

MSCP Rare Plant Monitoring: Field Monitoring Methods

City of San Diego
Planning Department
Multiple Species Conservation Program Division

September 2005



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Introduction

The *Biological Monitoring Plan for the Multiple Species Conservation Program* (MSCP BMP) was developed in 1996 by Ogden Environmental, Inc. and is a component of the City of San Diego's MSCP. The plan sets forth monitoring requirements for a variety of species, including rare plants, which are covered by the MSCP permit in order to assess regional changes in habitat conditions and wildlife.

The City of San Diego began rare plant monitoring in 1999 with quantitative surveys of *Ambrosia pumila* and *Dudleya brevifolia*. In 2000 and 2001, Citywide rare plant reconnaissance surveys were conducted, as were expanded quantitative species monitoring efforts. In 2001, the Conservation Biology Institute (CBI) performed a review of the MSCP monitoring program. Their resulting draft *Status Summary of Biological Monitoring Protocols* included several recommendations to improve the MSCP monitoring program. The report was never finalized; however, some components of CBI's draft report have been incorporated into the City's monitoring program, and CBI's report recommendations have been included in this report.

Since 2001, the City has expanded the number of MSCP species and localities it monitors, and has performed plant monitoring in compliance with the BMP, with some exceptions due to incorrect species localities or recommendations made in CBI's 2001 report. Since neither the original BMP nor CBI's review outline specific methods to be used for plant monitoring, the City has worked to develop its own methods based on the general parameters set forth in the 1996 and 2001 reports. Most of these methods have been described generally in the City's annual plant monitoring reports; however, in order to ensure uniformity and avoid uncertainty due to staff turnover, this report has been developed to explain monitoring methods in greater detail and to serve as a central methods information repository. The manual has been created as a living document to be updated as plant monitoring methods change.

Thus, the goal of this manual is twofold: to ensure uniform implementation of the City's MSCP plant monitoring program as well as to detail current methodologies for use in rare plant monitoring improvements. It is our hope that this report will provide sufficient detail such that any biologist familiar with general monitoring methodologies and local species could use it to perform the City's rare plant monitoring. Additionally, this report is meant to provide background information on the City's monitoring requirements and methodologies so that the information can be used for improvements to the rare plant monitoring program.

***Acanthomintha ilicifolia* (San Diego Thorn-mint)**

MSCP Biological Monitoring Plan (BMP) Priority Listing and Required Monitoring Frequency [CBI Recommended Monitoring Frequency]

Second priority, Every two years [Annually]

BMP Required City Monitoring Locations:

None

Additional CBI Recommended City Monitoring Location (CBI, 2001):

Sabre Springs

Additional Locations Monitored in the City:

Black Mountain Ranch

Mission Trails Regional Park

Penasquitos Canyon

Years Monitored:

2000 (Blk Mtn Ranch, PQ Cyn, Sabre Springs)

2001 (Blk Mtn Ranch, MTRP, Otay Lakes, PQ Cyn, Sabre Springs)

2002 (Blk Mtn Ranch, MTRP, Otay Lakes, PQ Cyn, Sabre Springs)

2003 (Blk Mtn Ranch, MTRP, Otay Lakes, PQ, Sabre Springs)

2004 (Blk Mtn Ranch, MTRP, Otay Lakes, PQ Cyn, Sabre Springs)

2005 (Blk Mtn Ranch, MTRP, PQ Cyn, Sabre Springs)

Methods:

Black Mountain Ranch, Mission Trails Regional Park, Peñasquitos Canyon, Sabre Springs All *A. ilicifolia* monitoring, with the exception of Otay Lakes, is performed by Mike Kelly of the Conservation Resources Network and other volunteers. Based on correspondence with Mr. Kelly, full censuses are performed at each site. Additionally, 1x10 m transects have been established in order to compare and potentially project total counts from transects in future years. Permanent transects were selected by Mike Kelly in 1992 and each transect corner was staked with rebar, with an inscribed zero on one corner which indicates where the meter tape is laid. Three transects were placed in Santa Luz/Blk Mtn, three in Sabre Springs, and two in MTRP. Within each transect, all *A. ilicifolia* individuals are counted and recorded. Additionally, a percent cover of the following is assessed and recorded for each one meter within the ten meter transects: 1) Percent bare ground/litter; 2) Percent non-native and native cover for each meter of the 1x10 m transect; and 3) Within native cover, percent cover and number of *A. ilicifolia* individuals.

Additionally, a full plant list is generated for each transect and the surrounding site, and a threat assessment for each population is performed. Lastly, a GPS point is taken at each population.

Otay Lakes At Otay Lakes, there are relatively few plants in the population (60+/-), so a simple census is performed.

General: Note that in addition to selected preserve area quantitative monitoring, the 2001 CBI report suggests preserve-wide annual “Non-quantitative surveys to assess resource presence/absence or distribution, using habitat mapping, aerial photography, or other imagery,

and mapping of species distribution.” According to the report, such preserve-level monitoring would be used “to inform management decisions – required of all preserve managers at all preserve units and monitoring directives.”

Figure 1. City of San Diego *Acanthomintha ilicifolia* Monitoring Locations, Regional Map

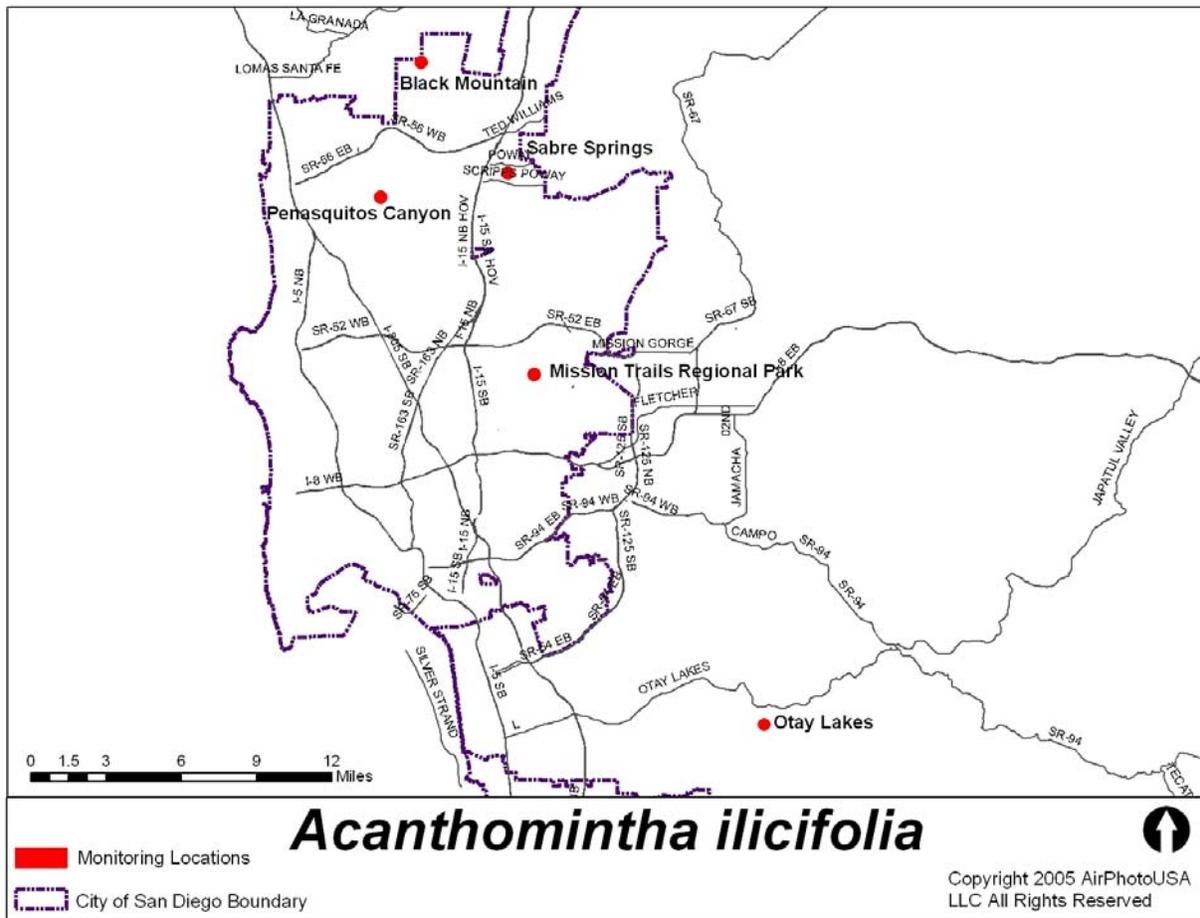


Figure 2. City of San Diego *Acanthomintha ilicifolia* Monitoring Location, Black Mountain



Figure 3. City of San Diego *Acanthomintha ilicifolia* Monitoring Location, MTRP



Figure 4. City of San Diego *Acanthomintha ilicifolia* Monitoring Location, Otay Lakes



Figure 5. City of San Diego *Acanthomintha ilicifolia* Monitoring Location, Peñasquitos Canyon Region

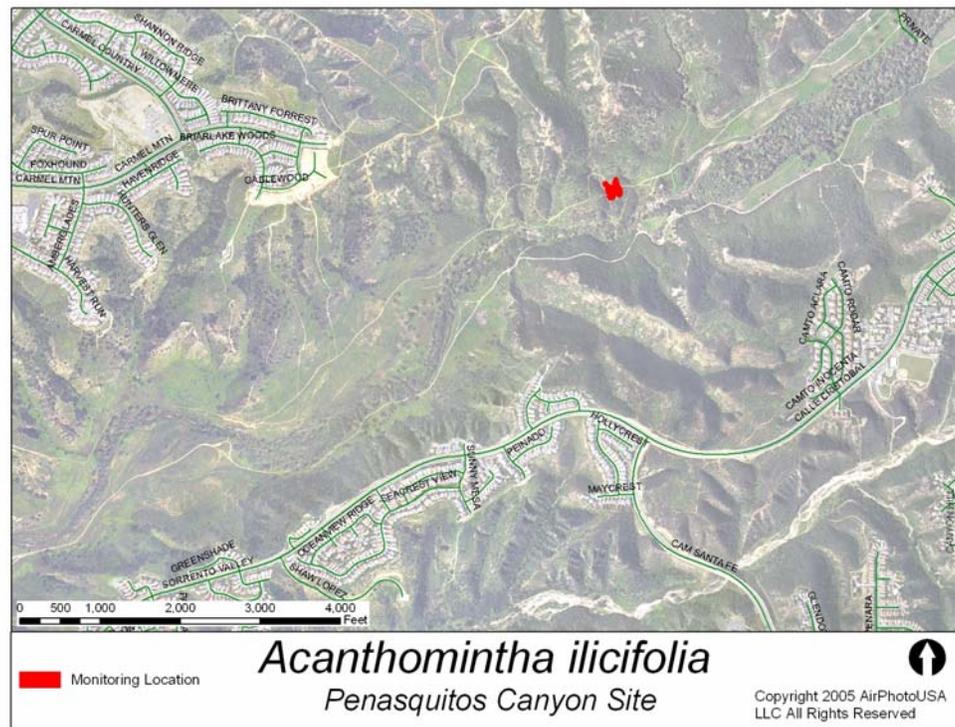
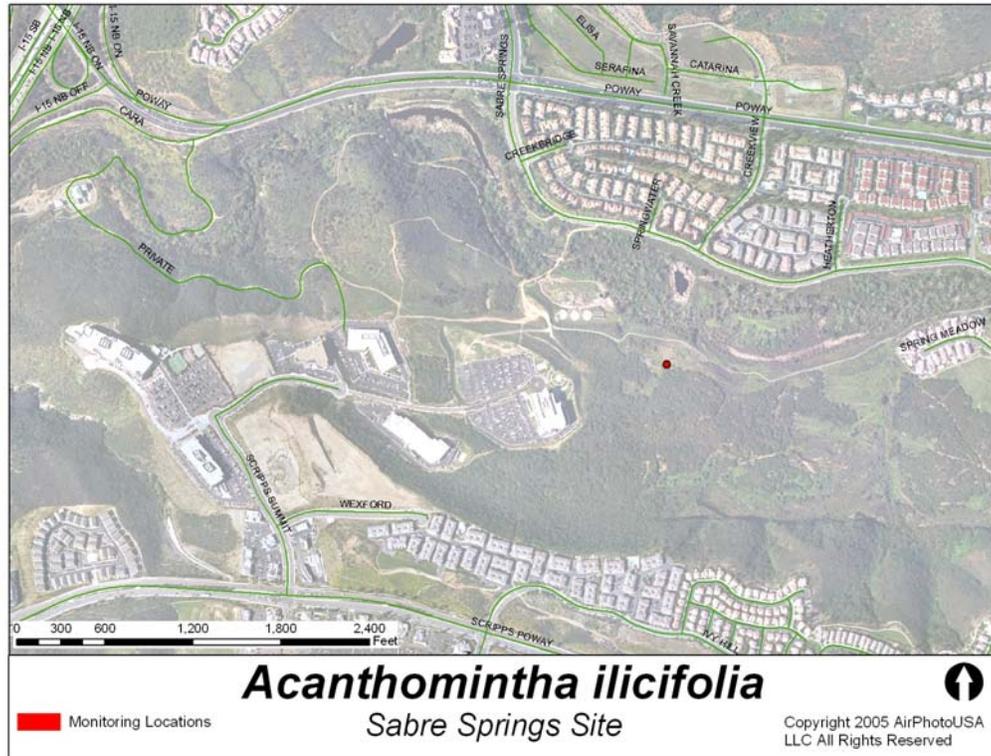


Figure 6. City of San Diego *Acanthomintha ilicifolia* Monitoring Location, Sabre Springs



***Ambrosia pumila* (San Diego Ambrosia)**

MSCP Biological Monitoring Plan (BMP) Priority Listing and Required Monitoring Frequency [CBI Recommended Monitoring Frequency]:

Second priority, Every two years [Annually]

BMP Required and CBI Recommended City Monitoring Location (BMP Point and Site Priority):

Mission Trails Regional Park (P-16; Moderate Priority)

Years Monitored:

1999, 2000, 2001, 2003

Methods:

The largest patch of San Diego ambrosia at MTRP (Ambrosia Management Plan “patch C6”), located immediately east of the Kumeyaay Lake Campground, was chosen during early survey years as a quantitative sampling area. According to previous monitoring reports, transect lines were allocated by staff in what was determined to be the core population area. Transects were aligned along an east to west stratification line in order to avoid problems with potential environmental gradients and the clumping distribution of San Diego ambrosia. Steel rods were installed to indicate the location of each transect. Transect post locations were mapped using a Global Positioning System (GPS). The total number of transects (N=13) and total number of quadrats (N=334) sample approximately 5% of the total sampling area.

