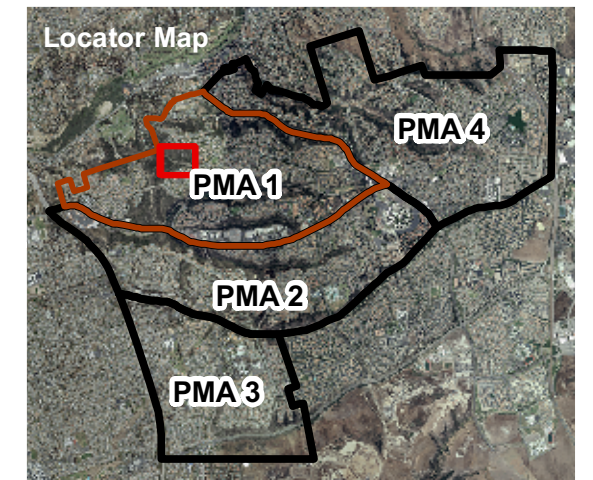
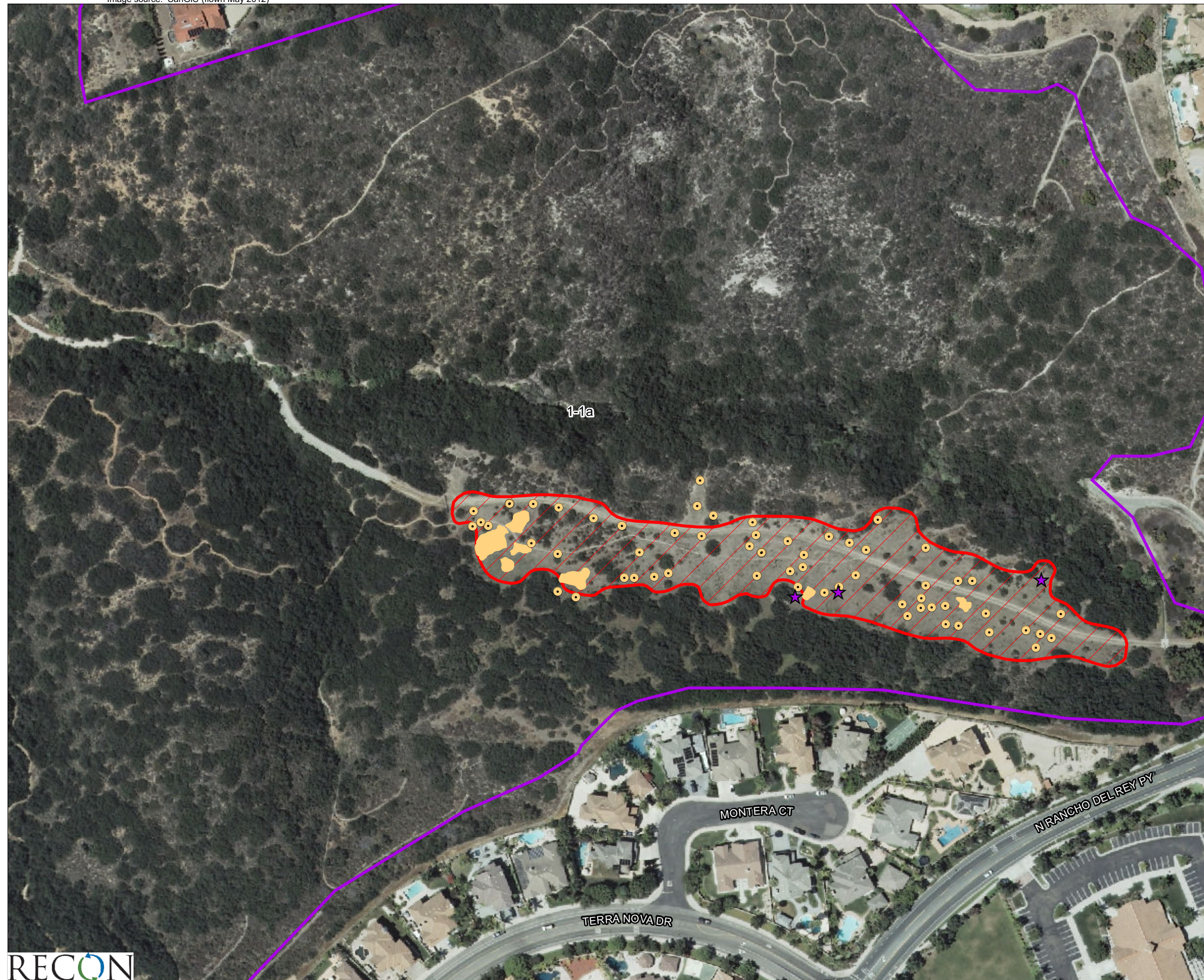






FIGURE 3

Preserve Management Subunits Selected  
for Restoration and Enhancement





-  PMA Subunit
-  Dethatching Area
-  *Acanthomintha ilicifolia* Seeding Area
-  *Deinandra conjugens*