A one meter square (1 m²) quadrat is used to define the quadrat boundary and estimate population size. The 1 m² quadrat is placed along the transect so that the quadrat is on the west side of the transect. Each “plant” (ramet) located within the 1 m² quadrat is counted and recorded. Quadrats are placed at 1 m intervals along each transect.

If time allows, the entire C6 population boundary is flagged and mapped using a sub-meter GPS unit.

In addition to quantitative surveys at population C6, each *A. pumila* patch documented in 1998 MTRP surveys for the management plan (Dudek and Associates, 2000) is qualitatively checked for presence or absence of San Diego ambrosia and for potential management issues. If time allows, population boundaries are flagged and mapped using a sub-meter GPS unit.

Directions:

To Kumeyaay Lake population (‘C6’): Take SR-163 North, then SR-52 East to Mast Boulevard. Go left (northeast) on Mast, right (south) on West Hills Parkway, right (west) on Mission Gorge Road, then veer right on Father Junipero Serra Trail. Campground area and Ambrosia population will be on your right. Park in large parking lot on your right, Ambrosia population is immediately north of lot in fenced area.

GPS shapefile for the the Kumeyaay Lake population, along with all other MTRP populations, is located on the City MSCP’s E: drive in Monitoring/1998.

General: Note that the 2001 CBI report suggests annual preserve-wide “mapping species distribution and quantitative or semi-quantitative surveys to assess resource abundance, density or other indices to monitor status and trends through time.”

Monitoring Time Notes:

This species was surveyed in August, which is within its typical flowering season, prior to 2005. Because the species is above ground most of the year, though, it was decided that it can be monitored prior to August for presence/absence surveys (i.e., non-demographic surveys).

In 2005, though, over half of the C6 population had flowered and dried up by July. Based on discussions with Dr. McEachern, staff had planned to flag and map the population, then randomly allocate the transects within the population area, rather than in the core population area only. However, due to the difficulty in locating stems among other dried vegetation, it was determined that a population boundary would not be reliable. Staff has proposed performing *A. pumila* monitoring early in 2006, before the bulk of the other monitoring work, since surveys could not be performed in 2005.

Figure 7. City of San Diego *Ambrosia pumila* Monitoring Locations, Vicinity Map

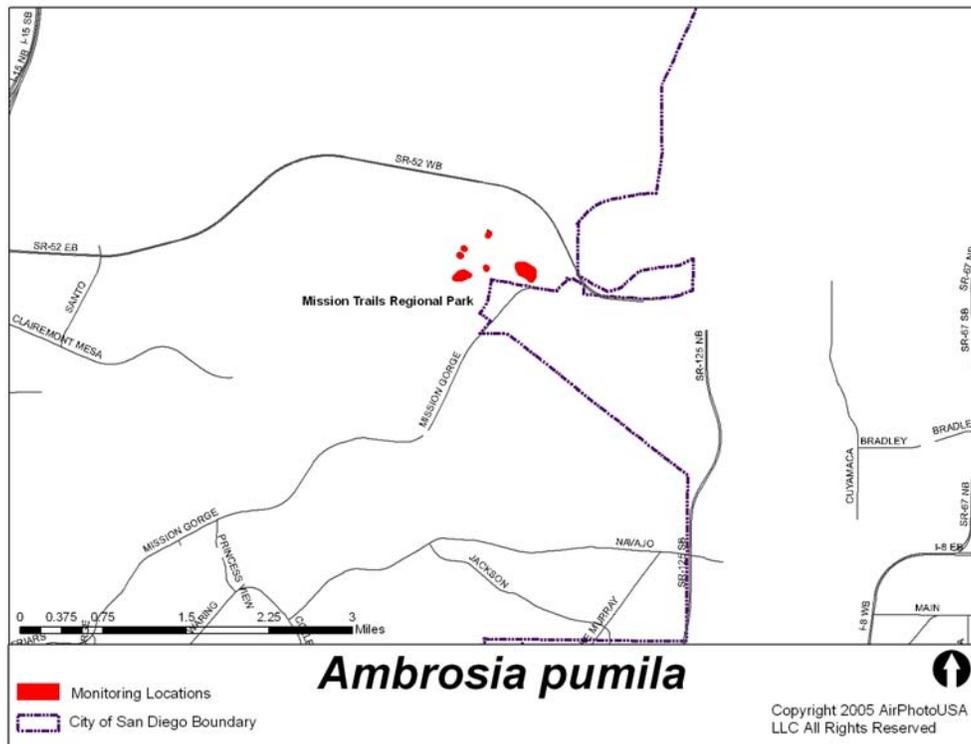
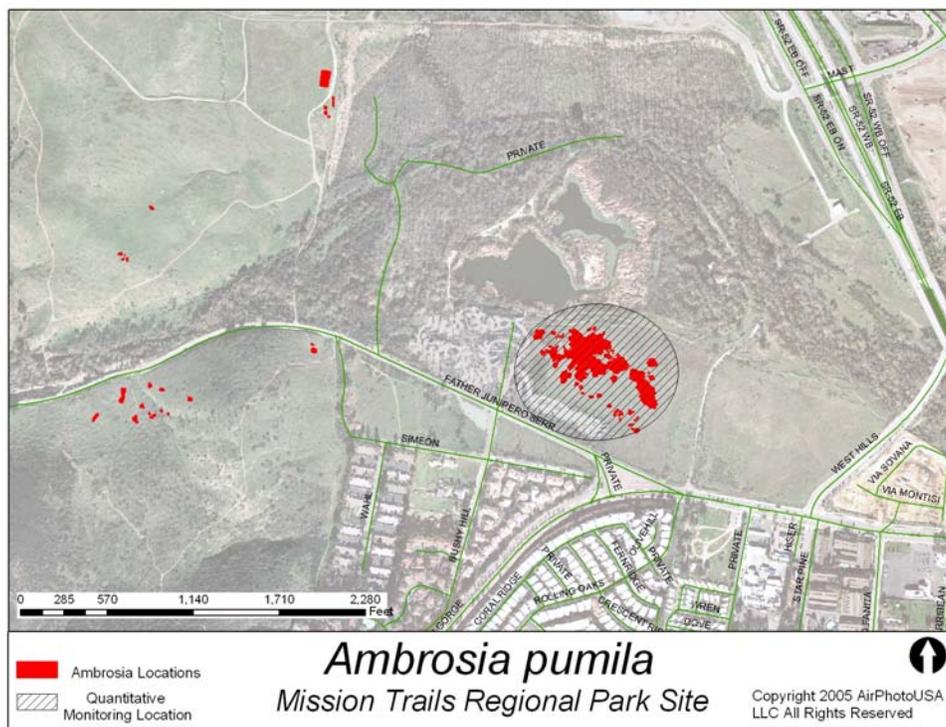


Figure 8. City of San Diego *Ambrosia pumila* Monitoring Location



***Arctostaphylos glandulosa* ssp. *crassifolia* (Del Mar Manzanita)**

MSCP Biological Monitoring Plan (BMP) Priority Listing and Required Monitoring Frequency [CBI Recommended Monitoring Frequency]:

Third priority, Every five years [Every five years]

BMP Required and CBI Recommended City Monitoring Locations (BMP Point and Site Priority):

Del Mar Heights/Crest Canyon (P-3; High priority)

Carmel Mountain (P-8; High priority)

Del Mar Mesa (P-10; Moderate priority)

Peñasquitos Canyon (P-12; Low priority)

San Dieguito River Bluffs (P-5; Low priority)

Years Monitored:

2002 (Carmel Mtn, Crest Cnyn, PQ Cnyn)

Methods:

In 2002, *A. glandulosa* ssp. *crassifolia* populations were censused using submeter GPS technology. Each individual located was recorded. In areas where the terrain was too steep, the approximate location was identified on orthophotographic aerial map as a point. No demographic information was recorded.

Note that the 2001 CBI report suggests preserve-wide “mapping species distribution and quantitative or semi-quantitative surveys to assess resource abundance, density or other indices to monitor status and trends through time” every five years, and that “area-specific management directives must address the autecology and natural history of these species, which may require quantitative studies not associated with population trend monitoring.” The report includes only the above-listed locations in its ‘summary of species locations recommended for qualitative monitoring,’ which may be the only known locales of this species in the City.

Figure 9. City of San Diego *Arctostaphylos glandulosa* ssp. *crassifolia* Monitoring Locations, Regional Map

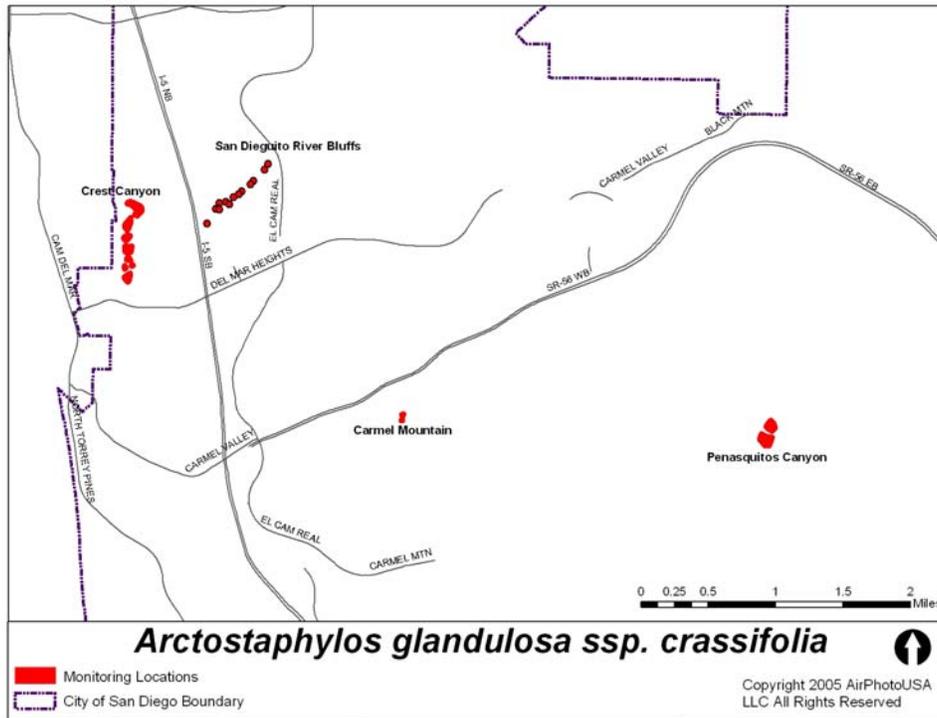


Figure 10. City of San Diego *Arctostaphylos glandulosa* ssp. *crassifolia* Monitoring Location, Carmel Mtn

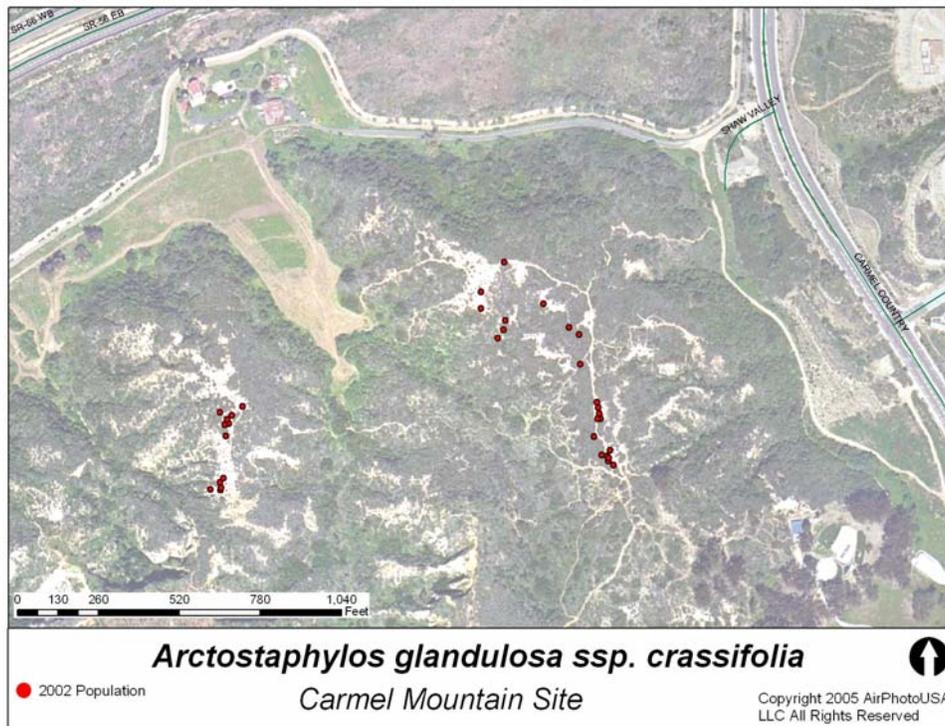


Figure 11. City of San Diego *Arctostaphylos glandulosa* ssp. *crassifolia* Monitoring Location, Crest Cyn



Figure 12. City of San Diego *Arctostaphylos glandulosa* ssp. *crassifolia* Monitoring Location, Peñasquitos

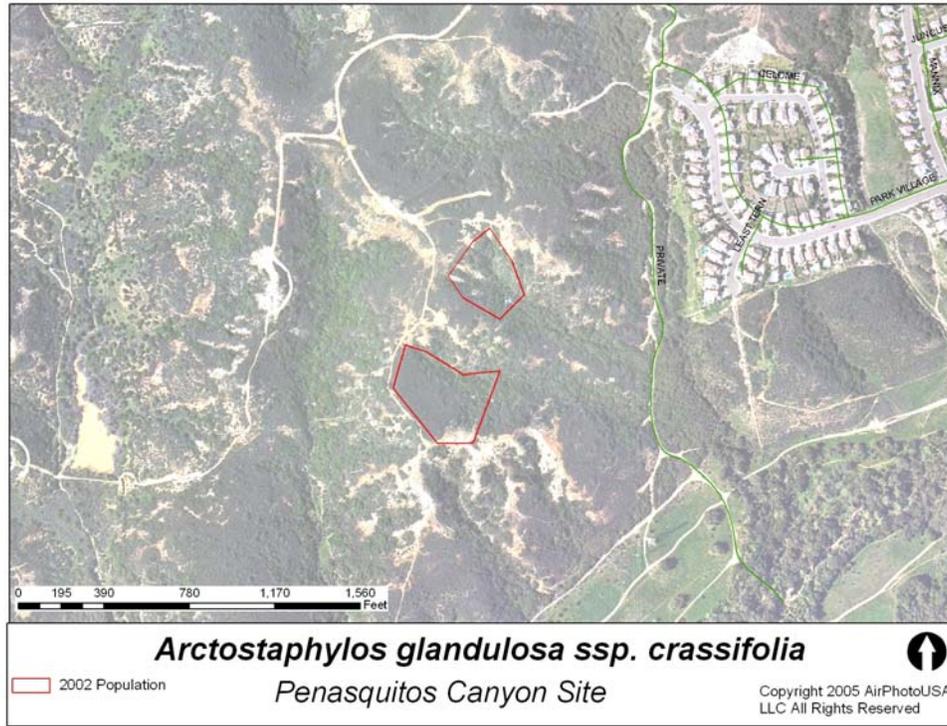
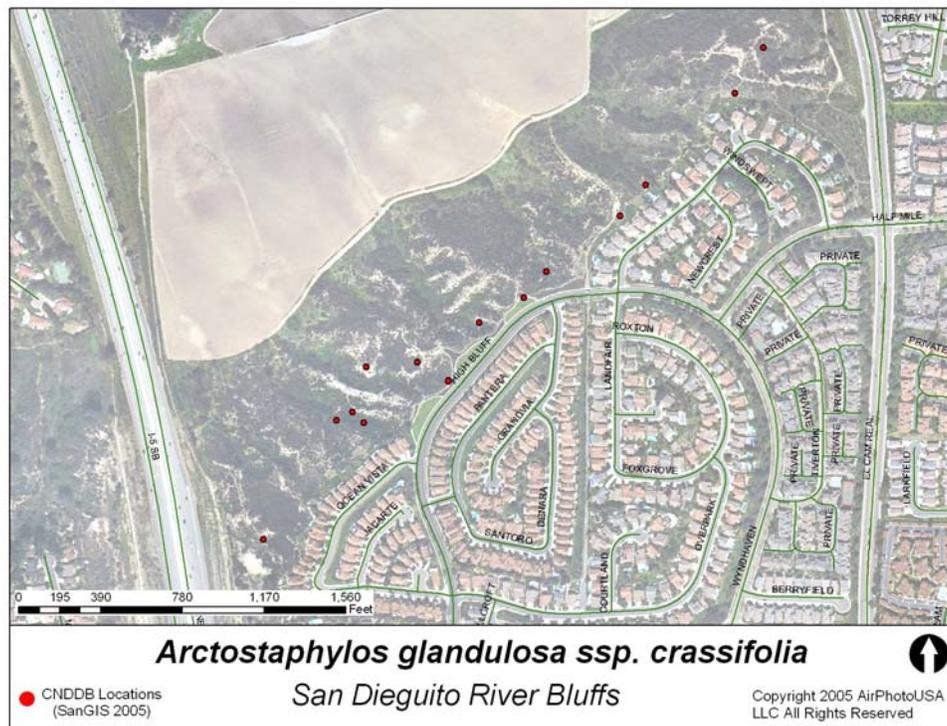


Figure 13. City of San Diego *Arctostaphylos glandulosa* ssp. *crassifolia* Monitoring Location, San Dieguito River Bluffs



***Brodiaea orcutti* (Orcutt's Brodiaea)**

MSCP Biological Monitoring Plan (BMP) Priority Listing and Required Monitoring Frequency [CBI Recommended Monitoring Frequency]:

Second priority, Every two years [Annually]

BMP Required and CBI Recommended City Monitoring Locations (BMP Point and Site Priority):

Carmel Mountain (P-9; Moderate priority)

Del Mar Mesa (P-11; Moderate priority)

Additional Locations Monitored in the City:

Carroll Canyon

General Dynamics

Nobel Drive

Years Monitored:

2001 (Gen Dynamics, Nobel Dr, Carroll Canyon, Del Mar Mesa)

2002 (Gen Dynamics, Nobel Dr, Carroll Canyon, Del Mar Mesa)

2003 (Gen Dynamics, Nobel Dr, Carroll Canyon, Del Mar Mesa)

2005 (Gen Dynamics, Carroll Canyon, Nobel Drive)

Methods:

General Dynamics and Carroll Canyon During 2001-2003, *B. orcuttii* monitoring at General Dynamics and Carroll Canyon was performed by counting all individuals within one meter square quadrats, then using the counts to estimate the total site population. However, quadrats were selected in the field in a non-random manner. Based on this information and a site visit in spring 2005 during which it was noted that the population is fenced, thus *B. orcuttii* faces very few threats from human disturbance. As a species that requires open area, though, *B. orcuttii* could be threatened by community transitions if adjacent scrub habitat extends into the open areas within the site. Based on these observations, Dr. Kathryn McEachern of the USGS recommended a new monitoring method for this species at the the General Dynamics and Carroll Canyons sites.

In 2005, six permanent plots (1 x 3 m) were established within both the General Dynamics and Carroll Canyon *B. orcuttii* populations in order to track potential habitat change/succession. Three plots were placed immediately adjacent to shrub-dominated areas; three were placed in areas not immediately adjacent shrub habitats. All plots were selected in the field by staff (non-random). All plots were staked using surveyors nails and were also mapped using submeter GPS technology. Within each 1 x 3 m plot, all flowering and non-flowering individuals within each plot are counted (census) and recorded using standard data sheets. An individual is considered flowering if any internal flowering structures are visible to the naked eye (i.e., flower is opened enough such that internal structures, e.g., filaments, are visible) or if the plant has flowered (e.g., dried flower).

Nobel Drive The Nobel Drive population is very small (23 in 2005) and can be easily counted (censused).

Del Mar Mesa According to 2003 monitoring reports, “The irregular shape of the populations and wet vernal pools around the population area precluded the use of transects in most locations. Therefore, a one-meter quadrat sampling method was used to estimate the size of each population. One-meter quadrats were randomly allocated within the populations as randomly allocated points using ArcView software on a Geographic Information System (GIS). Each point was then navigated to using a submeter Global Positioning System (GPS) and quadrats were placed to the northeast, northwest, southeast, or southwest alternating direction with each point. For Del Mar Mesa, the population location was not available until the site was surveyed on May 19, 2003 and randomly allocated points in ArcView GIS could not be provided. In that case, points were “selected in the field.”

General: Note that in addition to selected preserve area quantitative monitoring at Carmel Mountain and Del Mar Mesa, the 2001 CBI report suggests preserve-wide annual “Non-quantitative surveys to assess resource presence/absence or distribution, using habitat mapping, aerial photography, or other imagery, and mapping of species distribution.” According to the report, such preserve-level monitoring would be used “to inform management decisions – required of all preserve managers at all preserve units and monitoring directives.”

Figure 14. City of San Diego *Brodiaea orcuttii* Monitoring Locations, Regional Map

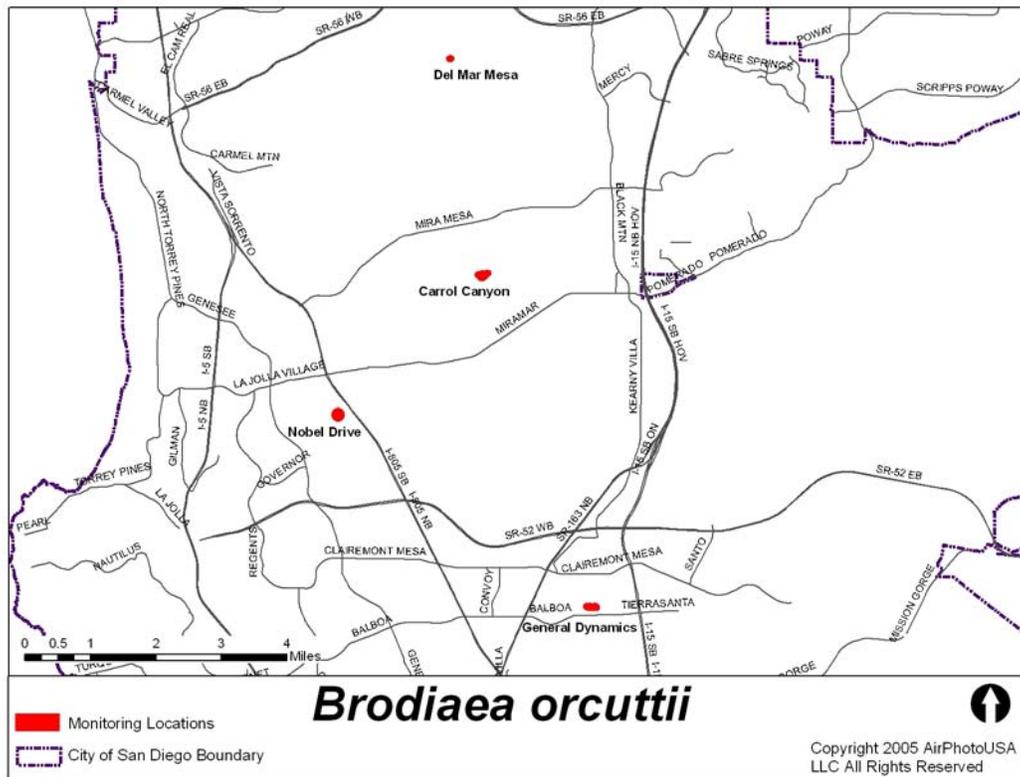


Figure 15. City of San Diego *Brodiaea orcuttii* Monitoring Location, Carroll Canyon

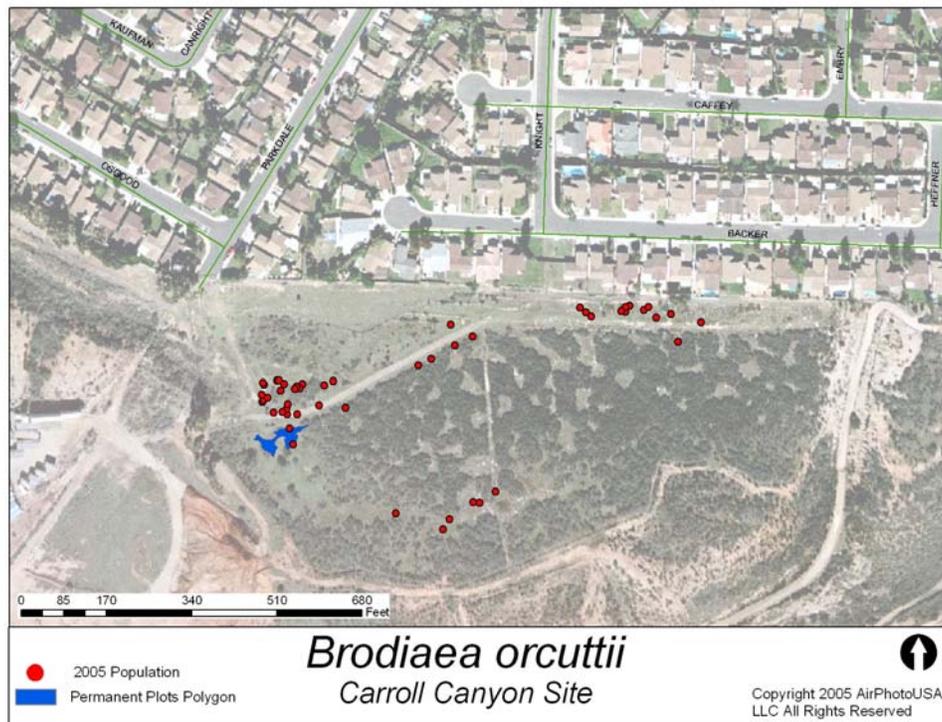


Figure 16. City of San Diego *Brodiaea orcuttii* Monitoring Location, Del Mar Mesa

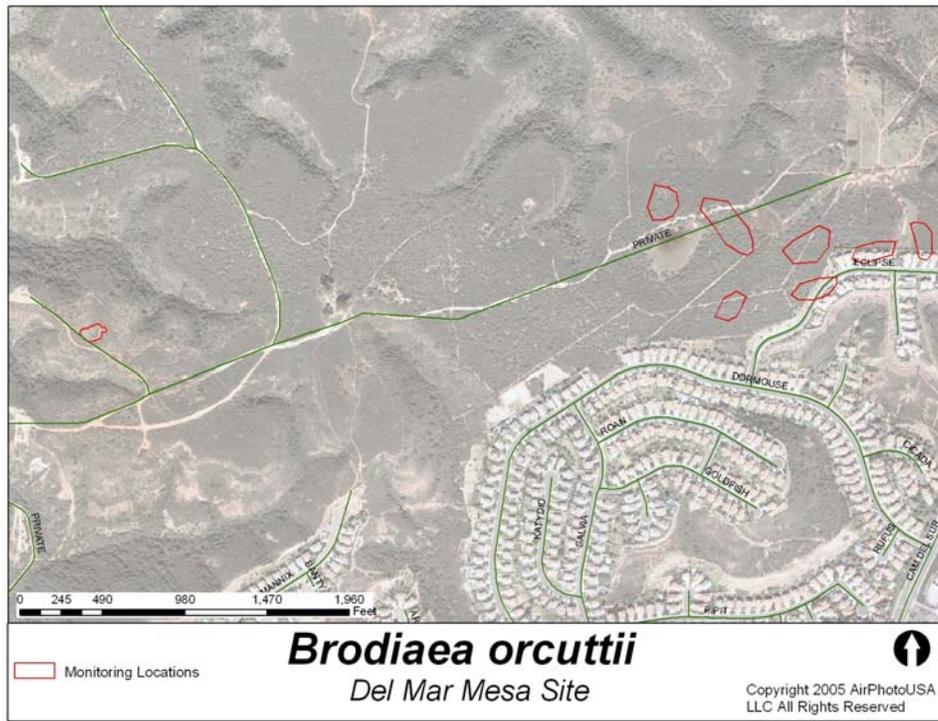


Figure 17. City of San Diego *Brodiaea orcuttii* Monitoring Location, General Dynamics