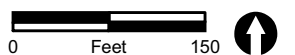


FIGURE 4a

PMA 1-1a 2014 Sensitive Plant Species





FIGURE 4b

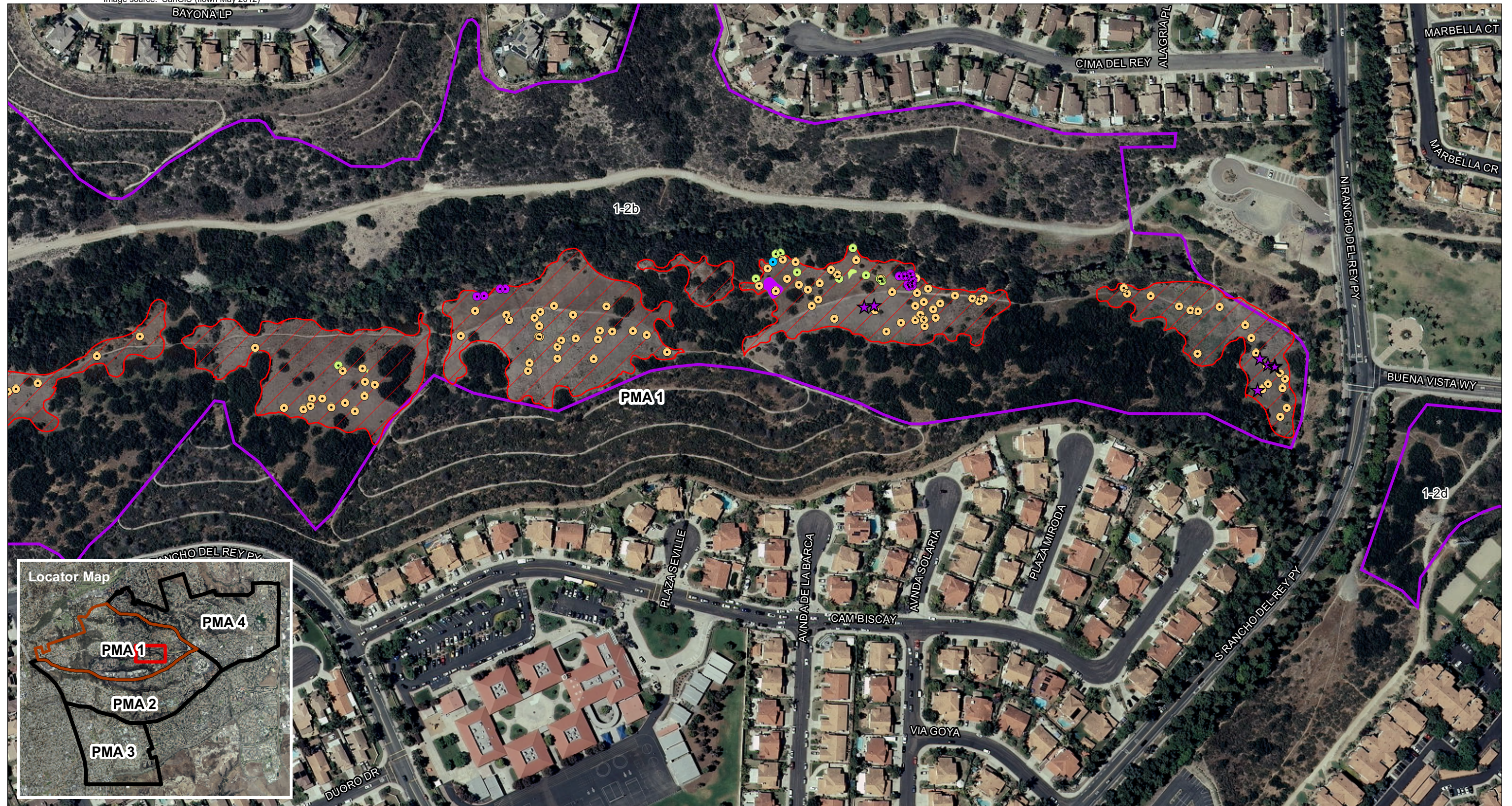




- |  |  |
|--|--|
|  PMA Subunit      |  <i>Deinandra conjugens</i> |
|  Dethatching Area |  <i>Dudleya variegata</i>   |

FIGURE 4c.1





- |                  |  |                            |
|------------------|--|----------------------------|
| PMA Subunit      | <i>Acanthomintha ilicifolia</i>              | <i>Deinandra conjugens</i> |
| Dethatching Area | <i>Acanthomintha ilicifolia</i> Seeding Area | <i>Dudleya variegata</i>   |
|                  | <i>Harpogenella palmeri</i>                  |                            |