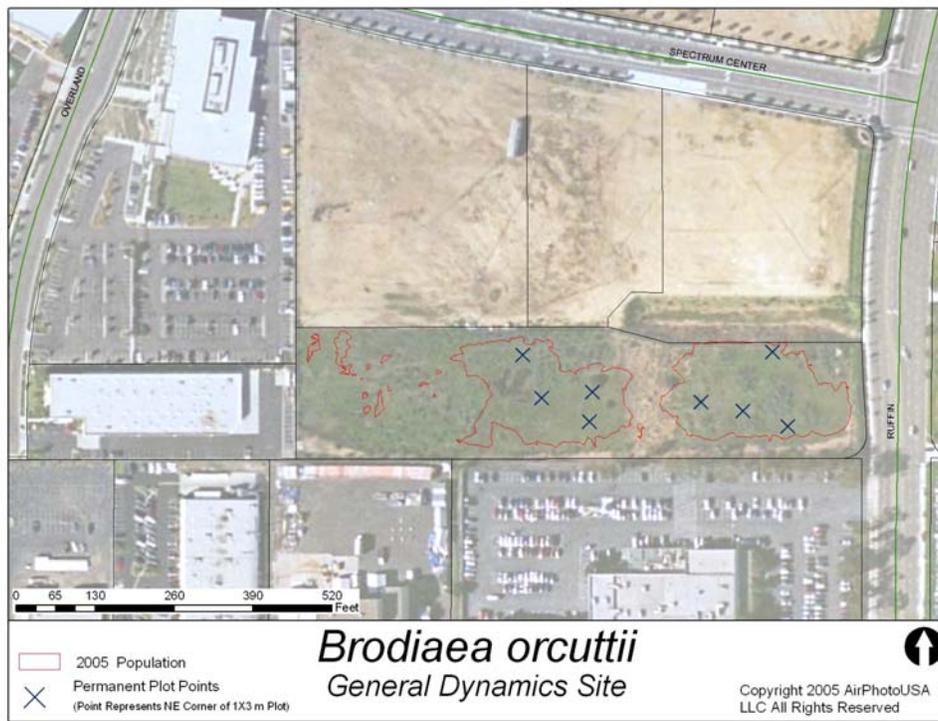
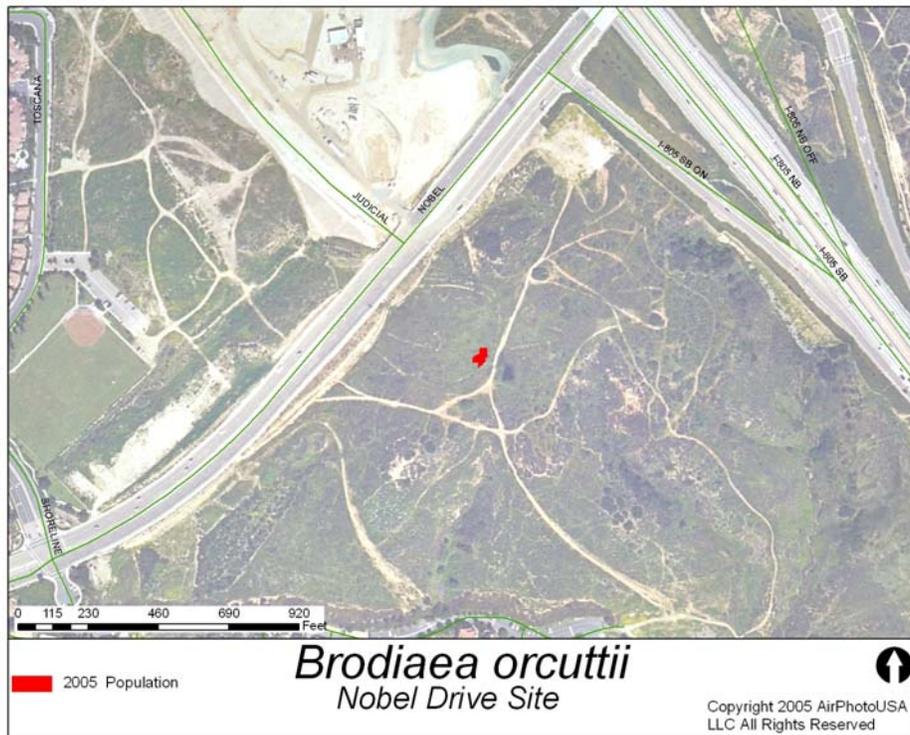


Figure 18. City of San Diego *Brodiaea orcuttii* Monitoring Location, Nobel Drive



***Cordylanthus orcuttianus* (Orcutt's Bird's Beak)**

MSCP Biological Monitoring Plan (BMP) Priority Listing and Required Monitoring Frequency [CBI Recommended Monitoring Frequency]:

First priority, Annually [Annually]

BMP Required and CBI Recommended City Monitoring Locations (BMP Point and Site Priority):

Goat Canyon-Spooner's Mesa (P-23; High priority)

Note: Goat Canyon and Spooner's Mesa are part of the Tijuana Park, which is owned and overseen by County of San Diego.

Additional CBI Recommended Monitoring Location:

Otay River Valley

Years Monitored:

2001, 2002, 2003, 2004, 2005 (Otay River Valley)

Methodology/Methodology Background:

In previous years, *C. orcuttianus* was monitored by counting all individuals within 1 meter quadrats, then using the counts to estimate total population. However, quadrats were selected in the field in a non-random manner, and several quadrats were eliminated due to presence of poison oak. Based on this information and a site visit in spring 2005 during which it was noted that *C. orcuttianus* tends to occupy areas immediately adjacent trails or other disturbed areas within the Otay River Valley, Dr. Kathryn McEachern recommended the 2005 monitoring method for this species. A revised methodology as follows: In 2005, four permanent plots (1 x 3 m) were established within the Otay River Valley *C. orcuttianus* population in order to track potential habitat change/succession. Two plots were placed immediately adjacent and parallel to trails; three were placed in areas not immediately adjacent a trail. All plots were selected in the field by staff (non-random). All plots were staked using surveyors nails and were also mapped using GPS technology. Within each 1 x 3 m plot, all flowering and non-flowering individuals within each plot are counted (census) and recorded using standard data sheets. An individual is considered flowering if any flowering structures are present (i.e., buds are counted as flowering individuals) or if the plant has flowered (e.g., dried flower).

In addition to counts within the permanent plots, all general areas in the valley known to support *C. orcuttianus* are re-visited and surveyed. Population boundaries are flagged and mapped using a sub-meter GPS unit.

Note that the 2001 CBI report suggests preserve-wide "mapping species distribution and quantitative or semi-quantitative surveys to assess resource abundance, density or other indices to monitor status and trends through time." The report lists Goat Canyon-Spooner's Mesa and Otay River Valley in its 'summary of species locations recommended for qualitative monitoring;' which may be the only known locations of the species. Reiser (1994), however, states that "An old biological survey report notes this species near the large borrow pit at the extreme eastern end of the Tijuana Hills south of Monument Road. Data Base reports are from 0.75 mile due east of Wruck Canyon on Otay Mesa, and south of the Borderland Air Sports Center 1.5 miles east of

Lower Otay Reservoir” and that “The Otay River colonies should be considered the only vigorous extant U.S. population and should be rigidly protected.”

Figure 19. City of San Diego *Cordylanthus orcuttii* Otay River Valley Monitoring Location, Vicinity Map

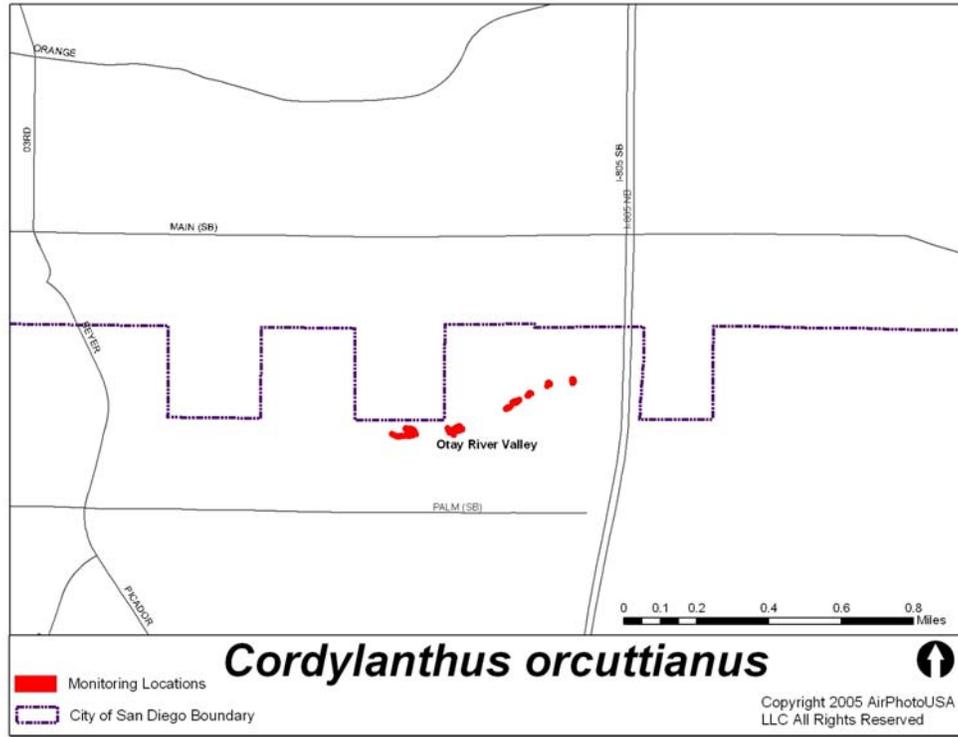
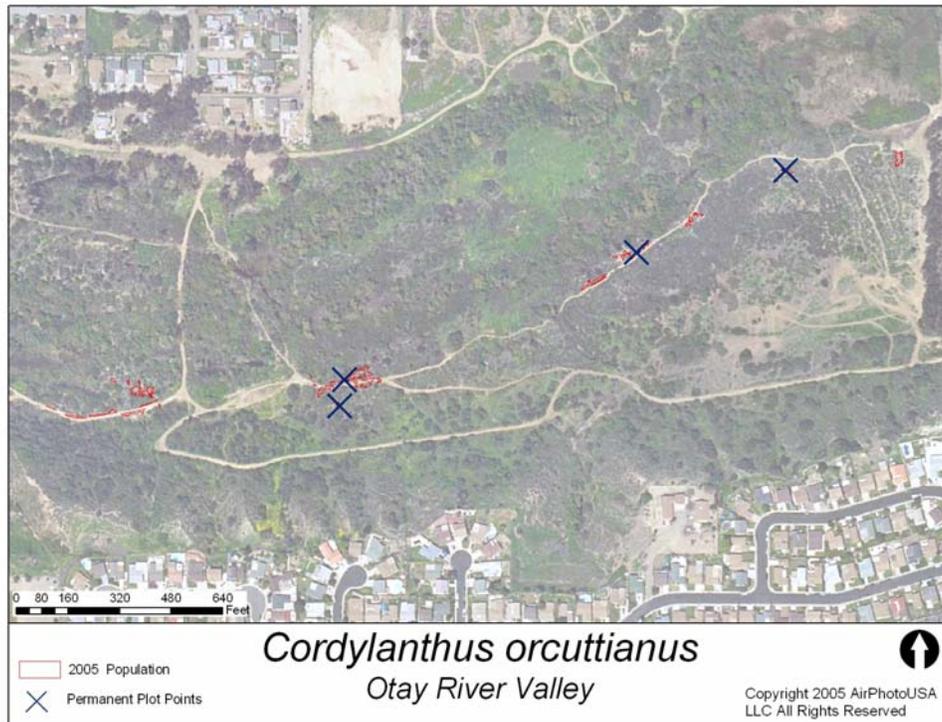


Figure 20. City of San Diego *Cordylanthus orcuttii* Monitoring Location, Otay River Valley



***Cylindropuntia californica* var. *californica* (Snake Cholla)**

(Formerly *Opuntia parryi* var. *serpentina*)

MSCP Biological Monitoring Plan (BMP) Priority Listing and Required Monitoring Frequency [CBI Recommended Monitoring Frequency]:

Third priority, Every five years [Every five years]

BMP Required and CBI Recommended City Monitoring Locations (BMP Point and Site Priority):

Spring Canyon (P-26; Moderate priority)

Additional Locations Monitored in the City:

Balboa Park, Otay Mesa

Years Monitored:

2002 (Balboa Pk, Otay Mesa, Spring Cnyn)

2005 (Otay Mesa, Spring Cnyn – presence/absence and threats assessment only)

Methods:

All individual plants were located and mapped using submeter GPS technology in 2002. 2005 monitoring included qualitatively observing the populations, noting overall habitat composition and percent non-native cover and noting any other potential management issues that may be present. Plants should be re-mapped (GPS'd) periodically, at approximately five year intervals.

Note that the 2001 CBI report suggests preserve-wide “mapping species distribution and quantitative or semi-quantitative surveys to assess resource abundance, density or other indices to monitor status and trends through time;” however, the report includes only Spring Canyon in its ‘summary of species locations recommended for qualitative monitoring’ in the City of San Diego.

Directions to Spring Canyon Site:

From downtown area, take I-5 or I-805 south to Otay Mesa Road/905. Take Otay Mesa Road/905 east, go several miles, passing the San Ysidro High School on the right, then go right on Cactus Road. At the end of Cactus, go right on Calle de Linea. Shortly after the turn and before the trucking business area, there is an entrance to the canyon on the right. Take this road trail and off-road trails and/or hiking trails to the monitoring site using aerial and/or GPS.