FIGURE 4c.2



## Photographs





PHOTOGRAPH 1  
Otay Tarplant



PHOTOGRAPH 2  
San Diego Thornmint





PHOTOGRAPH 3  
Variegated Dudleya



PHOTOGRAPH 4  
Small-flowered Morning-glory



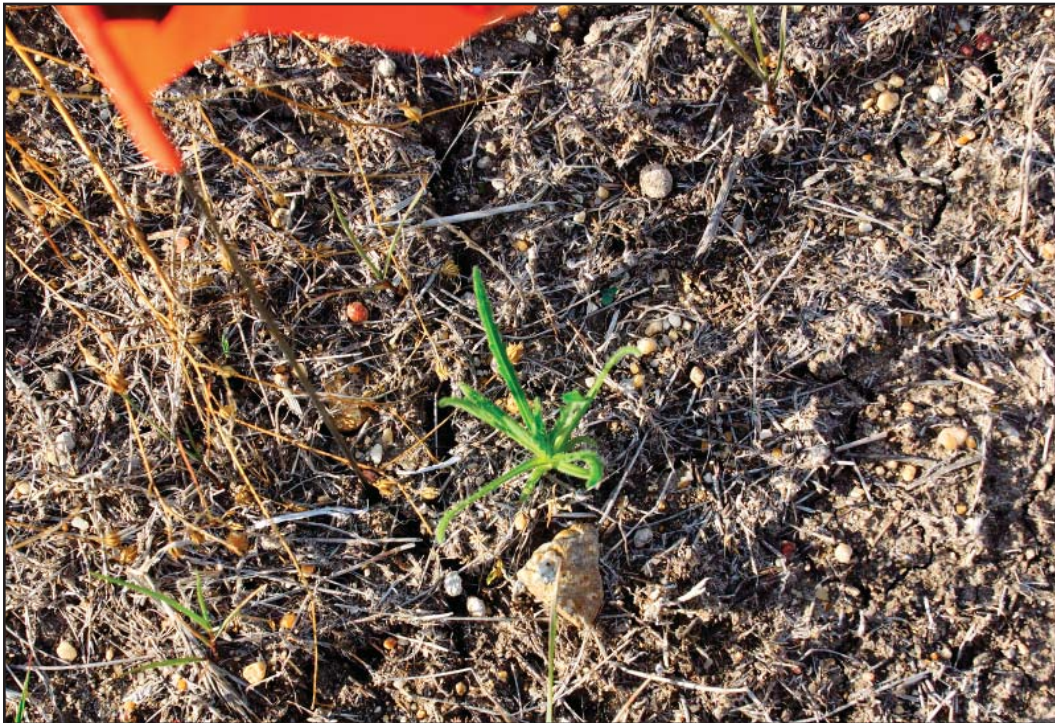


PHOTOGRAPH 5  
San Diego Thornmint Seedlings Observed in January 2014

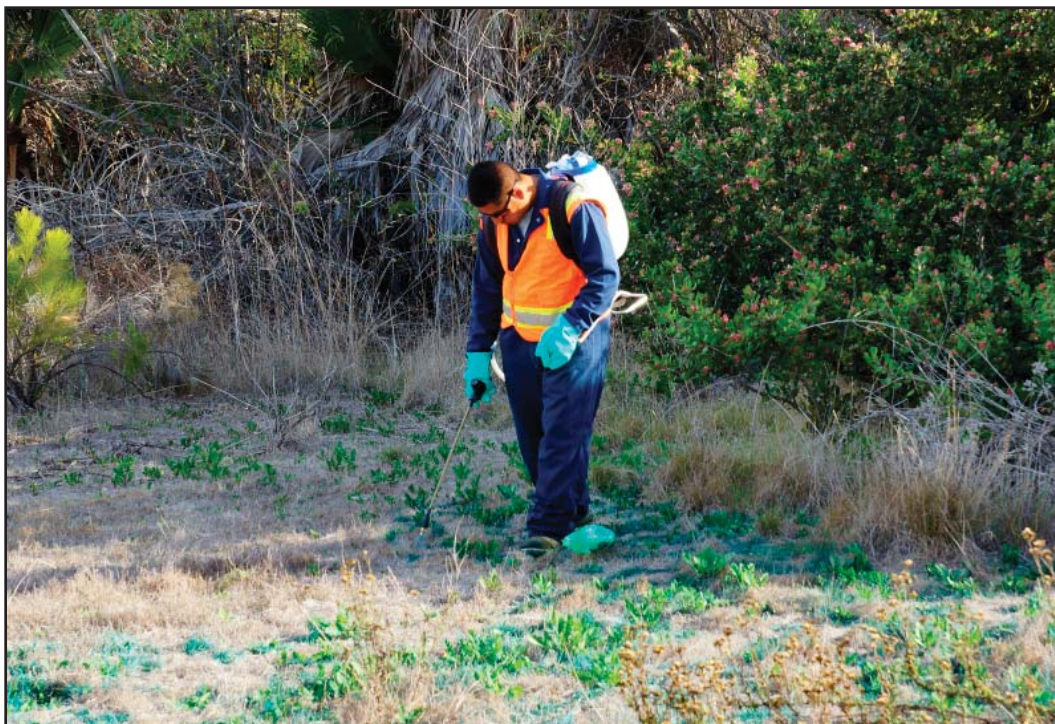


PHOTOGRAPH 6  
Otay Tarplant Seedlings Observed in January 2014





PHOTOGRAPH 7  
Otay Tarplant Seedlings Flagged by  
Biologists for Avoidance Prior to Spraying



PHOTOGRAPH 8  
RECON Crews Spraying Non-natives





PHOTOGRAPH 9  
RECON Crews Spraying Non-natives



PHOTOGRAPH 10  
Mustards and Tocalote Immediately After Spraying





PHOTOGRAPH 11  
Flowering Thornmint and Otay Tarplant



PHOTOGRAPH 12  
Flowering Otay Tarplant





PHOTOGRAPH 13  
Vegetative Variegated Dudleya



PHOTOGRAPH 14  
Flower Buds of Variegated  
Dudleya Just Prior to Opening





PHOTOGRAPH 15  
Flowering Arroyo Lupine



PHOTOGRAPH 16  
Splendid Mariposa Lily



PHOTOGRAPH 17  
Flowering Death Camas





PHOTOGRAPH 18  
Small-flowered Morning-glory



PHOTOGRAPH 19  
Variegated Dudleya Responded to Early Rainfall





PHOTOGRAPH 20  
Otay Tarplant Seedling Germinated from a Late Winter Rain Storm



PHOTOGRAPH 21  
Seeded San Diego Thornmint Began Flowering in March





PHOTOGRAPH 22  
Flowering Otay Tarplant

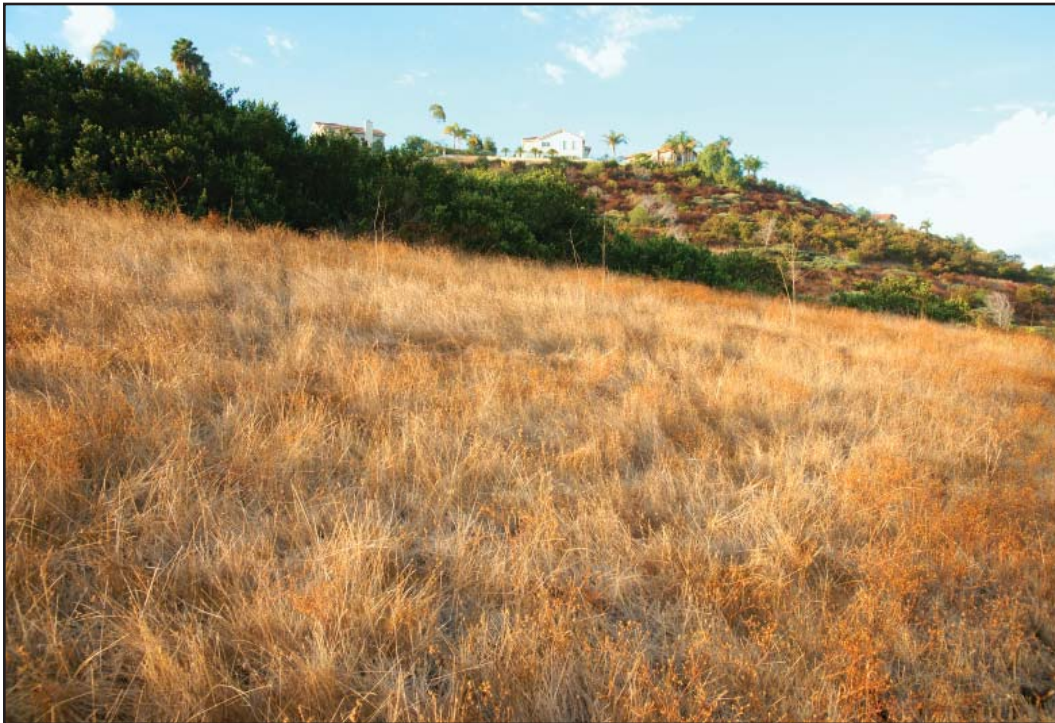


PHOTOGRAPH 23  
Thornmint Seed Produced from Seeded Plants



PHOTOGRAPH 24  
Some of the Planted Purple Needle Grass Survived into 2014 Season





PHOTOGRAPH 25  
Location in Rice Canyon (PMA Subunit 1-2b)  
Prior to Implementation in October 2011



PHOTOGRAPH 26  
Same Location in Rice Canyon (PMA Subunit 1-2b) in June 2014



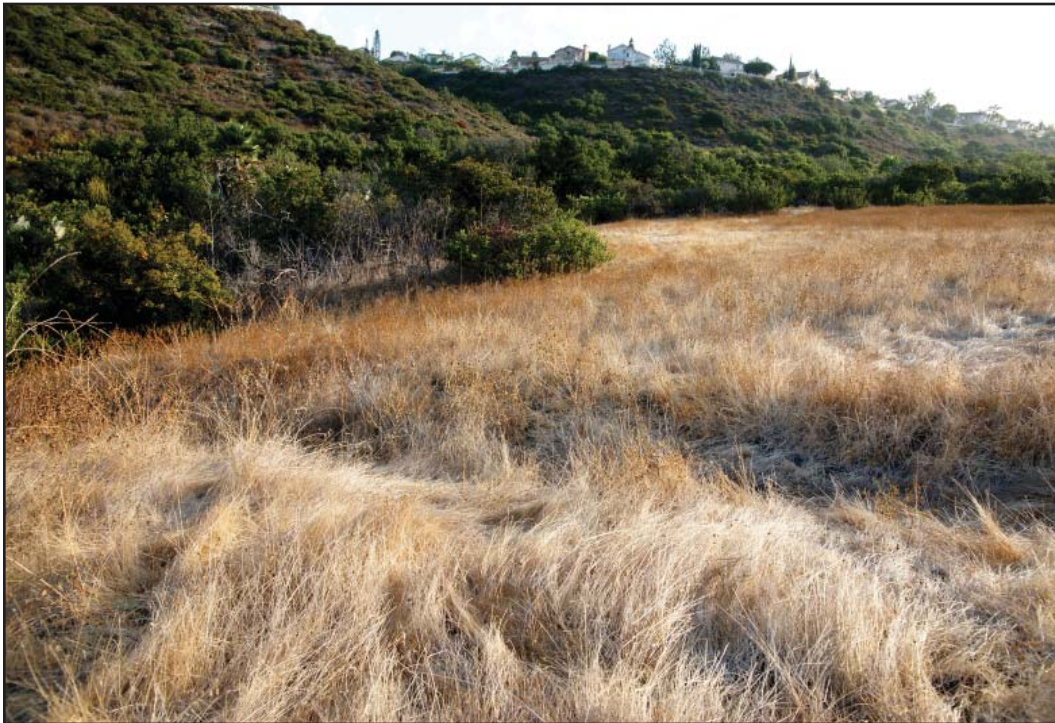


**PHOTOGRAPH 27**  
Location in Rice Canyon (PMA Subunit 1-2b)  
Prior to Implementation in October 2011



**PHOTOGRAPH 28**  
Same Location in Rice Canyon (PMA Subunit 1-2b) in June 2014





PHOTOGRAPH 29  
Location in Rice Canyon (PMA Subunit 1-2b)  
Prior to Implementation in October 2011