Figure 21. City of San Diego *Cylindropuntia californica* var. *californica* Monitoring Locations, Regional Map

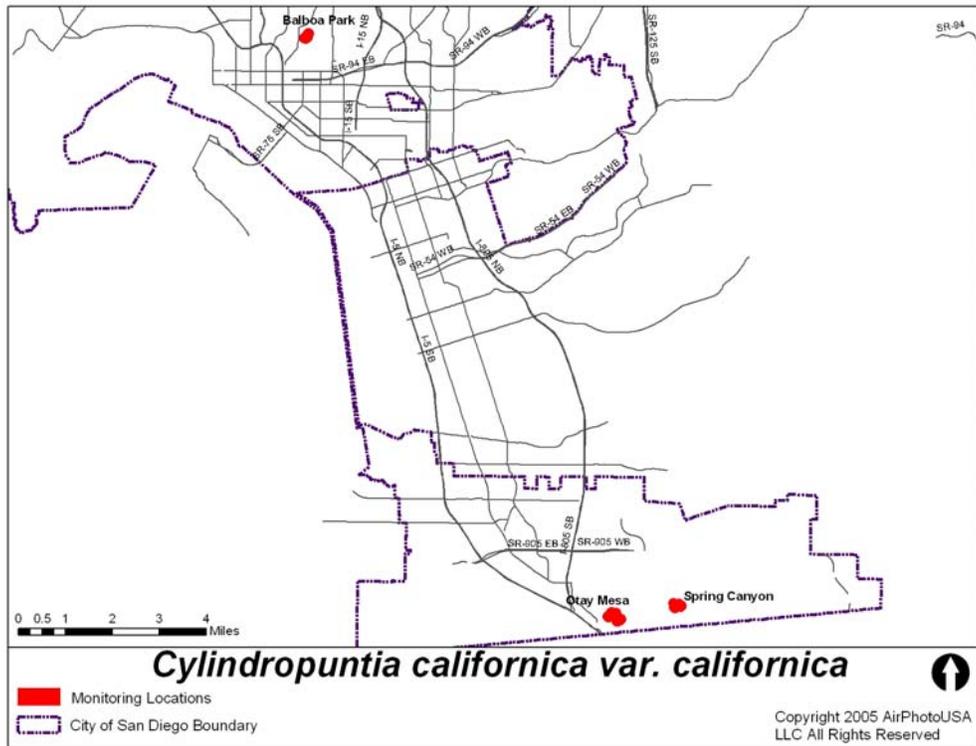


Figure 22. City of San Diego *Cylindropuntia californica* var. *californica* Monitoring Location, Balboa Park

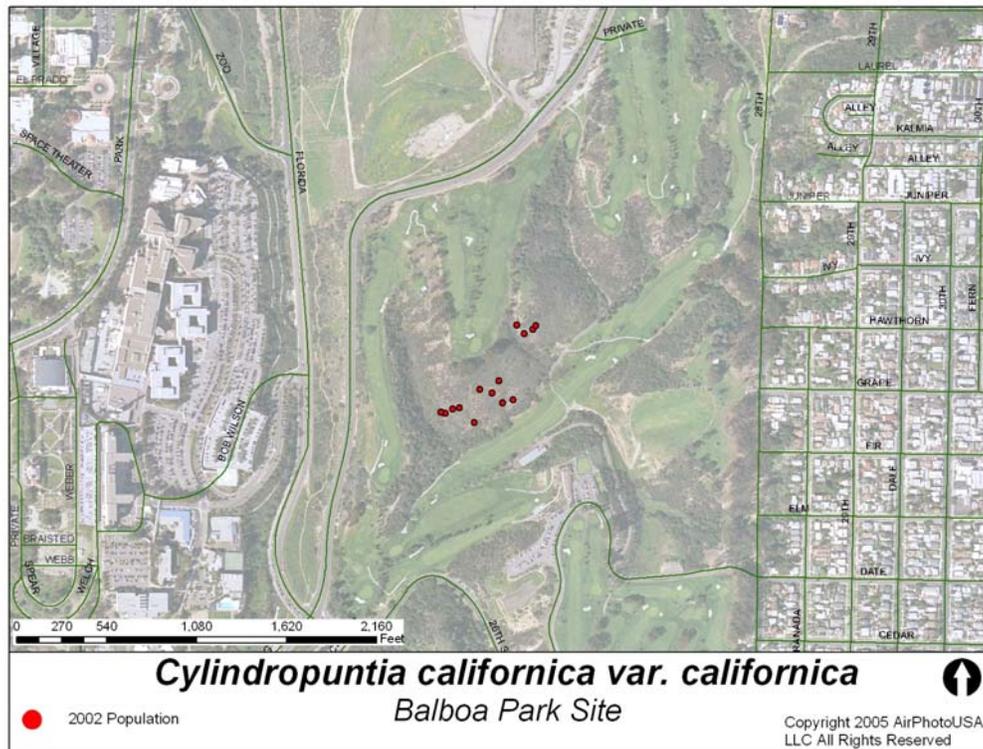


Figure 23. City of San Diego *Cylindropuntia californica* var. *californica* Monitoring Location, Otay Mesa

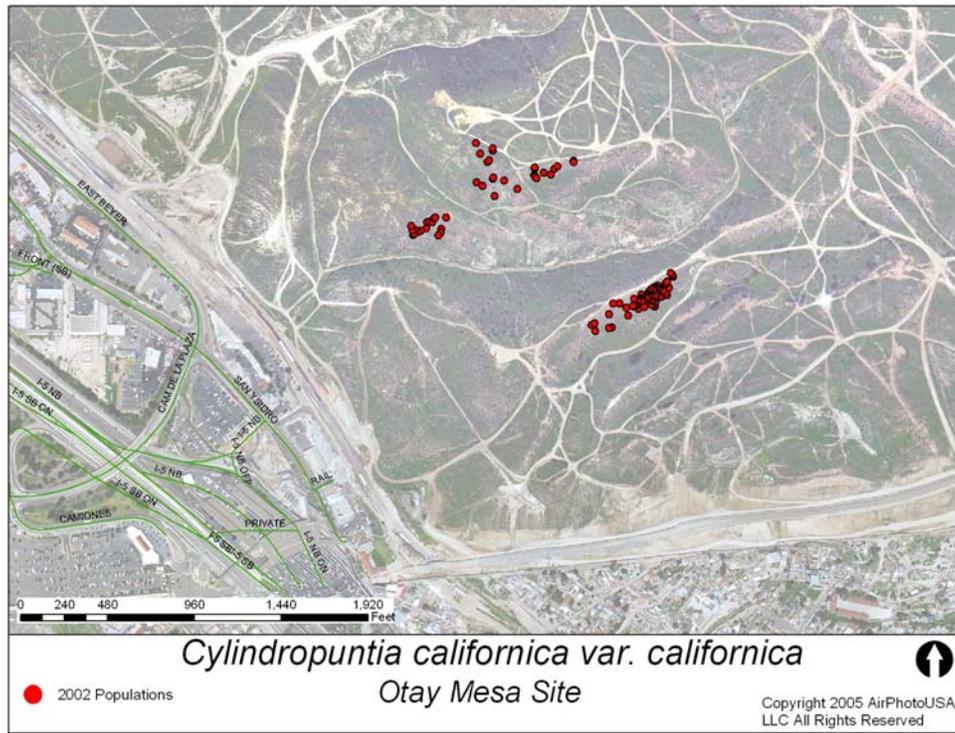
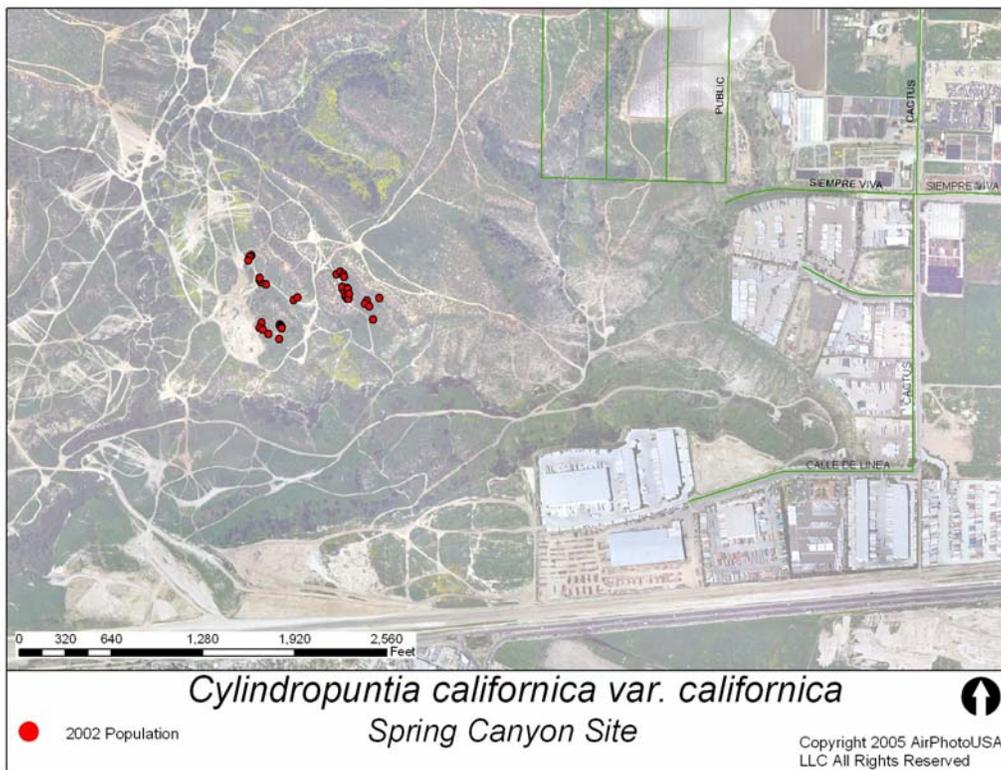


Figure 24. City of San Diego *Cylindropuntia californica* var. *californica* Monitoring Location, Spring Cnyn



***Deinandra conjugens* (Otay Tarplant)**

(Formerly *Hemizonia conjugens*)

MSCP Biological Monitoring Plan (BMP) Priority Listing and Required Monitoring Frequency [CBI Recommended Monitoring Frequency]:

First priority, Annually [Annually]

BMP Required and CBI Recommended City Monitoring Locations:

None

Additional Non-Required Monitoring Locations:

Proctor Valley

Years Monitored:

2003 (Proctor Vly)

2004 (Proctor Vly)

2005 (Proctor Vly)

Methodology:

There are three east/west transects within the Proctor Valley Otay Tarplant population that were established in 2000 using a random numbers table. Transects are used for belt transect surveying; all plants within one-half meter of either side of the transect are counted (for a one-meter wide belt). Population boundaries are also periodically flagged and mapped using a sub-meter GPS unit. Otay Tarplant can be confused with the more common *Deinandra fasciculata* (Fascicled Tarweed), but can be distinguished in the field by having eight ray flowers (petals); Fascicled Tarweed has only five. In 2005, a large area of of tarplant was found to be located nearby the previously mapped population (to the west, on other side of trail). However, it is unclear whether this area is newly established or this area simply wasn't surveyed in previous years. As such, it is recommended that an approximate survey area be delineated in future reports and mapping.

General: Note that the 2001 CBI report suggests preserve-wide annual "Non-quantitative surveys to assess resource presence/absence or distribution, using habitat mapping, aerial photography, or other imagery, and mapping of species distribution." According to the report, such preserve-level monitoring would be used "to inform management decisions – required of all preserve managers at all preserve units and monitoring directives."

Figure 25. City of San Diego *Deinandra conjugens* Monitoring Location, Regional Map

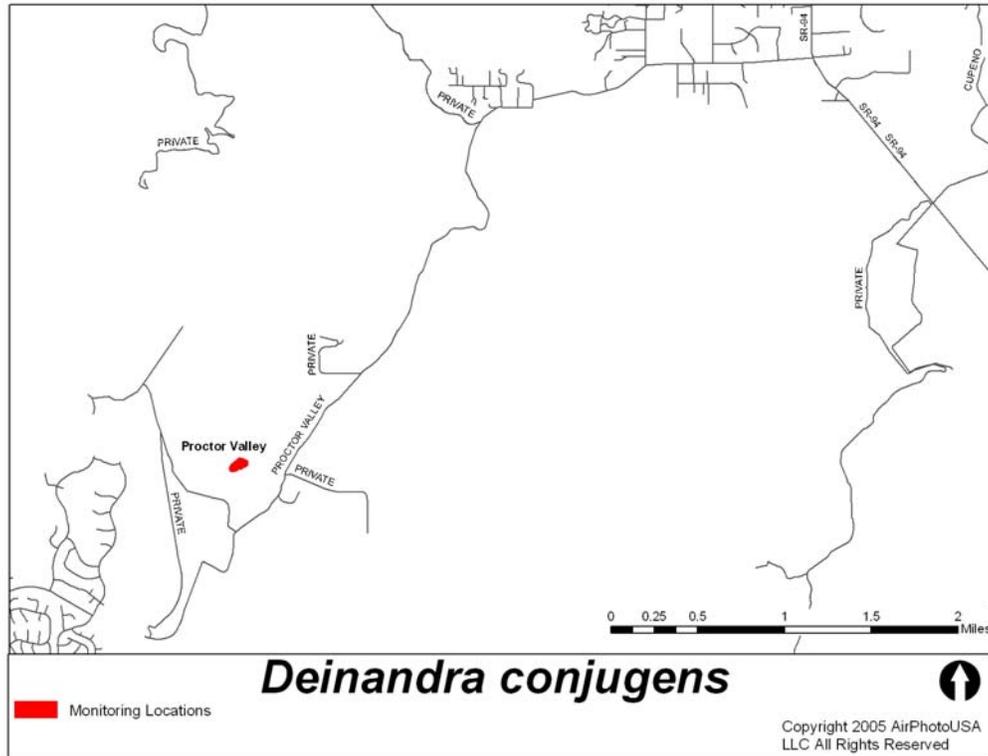
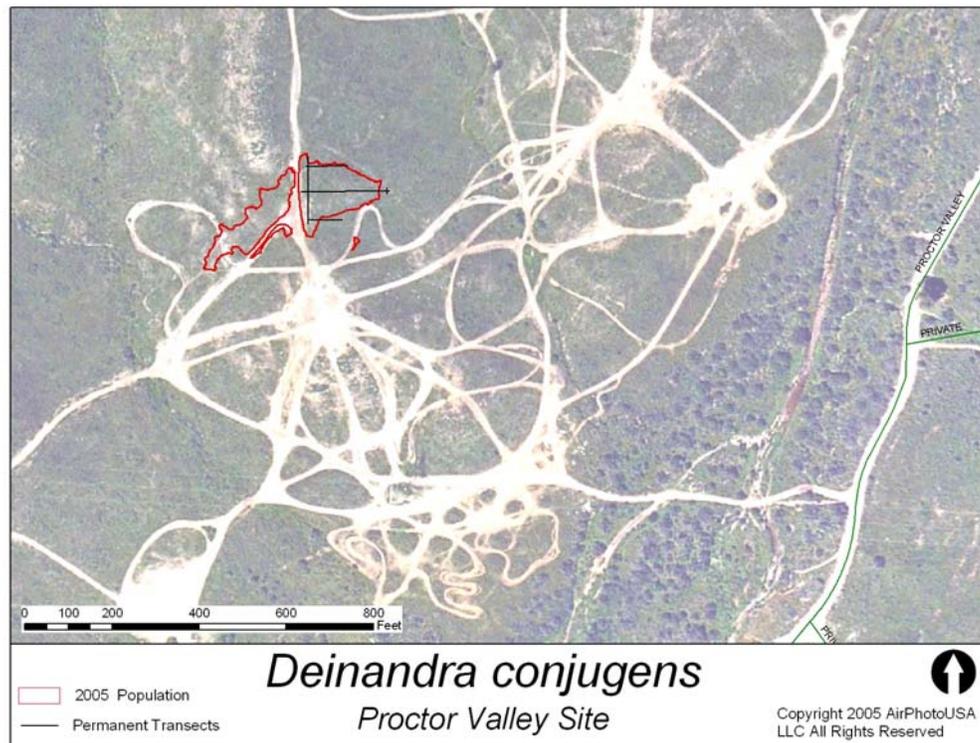