PHOTOGRAPH 30  
Same Location in Rice Canyon (PMA Subunit 1-2b) in June 2014





PHOTOGRAPH 31

Location in PMA Subunit 1-1a Prior to Implementation in October 2011



PHOTOGRAPH 32

Same Location in PMA Subunit 1-1a in June 2014





PHOTOGRAPH 33

Location in PMA Subunit 1-1a Prior to Implementation in October 2011



PHOTOGRAPH 34

Same Location in PMA Subunit 1-1a in June 2014





PHOTOGRAPH 35

Location in PMA Subunit 1-1a Prior to Implementation in October 2011



PHOTOGRAPH 36

Same Location in PMA Subunit 1-1a in June 2014





PHOTOGRAPH 37

Location in PMA Subunit 1-1c Prior to Implementation in October 2011



PHOTOGRAPH 38

Same Location in PMA Subunit 1-1c in February 2014





PHOTOGRAPH 39

Location in PMA Subunit 1-1c Prior to Implementation in October 2011



PHOTOGRAPH 40

Same Location in PMA Subunit 1-1c in February 2014

## **ATTACHMENT 2**

**Plant Species Observed within the Otay Tarplant and  
San Diego Thornmint Restoration and Enhancement Areas**



**ATTACHMENT 2**  
**PLANT SPECIES OBSERVED WITHIN THE OTAY TARPLANT AND SAN DIEGO THORN MINT**  
**RESTORATION AND ENHANCEMENT AREAS**

| Scientific Name   | Common Name                    | Sensitivity | Preserve Management Unit | Origin |
|---|--------------------------------|-------------|--------------------------|--------|
| <b>LYCOPODS</b>   |                                |             |                          |        |
| <b>SELAGINELLACEAE SPIKE-MOSS FAMILY</b>  |                                |             |                          |        |
| <i>Selaginella cinerascens</i> A.A. Eaton   | ashy spike-moss                | CNPS 4.1    | 1-2b                     | N      |
| <b>FERNS</b>  |                                |             |                          |        |
| <b>PTERIDACEAE BRAKE FAMILY</b>   |                                |             |                          |        |
| <i>Pentagramma triangularis</i> (Kaulf.) Yatsk. Windham & E. Wollenw.                                     | goldback fern                  | -           | 1-1a                     | N      |
| <b>ANGIOSPERMS: MONOCOTS</b>  |                                |             |                          |        |
| <b>AGAVACEAE AGAVE FAMILY</b>   |                                |             |                          |        |
| <i>Chlorogalum parviflorum</i> S. Watson  | small-flower soap-plant, amole | -           | 1-1a, 1-1c, 1-2b         | N      |
| <b>IRIDACEAE IRIS FAMILY</b>  |                                |             |                          |        |
| <i>Sisyrinchium bellum</i> S. Watson  | western blue-eyed-grass        | -           | 1-1a, 1-1c, 1-2b         | N      |
| <b>MELANTHIACEAE BUNCH FLOWER OR CAMAS FAMILY</b>   |                                |             |                          |        |
| <i>Toxicoscordion</i> sp.   | camas                          | -           | 1-2b                     | N      |
| <b>POACEAE (GRAMINEAE) GRASS FAMILY</b>   |                                |             |                          |        |
| <i>Agrostis</i> sp.   | bent grass                     | -           | 1-2b                     | N      |
| <i>Avena barbata</i> Pott ex Link   | slender wild oat               | -           | 1-1a, 1-1c, 1-2b         | I      |
| <i>Avena fatua</i> L.   | wild oat                       | -           | 1-1a, 1-1c, 1-2b         | I      |
| <i>Brachypodium distachyon</i> (L.) P. Beauv.   | purple falsebrome              | -           | 1-1a, 1-1c, 1-2b         | I      |
| <i>Bromus diandrus</i> Roth   | ripgut grass                   | -           | 1-2b                     | I      |
| <i>Bromus hordeaceus</i> L.   | soft chess                     | -           | 1-1a, 1-2b               | I      |
| <i>Bromus madritensis</i> L. ssp. <i>rubens</i> (L.) Husn.  | red brome                      | -           | 1-1a, 1-1c, 1-2b         | I      |
| <i>Festuca</i> [= <i>Vulpia</i> ] <i>myuros</i> L.  | rattail sixweeks grass         | -           | 1-2b                     | I      |
| <i>Festuca perennis</i> (L.) Columbus & J.P. Sm. [= <i>Lolium multiflorum</i> and <i>Lolium perenne</i> ] | rye grass                      | -           | 1-1a, 1-1c, 1-2b         | I      |
| <i>Gastridium phleoides</i> [= <i>ventricosum</i> ] (Nees & Meyen) C. E. Hubb.                            | nit grass                      | -           | 1-1a, 1-2b               | I      |
| <i>Phalaris minor</i> Retz.   | little-seeded canary grass     | -           | 1-2b                     | I      |