Figure 26. City of San Diego *Deinandra conjugens* Monitoring Location, Proctor Valley



***Dudleya brevifolia* (Short-Leaf Dudleya)**

(Formerly *Dudleya blochmaniae* ssp. *brevifolia*)

MSCP Biological Monitoring Plan (BMP) Priority Listing and Required Monitoring Frequency [CBI Recommended Monitoring Frequency]:

First priority, Annually [Annually]

BMP Required and CBI Recommended City Monitoring Locations (BMP Point and Site Priority):

Del Mar Heights/Crest Canyon (P-3; High priority)

Carmel Mountain (P-8; High priority)

Additional CBI Recommended Monitoring Location:

Del Mar Mesa

Note that neither the City's 2001 reconnaissance surveys nor the California Natural Diversity Database report any *Dudleya brevifolia* from the Del Mar Mesa area; thus, this area is not monitored.

Additional Locations Monitored in the City:

Skeleton Canyon (UCSD property)

Note that Torrey Pines populations have been surveyed by City staff in the past; however, these populations are on state lands and are no longer monitored by city staff due to access restrictions and staffing shortages; additionally, the 2001 CBI identifies State Parks as the responsible agent for these populations.

Years Monitored:

1999 (Crml Mtn)

2000 (Crml Mtn)

2001 (Crml Mtn, Crest Cnyn, Skeleton Cnyn)

2002 (Crml Mtn, Crest Cnyn, Skeleton Cnyn)

2003 (Crml Mtn, Crest Cnyn, Skeleton Cnyn, Torrey Pines)

2004 (Crml Mtn, Crest Cnyn, Skeleton Cnyn)

2005 (Crml Mtn, Crest Cnyn, pres/abs at Skeleton Cnyn)

Methods:

Carmel Mountain Permanent transects have been established at Carmel Mountain within three subpopulations. Transects of varying lengths were randomly selected using a random numbers table in 1999. Each subpopulation is adjacent to a trail, and transects are perpendicular to the trail, with the beginning point of each transect considered to be end nearest the trail. At each transect, beginning from the end closest to the trail, a one-meter quadrat is placed along the left side of each transect. All *D. brevifolia* individuals are counted within alternate one meter quadrats, skipping the first quadrat along the transect (e.g., the quadrat is laid with right side on the transect line and the bottom of the quadrat perpendicular to the transect starting point. This quadrat is not counted and the quadrat is flipped along its edge to the next 1m quadrat along the transect. All individuals in this second quadrat are counted and recorded, then the process is repeated along the length of each transect). If a quadrat does not fall entirely within the transect, it is not counted (i.e., if a quadrat falls at the end of the transect and is partially beyond the

transect terminus, it is not counted). Flowering status is also recorded for each plant counted: An individual is considered flowering if any internal flowering structures are visible (i.e., stamens, pistils) or if the plant has flowered (e.g., dried flower). It is non-flowering if no floral structures are present or if the plant is in bud stage only, with no internal flowering structures visible.

Crest Canyon There are two *D. brevifolia* subpopulations at Crest Canyon. The southernmost population is very small and scattered, and occurs in an area of high foot traffic. In 2005, locations of *D. brevifolia* in this area were recorded using a sub-meter GPS unit and all individuals were counted and recorded on data sheets. The more northern population, which is larger, is mapped using sub-meter GPS technology and notes are taken regarding co-occurring species (esp non-natives) and any potential threats or management concerns regarding the population.

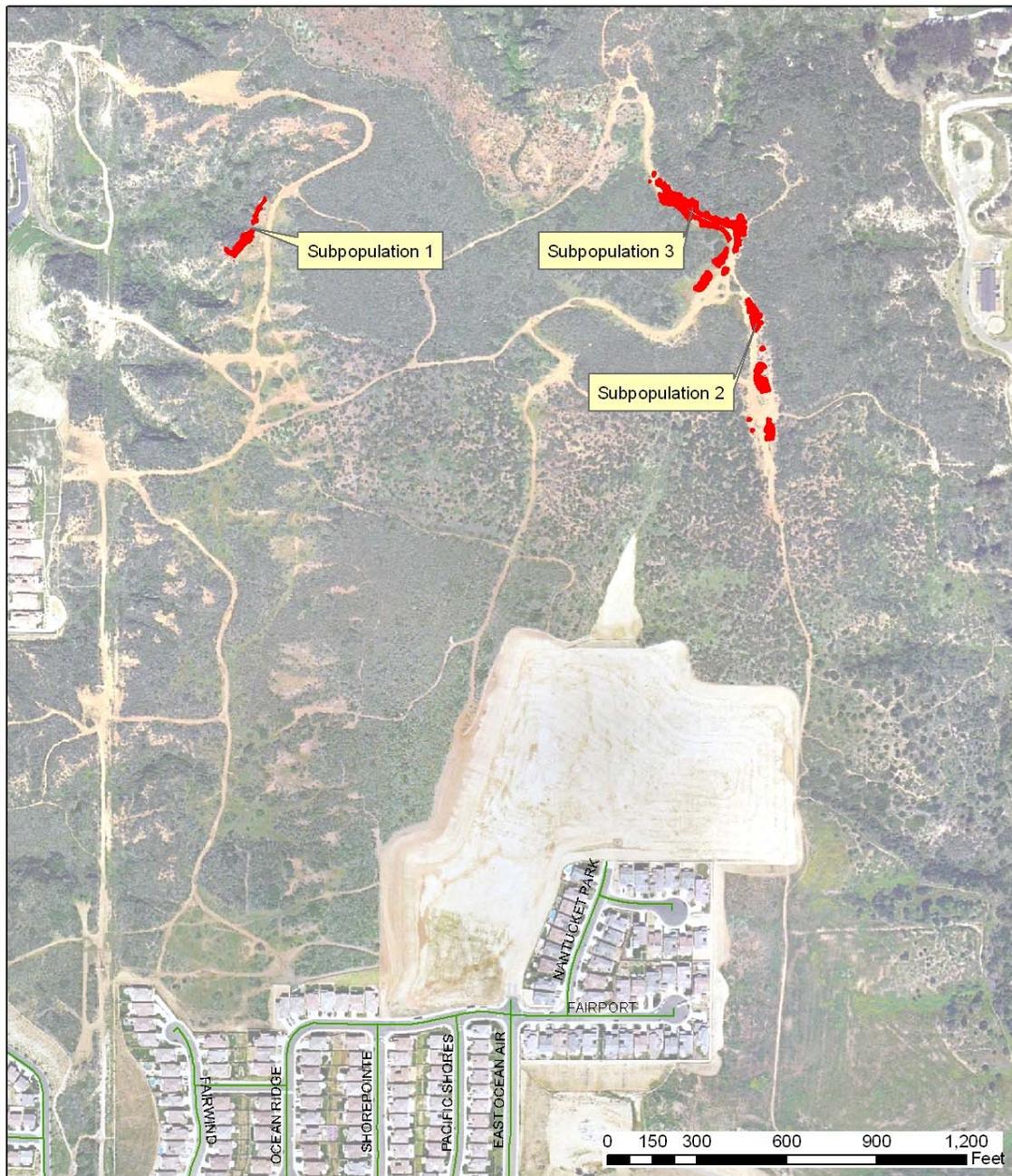
In the past, the northern population was monitored by selecting points in the field (non-randomly), and counts for several one m² plots were counted to estimate the total population number. Due to the delicacy of this species and potential for trampling, as well as questions about previous methodology, quadrats were not performed in this area in 2005. Instead, the population boundary was mapped using a sub-meter GPS unit, and potential population threats were assessed.

Skeleton Canyon Skeleton Canyon is owned by the University of California, San Diego. *D. brevifolia* has been monitored at this site by mapping the populations using sub-meter GPS and counting all individuals (census).

Torrey Pines State Park *D. brevifolia* has been monitored at Torrey Pines State Park in 2003 by mapping the populations using sub-meter GPS.

General Note that the 2001 CBI report suggests preserve-wide “mapping species distribution and quantitative or semi-quantitative surveys to assess resource abundance, density or other indices to monitor status and trends through time.” The report lists Del Mar Heights (Crest Canyon; P3), Carmel Mountain, Del Mar Mesa and Crest Canyon in its ‘summary of species locations recommended for qualitative monitoring’ for the City of San Diego, which may be the only known locations of the species in the City. Note that the double citation of Crest Canyon is presumably a mistake; it is believed that “Del Mar Heights (Crest Canyon; P3)” and “Crest Canyon” both refer to the two populations within Crest Canyon Park.

Figure 28. City of San Diego *Dudleya brevifolia* Monitoring Locations, Carmel Mtn



Dudleya brevifolia

Carmel Mountain Site



 2005 Population

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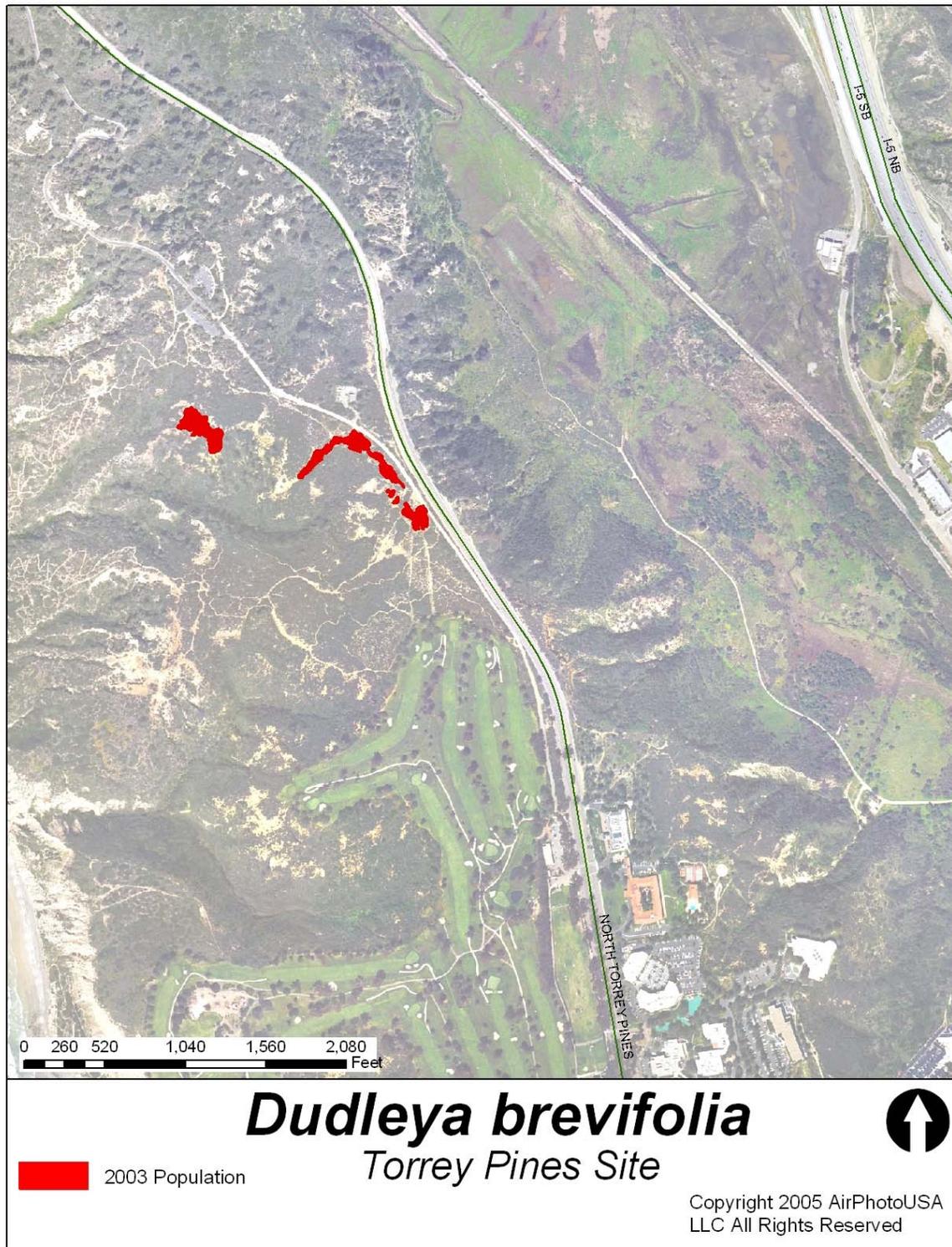
Figure 29. City of San Diego *Dudleya brevifolia* Monitoring Locations, Crest Cnyn



Figure 30. City of San Diego *Dudleya brevifolia* Monitoring Location, Skeleton Canyon



Figure 31. City of San Diego *Dudleya brevifolia* Monitoring Location, Torrey Pines



***Dudleya variegata* (Variegated Dudleya)**

MSCP Biological Monitoring Plan (BMP) Priority Listing and Required Monitoring Frequency [CBI Recommended Monitoring Frequency]:

First priority, Annually [Annually]

BMP Required and CBI Recommended City Monitoring Locations (BMP Point and Site Priority):

Sycamore Canyon/East Elliot/Fanita (P-15; High priority; Note that Fanita is Santee)

Otay River West (p-28; High priority; Note that CBI lists responsibility as 'Cities of Chula Vista/SD/County')

Marron Valley (P-34; High priority)

Additional CBI Recommended Monitoring Location:

Otay Mesa (CBI lists responsibility as 'City/County of SD' for this site)

Additional Locations Monitored in the City:

Black Mountain Ranch

Margerum Avenue

Mercy Road

Mission Trails Regional Park

Otay Lakes

Penasquitos Canyon

Santa Luz/Black Mountain

Spring Canyon/Goat Mesa

Years Monitored:

2001 (BMR, Margerum Rd, Mercy Rd., MTRP, Otay Lakes, Spring Cnyn)

2002 (BMR, Margerum Rd, Mercy Rd., MTRP, Otay Lakes, Spring Cnyn)

2003 (BMR, Margerum Rd, Mercy Rd., MTRP, Otay Lakes, Spring Cnyn)

2004 (East Elliot, Margerum Rd, MTRP, Otay Lakes, Spring Cnyn)

2005 (MTRP, Marron Valley, Otay Lakes, Spring Cnyn)

Methods:

Mission Trails Regional Park, Peñasquitos Canyon, and Santa Luz/Black Mountain *D. variegata* monitoring at these sites is performed by Mike Kelly and other volunteers. All populations are censused.