**ATTACHMENT 2**  
**PLANT SPECIES OBSERVED WITHIN THE OTAY TARPLANT AND SAN DIEGO THORN MINT**  
**RESTORATION AND ENHANCEMENT AREAS**  
**(continued)**

| Scientific Name  | Common Name                    | Sensitivity                         | Preserve Management Unit | Origin |
|--|--------------------------------|-------------------------------------|--------------------------|--------|
| <i>Stipa</i> [=Nassella] <i>lepida</i> Hitchc.   | foothill needle grass          | -                                   | 1-1a, 1-1c, 1-2b         | N      |
| <i>Stipa</i> [=Nassella] <i>pulchra</i> Hitchc.  | purple needle grass            | -                                   | 1-1a, 1-1c, 1-2b         | N      |
| <b>THEMIDACEAE                      BRODIAEA FAMILY</b>  |                                |                                     |                          |        |
| <i>Bloomeria crocea</i> (Torr.) Coville  | common goldenstar              | -                                   | 1-1a, 1-1c, 1-2b         | N      |
| <b>ANGIOSPERMS: DICOTS</b>   |                                |                                     |                          |        |
| <b>ANACARDIACEAE                      SUMAC OR CASHEW FAMILY</b>   |                                |                                     |                          |        |
| <i>Rhus integrifolia</i> (Nutt.) Benth. & Hook. f. ex Rothr.   | lemonade berry                 | -                                   | 1-1a, 1-1c, 1-2b         | N      |
| <b>APIACEAE (UMBELLIFERAE)                      CARROT FAMILY</b>  |                                |                                     |                          |        |
| <i>Apiastrum angustifolium</i> Nutt.   | mock-parsley                   | -                                   | 1-2b                     | N      |
| <i>Daucus pusillus</i> Michx.  | rattlesnake weed               | -                                   | 1-1a                     | N      |
| <i>Foeniculum vulgare</i> Mill.  | fennel                         | -                                   | 1-1c, 1-2b               | I      |
| <b>ASTERACEAE                      SUNFLOWER FAMILY</b>  |                                |                                     |                          |        |
| <i>Ambrosia psilostachya</i> DC.   | western ragweed                | -                                   | 1-2b                     | N      |
| <i>Artemisia californica</i> Less.   | California sagebrush           | -                                   | 1-1a, 1-1c, 1-2b         | N      |
| <i>Baccharis sarothroides</i> A. Gray  | broom baccharis                | -                                   | 1-1c, 1-2b               | N      |
| <i>Carduus pycnocephalus</i> L.  | Italian thistle                | -                                   | 1-2b                     | I      |
| <i>Centaurea melitensis</i> L.   | totalote, Maltese star-thistle | -                                   | 1-1a, 1-1c, 1-2b         | I      |
| <i>Corethrogyne filaginifolia</i> [= all previously known <i>Lessingia filaginifolia</i> varieties in California] (Hook. & Arn.) Nutt. | California-aster               | -                                   | 1-1a, 1-1c, 1-2b         | N      |
| <i>Cynara cardunculus</i> L.   | cardo, artichoke thistle       | -                                   | 1-2b                     | I      |
| <i>Deinandra</i> [=Hemizonia] <i>conjugens</i> (D.D. Keck) B.G. Baldwin  | Otay tarplant                  | CE/FT, MSCP<br>NE/4-1,<br>CNPS 1B.1 | 1-1a, 1-1c, 1-2b         | N      |
| <i>Encelia californica</i> Nutt.   | California encelia             | -                                   | 1-1a                     | N      |
| <i>Eriophyllum confertiflorum</i> (DC.) A. Gray var. <i>confertiflorum</i>   | long-stem golden-yarrow        | -                                   | 1-1a, 1-1c               | N      |
| <i>Glebionis coronaria</i> (L.) Spach [=Chrysanthemum coronarium]  | garland, crown daisy           | -                                   | 1-1a                     | I      |
| <i>Grindelia camporum</i> Greene [=Grindelia camporum var. <i>bracteosa</i> ]  | gumplant                       | -                                   | 1-1a, 1-1c, 1-2b         | N      |
| <i>Hazardia squarrosa</i> (Hook. & Arn.) Greene  | saw-toothed goldenbush         | -                                   | 1-1a, 1-2b               | N      |



**ATTACHMENT 2**  
**PLANT SPECIES OBSERVED WITHIN THE OTAY TARPLANT AND SAN DIEGO THORN MINT**  
**RESTORATION AND ENHANCEMENT AREAS**  
**(continued)**

| Scientific Name  | Common Name                                    | Sensitivity        | Preserve Management Unit | Origin |
|--|--|--------------------|--------------------------|--------|
| <i>Hedypnois cretica</i> (L.) Dum. Cours.  | crete weed                                     | -                  | 1-1a, 1-1c               | I      |
| <i>Helminthotheca</i> [= <i>Picris</i> ] <i>echioides</i> (L.) Holub                           | bristly ox-tongue                              | -                  | 1-1c, 1-2b               | I      |
| <i>Isocoma menziesii</i> (Hook. & Arn.) G.L. Nesom var. <i>decumbens</i> (Greene) G.L. Nesom   | decumbent goldenbush                           | CNPS 1B.2          | 1-1a, 1-1c, 1-2b         | N      |
| <i>Lactuca serriola</i> L.   | prickly lettuce                                | -                  | 1-2b                     | I      |
| <i>Logfia</i> [= <i>Filago</i> ] <i>gallica</i> (L.) Coss. & Germ.                             | daggerleaf cottonrose, narrow-leaf herba impia | -                  | 1-1a                     | I      |
| <i>Osmadenia tenella</i> Nutt.   | osmadenia                                      | -                  | 1-1c                     | N      |
| <i>Senecio</i> sp.   | groundsel                                      | -                  | 1-2b                     | N      |
| <i>Sonchus asper</i> (L.) Hill ssp. <i>asper</i>   | prickly sow thistle                            | -                  | 1-1a, 1-1c, 1-2b         | I      |
| <i>Sonchus oleraceus</i> L.  | common sow thistle                             | -                  | 1-1c, 1-2b               | I      |
| <b>BORAGINACEAE                      BORAGE FAMILY</b>   |  |                    |                          |        |
| <i>Harpagonella palmeri</i> A. Gray  | Palmer's grapplinghook                         | CNPS 4.2           | 1-2b                     | N      |
| <i>Heliotropium curassavicum</i> L. var. <i>oculatum</i> (A. Heller) I. M. Johnst. ex Tidestr. | seaside heliotrope, alkali heliotrope          | -                  | 1-2b                     | N      |
| <b>BRASSICACEAE (CRUCIFERAE)      MUSTARD FAMILY</b>   |  |                    |                          |        |
| <i>Brassica nigra</i> (L.) W.D.J. Koch   | black mustard                                  | -                  | 1-1a, 1-1c, 1-2b         | I      |
| <b>CACTACEAE                              CACTUS FAMILY</b>                                    |  |                    |                          |        |
| <i>Cylindropuntia</i> [= <i>Opuntia</i> ] <i>prolifera</i> (Engelm.) F.M. Knuth                | coast cholla                                   | -                  | 1-1a, 1-1c, 1-2b         | N      |
| <i>Ferocactus viridescens</i> (Torr. & A. Gray) Britton & Rose                                 | San Diego barrel cactus                        | CNPS 2.1, MSCP 4-1 | 1-1a                     | N      |
| <i>Opuntia ficus-indica</i> (L.) Mill.   | mission prickly-pear, Indian fig               | -                  | 1-1c                     | I      |
| <i>Opuntia littoralis</i> (Engelm.) Cockerell.   | coast prickly-pear, shore cactus               | -                  | 1-1a, 1-1c, 1-2b         | N      |
| <i>Opuntia oricola</i> Philbrick   | chaparral prickly-pear                         | -                  | 1-1c, 1-2b               | N      |
| <b>CHENOPODIACEAE                      GOOSEFOOT FAMILY</b>                                    |  |                    |                          |        |
| <i>Atriplex glauca</i> L.  | grey saltbush                                  | -                  | 1-1a                     | I      |
| <i>Atriplex semibaccata</i> R. Br.   | Australian saltbush                            | -                  | 1-1c                     | I      |
| <i>Salsola tragus</i> L.   | Russian thistle, tumbleweed                    |                    | 1-1c, 1-2b               | I      |
| <b>CLEOMACEAE                              SPIDERFLOWER FAMILY</b>                             |  |                    |                          |        |
| <i>Peritoma</i> [= <i>Isomeris</i> ] <i>arborea</i> (Nutt.) H. H. Iltis                        | bladderpod                                     | -                  | 1-1a, 1-1c, 1-2b         | N      |

**ATTACHMENT 2**  
**PLANT SPECIES OBSERVED WITHIN THE OTAY TARPLANT AND SAN DIEGO THORN MINT**  
**RESTORATION AND ENHANCEMENT AREAS**  
**(continued)**