Marron Valley The *D. variegata* population is at Marron Valley is flagged, the boundaries are mapped using sub-meter GPS, and all flowering and non-flowering individuals within each area are counted (census) and recorded using standard data sheets. An individual is considered flowering if the internal flowering structures are visible (e.g., anthers, etc.), or if the plant has flowered (e.g., dried flower).

Otay Lakes At Otay Lakes, sixteen permanent transects were established randomly using a random numbers table within the *D. variegata* population in 2001. The transects are maintained as a GIS file and are relocated and flagged in the field. The transects are used for belt transect monitoring; the center line of the transect serves as the center point of a one-meter wide belt.

The transect is walked with a one-meter wide plastic pipe (approximately 2" wide pvc irrigation pipe, with the center line marked), and each *D. variegata* located within the one-meter wide belt is counted and recorded on standard data sheets. Flowering status is also recorded for each plant counted: An individual is considered flowering if internal flowering structures are visible (i.e., stamens, pistils) or if the plant has flowered (e.g., dried flower). It is non-flowering if no floral structures are present or if the plant is in bud stage only, with no internal flowering structures present.

General: Note that in addition to selected preserve area quantitative monitoring at the sites identified above, the 2001 CBI report suggests preserve-wide annual "Non-quantitative surveys to assess resource presence/absence or distribution, using habitat mapping, aerial photography, or other imagery, and mapping of species distribution." According to the report, such preserve-level monitoring would be used "to inform management decisions" and should be performed by "all preserve managers at all preserve units and monitoring directives."

Timing Note: This species can be difficult to locate when surrounding tarplant (*Deinandra fasciculata*) is in flower; this is most apparent at the Otay Lakes sites. If monitoring can be scheduled at the earliest stage of *D. variegata* flowering, tarplant can sometimes be avoided since its blooming time is slightly later. Early May in 2005 (very wet year) proved a good time for monitoring at the Otay Lakes site.

Figure 33. City of San Diego *Dudleya variegata* Monitoring Location, East Elliott

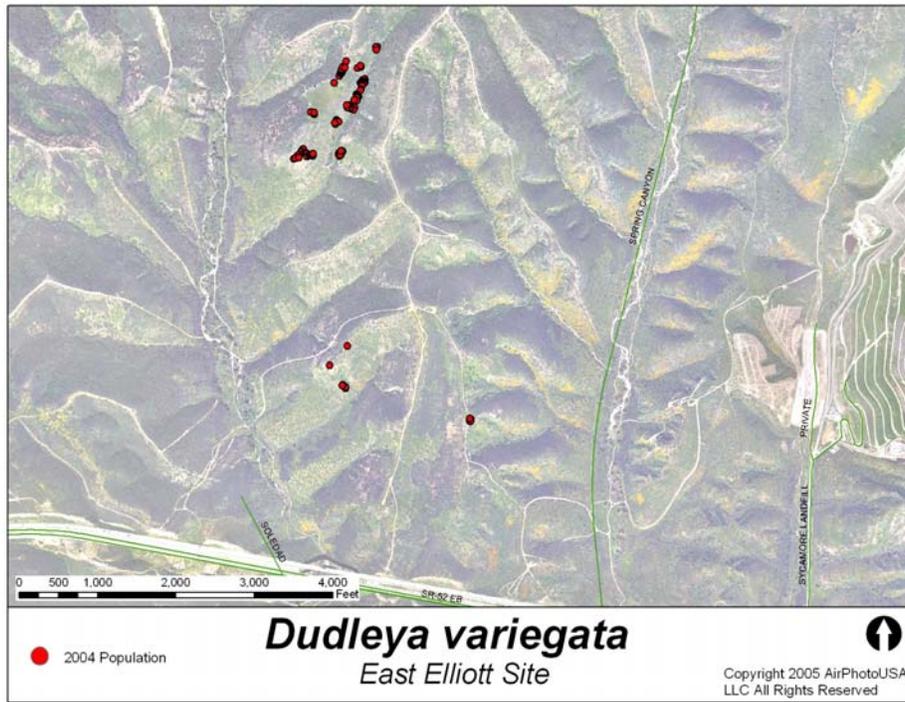


Figure 34. City of San Diego *Dudleya variegata* Monitoring Location, Marron Valley Vicinity Map

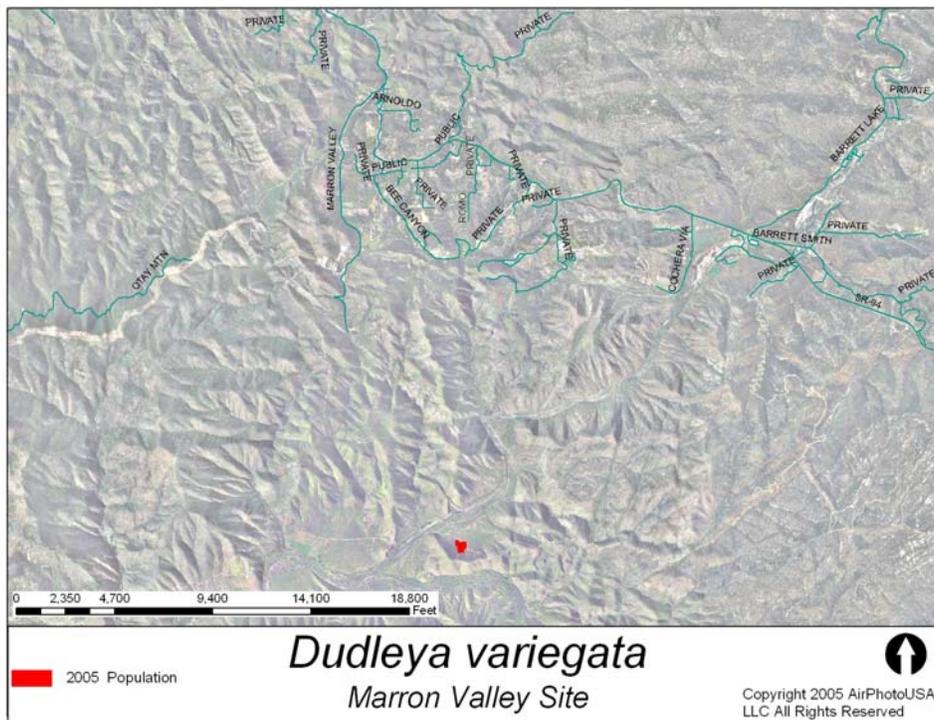


Figure 35. City of San Diego *Dudleya variegata* Monitoring Location, Marron Valley

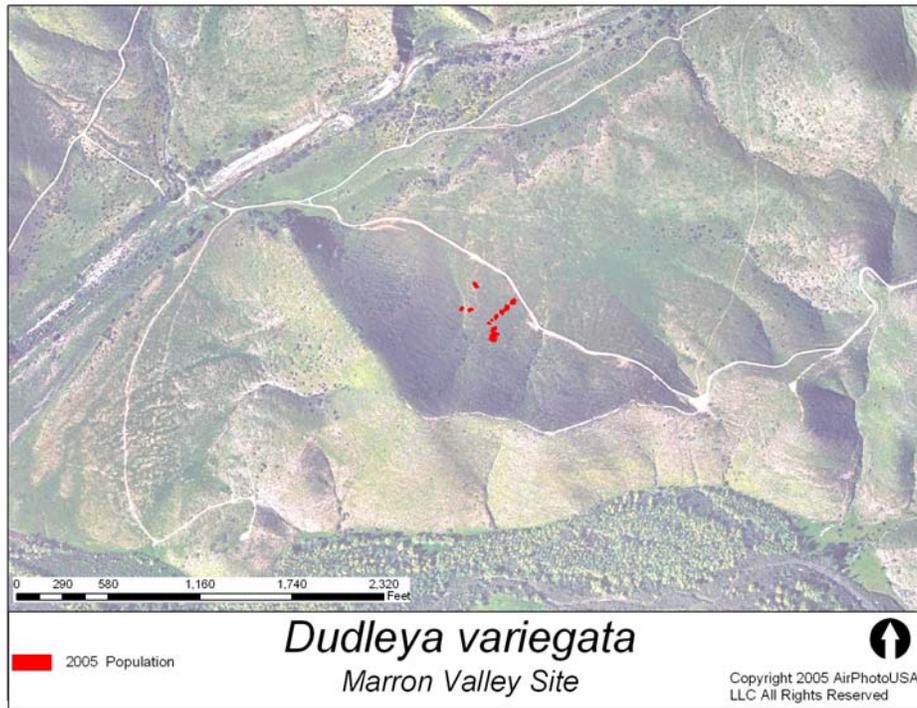


Figure 36. City of San Diego *Dudleya variegata* Monitoring Location, MTRP

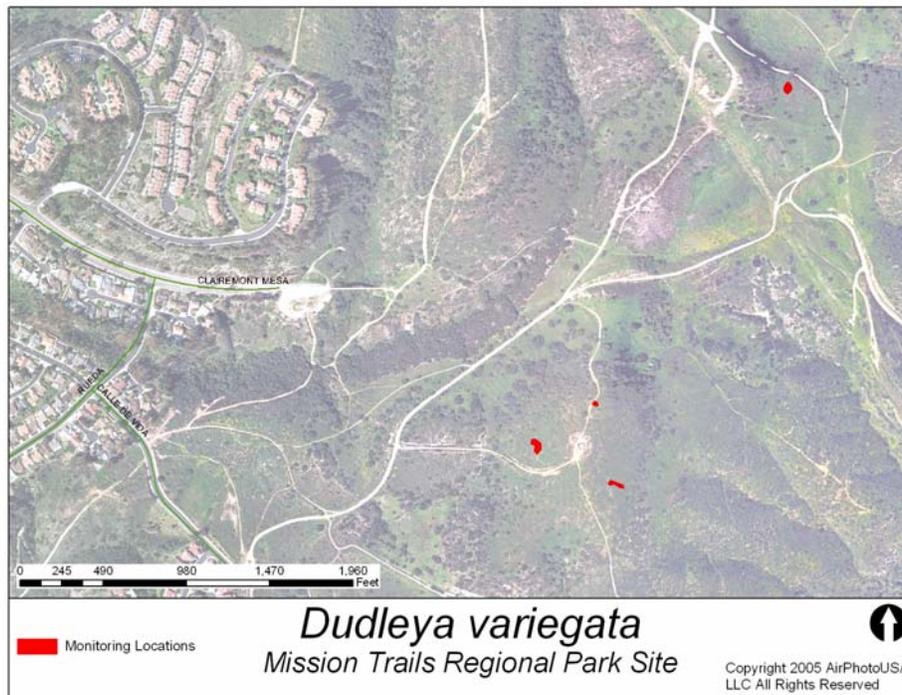
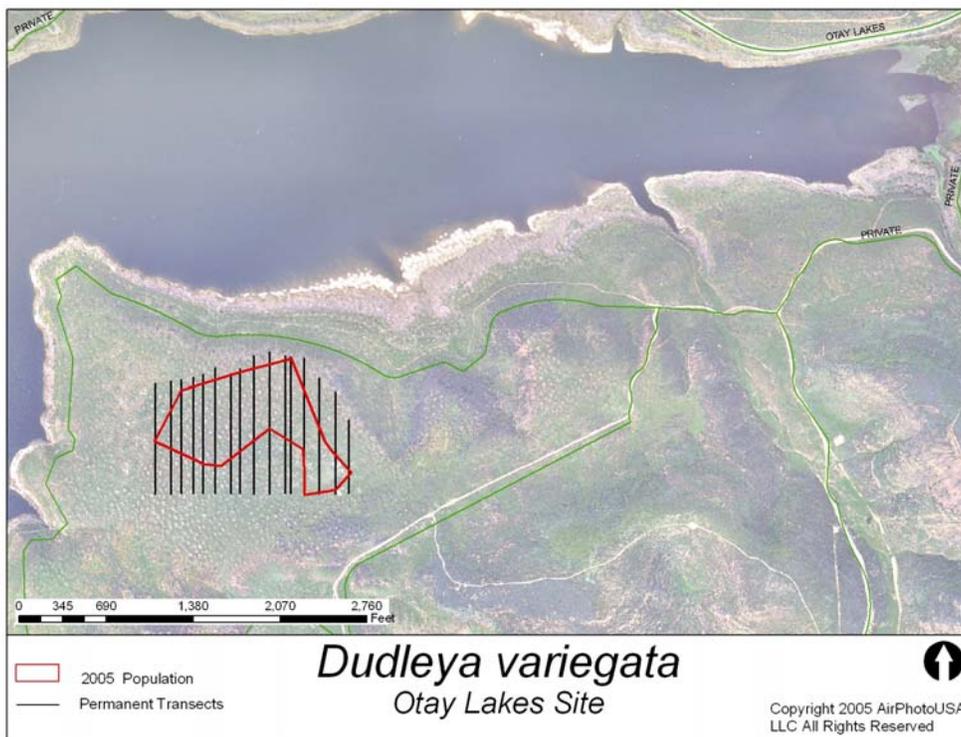


Figure 37. City of San Diego *Dudleya variegata* Monitoring Location, Otay Lakes



***Lessingia filaginifolia* var. *linifolia* (Del Mar Sand Aster)**

(aka *Lessingia filaginifolia* var. *filaginifolia*; Formerly *Corethrogyne filaginifolia* var. *linifolia*)

MSCP Biological Monitoring Plan (BMP) Priority Listing and Required Monitoring Frequency [CBI Recommended Monitoring Frequency]:

Second priority, Every two years [Annually]

BMP Required and CBI Recommended City Monitoring Locations (BMP Point and Site Priority):

San Dieguito River Bluffs (Overlook Park and Torrey Highlands) (P-4; Moderate Priority)

Del Mar Mesa (P-10; Moderate priority)

Additional CBI Recommended Monitoring Location:

Del Mar Highlands (Crest Canyon)

Carmel Mountain

Note that two populations are monitored on Carmel Mtn, and Crml Mtn West has been referred to as ‘Carmel Valley’ in past reports, with the eastern population referred to as ‘Carmel Mountain’ or ‘Carmel Mtn East.’ Below, ‘Carmel Mtn’ refers to both populations.