| Scientific Name  | Common Name                  | Sensitivity                   | Preserve Management Unit | Origin |
|--|------------------------------|-------------------------------|--------------------------|--------|
| <b>CONVOLVULACEAE MORNING-GLORY FAMILY</b>   |                              |                               |                          |        |
| <i>Calystegia macrostegia</i> (Greene) Brummitt  | morning-glory                | -                             | 1-1c, 1-2b               | N      |
| <i>Convolvulus simulans</i> L.M. Perry   | small-flowered morning-glory | CNPS 4.2                      | 1-1a, 1-1c, 1-2b         | N      |
| <i>Cuscuta</i> sp.   | dodder                       | -                             | 1-2b                     | N      |
| <b>CRASSULACEAE STONECROP FAMILY</b>   |                              |                               |                          |        |
| <i>Dudleya variegata</i> (S. Watson) Moran   | variegated dudleya           | MSCP NE/4-1, CNPS 1B.2        | 1-1c, 1-2b               | N      |
| <b>EUPHORBIACEAE SPURGE FAMILY</b>   |                              |                               |                          |        |
| <i>Euphorbia</i> [= <i>Chamaesyce</i> ] <i>maculata</i> L.   | spotted spurge               | -                             | 1-1c, 1-2b               | I      |
| <i>Euphorbia peplus</i> L.   | petty spurge                 | -                             | 1-1a, 1-1c               | I      |
| <b>FABACEAE (LEGUMINOSAE) LEGUME FAMILY</b>  |                              |                               |                          |        |
| <i>Medicago polymorpha</i> L.  | California burclover         | -                             | 1-1c                     | I      |
| <b>FAGACEAE OAK FAMILY</b>   |                              |                               |                          |        |
| <i>Quercus engelmannii</i> Greene  | Engelmann oak, mesa oak      | CNPS 4.2                      | 1-2b                     | N      |
| <b>GERANIACEAE GERANIUM FAMILY</b>   |                              |                               |                          |        |
| <i>Erodium botrys</i> (Cav.) Bertol.   | long-beak filaree            | -                             | 1-2b                     | I      |
| <i>Erodium cicutarium</i> (L.) L'Hér. ex Aiton   | redstem filaree              | -                             | 1-1a, 1-1c, 1-2b         | I      |
| <b>LAMIACEAE MINT FAMILY</b>   |                              |                               |                          |        |
| <i>Acanthomintha ilicifolia</i> (A. Gray) A. Gray  | San Diego thornmint          | CE/FT, MSCP NE/4-2, CNPS 1B.1 | 1-1a, 1-1c, 1-2b         | N      |
| <i>Marrubium vulgare</i> L.  | horehound                    | -                             | 1-2b                     | I      |
| <i>Salvia apiana</i> Jeps.   | white sage                   | -                             | 1-1c                     | N      |
| <b>MALVACEAE MALLOW FAMILY</b>   |                              |                               |                          |        |
| <i>Sidalcea sparsifolia</i> (C.L. Hitchc.) S.R. Hill [= <i>Sidalcea malviflora</i> ssp. <i>sparsifolia</i> ] | southern checkerbloom        | -                             | 1-2b                     | N      |



**ATTACHMENT 2**  
**PLANT SPECIES OBSERVED WITHIN THE OTAY TARPLANT AND SAN DIEGO THORN MINT**  
**RESTORATION AND ENHANCEMENT AREAS**  
**(continued)**

| Scientific Name                                  | Common Name                                | Sensitivity | Preserve Management Unit | Origin |
|--|--|-------------|--------------------------|--------|
| <b>MYRSINACEAE</b> <b>MYRSINE FAMILY</b>         |  |             |                          |        |
| <i>Anagallis arvensis</i> L.                     | scarlet pimpernel, poor-man's weatherglass | -           | 1-1a, 1-1c, 1-2b         | I      |
| <b>PLANTAGINACEAE</b> <b>PLANTAIN FAMILY</b>     |  |             |                          |        |
| <i>Plantago erecta</i> E. Morris                 | dot-seed plantain                          | -           | 1-2b                     | N      |
| <b>POLYGONACEAE</b> <b>BUCKWHEAT FAMILY</b>      |  |             |                          |        |
| <i>Eriogonum fasciculatum</i> Benth.             | California buckwheat                       | -           | 1-1a, 1-1c, 1-2b         | N      |
| <b>ROSACEAE</b> <b>ROSE FAMILY</b>               |  |             |                          |        |
| <i>Heteromeles arbutifolia</i> (Lindl.) M. Roem. | toyon, Christmas berry                     | -           | 1-2b                     | N      |
| <b>SIMMONDSIACEAE</b> <b>JOJOBA FAMILY</b>       |  |             |                          |        |
| <i>Simmondsia chinensis</i> (Link) C.K. Schneid. | jojoba, goatnut                            | -           | 1-1a, 1-1c, 1-2b         | N      |

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**ATTACHMENT 2**  
**PLANT SPECIES OBSERVED WITHIN THE OTAY TARPLANT AND SAN DIEGO THORN MINT**  
**RESTORATION AND ENHANCEMENT AREAS**  
**(continued)**

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**FEDERAL CANDIDATES AND LISTED SPECIES**

FE = Federally listed endangered  
FT = Federally listed threatened  
FPT = Federally proposed (Threatened)

**STATE LISTED SPECIES**

CE = State listed endangered  
CR = State listed rare  
CT = State listed threatened  
FP = CDFG fully protected species  
SSC = CDFG species of special concern  
WL = CDFG watch list species

**CALIFORNIA NATIVE PLANT SOCIETY RARE PLANT RANKING**

1A = Species presumed extinct.  
1B = Species rare, threatened, or endangered in California and elsewhere. These species are eligible for state listing.  
2 = Species rare, threatened, or endangered in California but more common elsewhere. These species are eligible for state listing.  
3 = Species for which more information is needed. Distribution, endangerment, and/or taxonomic information is needed.  
4 = A watch list of species of limited distribution. These species need to be monitored for changes in the status of their populations.  
.1 = Species seriously threatened in California (over 80% of occurrences threatened; high degree and immediacy of threat)  
.2 = Species fairly threatened in California (20-80% occurrences threatened; moderate degree and immediacy of threat)  
.3 = Species not very threatened in California (<20% of occurrences threatened; low degree and immediacy of threat or no current threats known)

**CITY OF CHULA VISTA MSCP**

NE = Narrow endemic  
4-1 = Species adequately conserved (Table 4-1)  
4-2 = Species with known occurrences or suitable habitat within *Chula Vista Subarea* (Table 4-2)  
4-3 = Species not likely to be found in the *Chula Vista Subarea* (Table 4-3)

**ORIGIN**

N = Native to locality  
I = Introduced species from outside locality