Years Monitored:

2001 (Overlook Park and Torrey Highlands; Carmel Mountain)

2002 (Overlook Park and Torrey Highlands; Carmel Mountain)

2003 (Overlook Park and Torrey Highlands; Carmel Mountain)

2005 (Overlook Park and Torrey Highlands; Carmel Mountain)

Methods:

A census of all individuals within each monitored population is conducted. Populations were mapped using submeter GPS technology in 2005 and should be periodically re-mapped when needed and as staffing/scheduling allows. During 2005 surveys, several very large subpopulations were located along the San Dieguito River Bluffs (Overlook Park and Torrey Highlands) that were not previously mapped. At the Overlook Park site, it is known that only previously mapped sites were re-visited/censused; however, it is unclear whether the Torrey Highlands areas are newly established populations or the areas simply were not surveyed in previous years. As such, an approximate survey boundary line should also be delineated along with population boundaries. Additionally, for larger populations, a subsampling method has been discussed due to the difficulty and potential inaccuracies in counting very large numbers of individuals. Because the species is associated with disturbed/bare areas, Del Mar Sand Aster is scattered throughout the monitoring sites. Many of the sites are fairly large and are difficult as well as time-consuming to survey due to steep terrain and heavy brush.

Note that in addition to selected preserve area quantitative monitoring at the sites identified above, the 2001 CBI report suggests preserve-wide annual “Non-quantitative surveys to assess resource presence/absence or distribution, using habitat mapping, aerial photography, or other imagery, and mapping of species distribution” for Del Mar Sand Aster and that this preserve-level monitoring should be used to “inform management decisions” and is “required of all preserve managers at all preserve units where species occurs.”

The 2001 CBI report also recommends that “area-specific management directives must address the autecology and natural history of [this] species, which may require quantitative studies not associated with population trend monitoring.”

Figure 38. City of San Diego *Lessingia filaginifolia* var. *linifolia* Monitoring Location, Regional Map

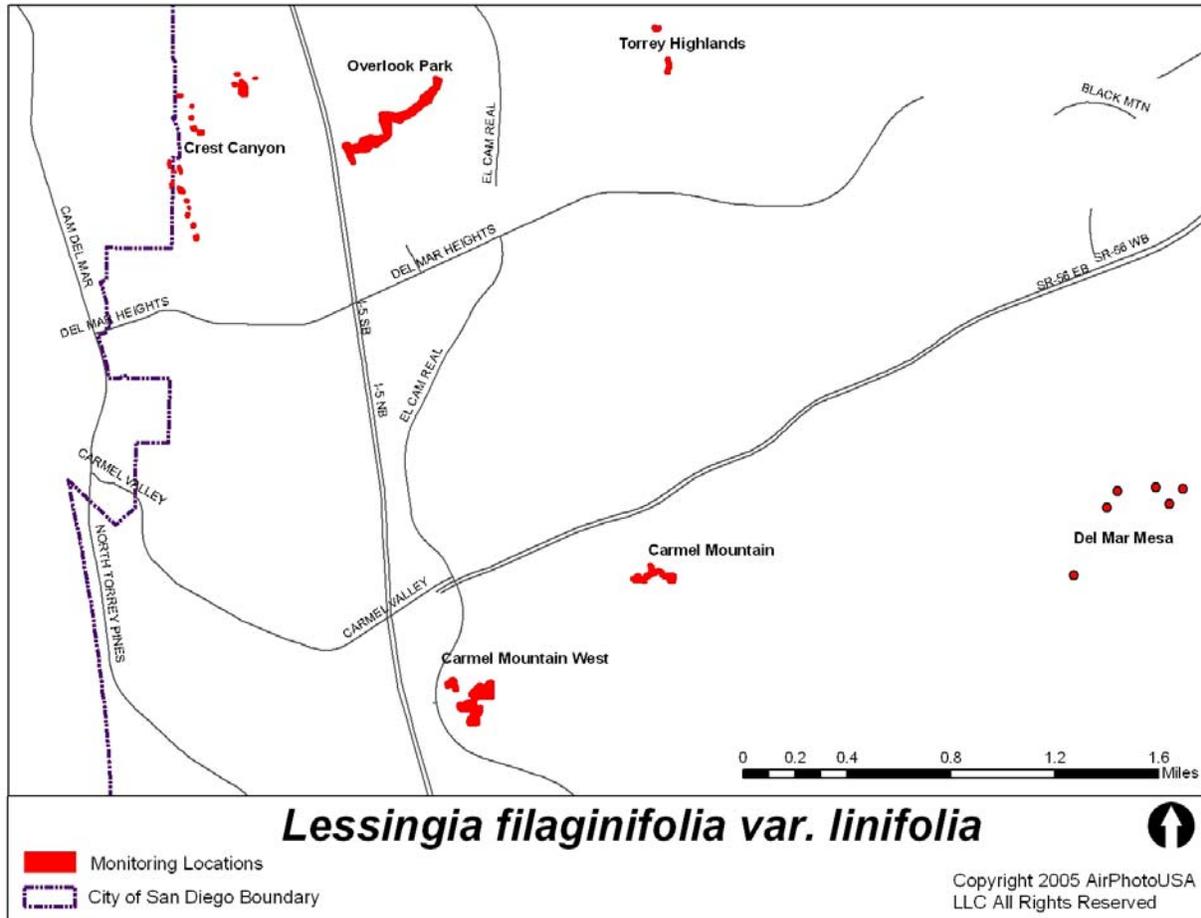


Figure 39. City of San Diego *Lessingia filaginifolia* var. *linifolia* Monitoring Location, Carmel Mountain

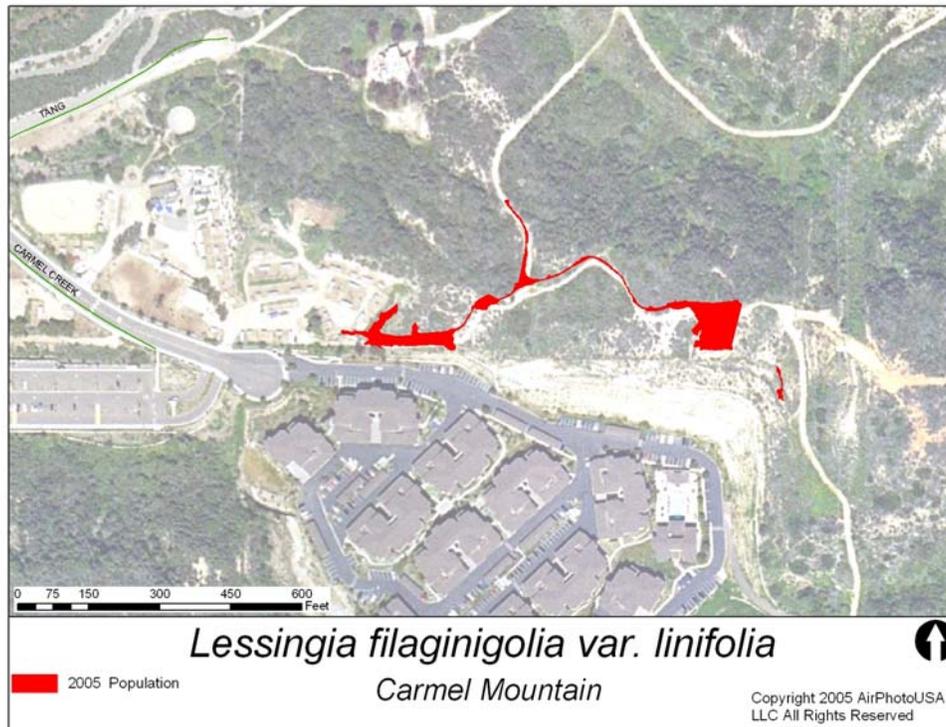


Figure 40. City of San Diego *Lessingia filaginifolia* var. *linifolia* Monitoring Location, Carmel Mtn West

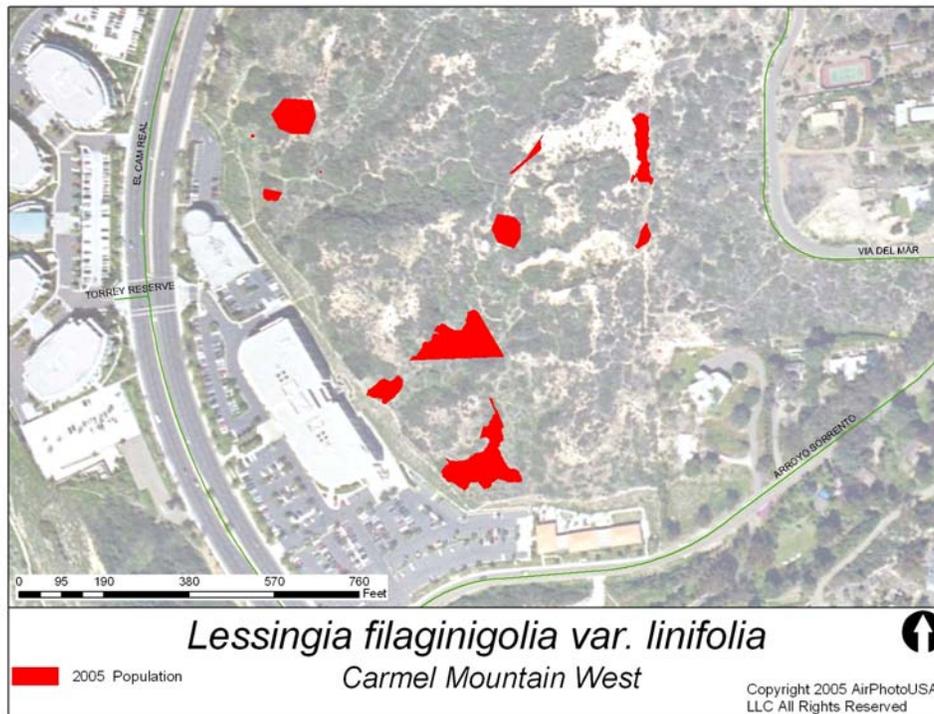


Figure 41. City of San Diego *Lessingia filaginifolia* var. *linifolia* Monitoring Location, Crest Cnyn

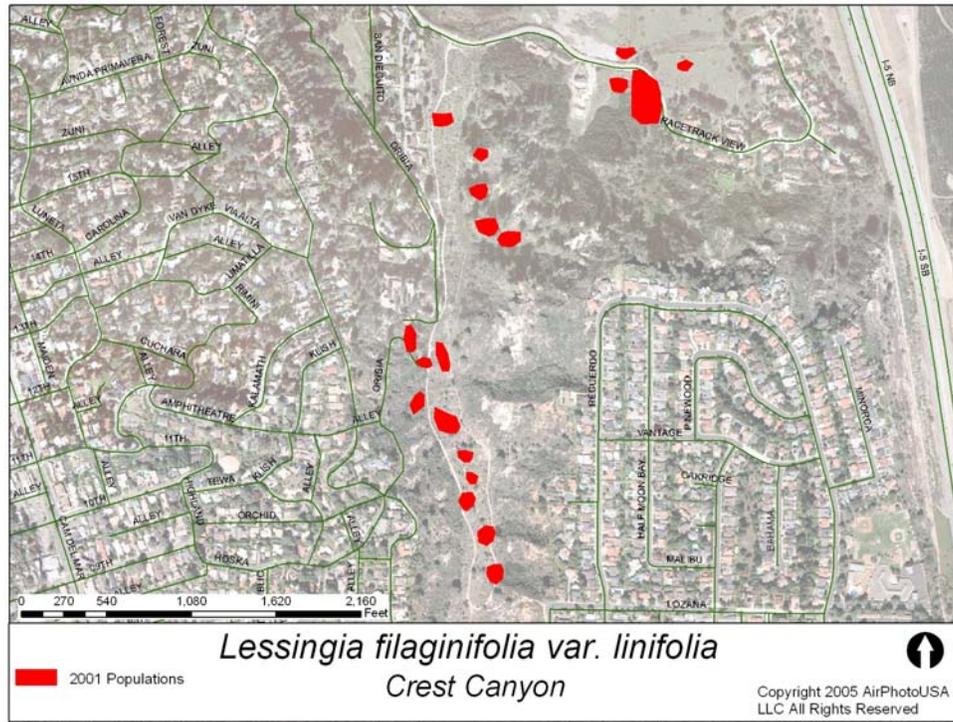


Figure 42. City of San Diego *Lessingia filaginifolia* var. *linifolia* Monitoring Location, Overlook Park

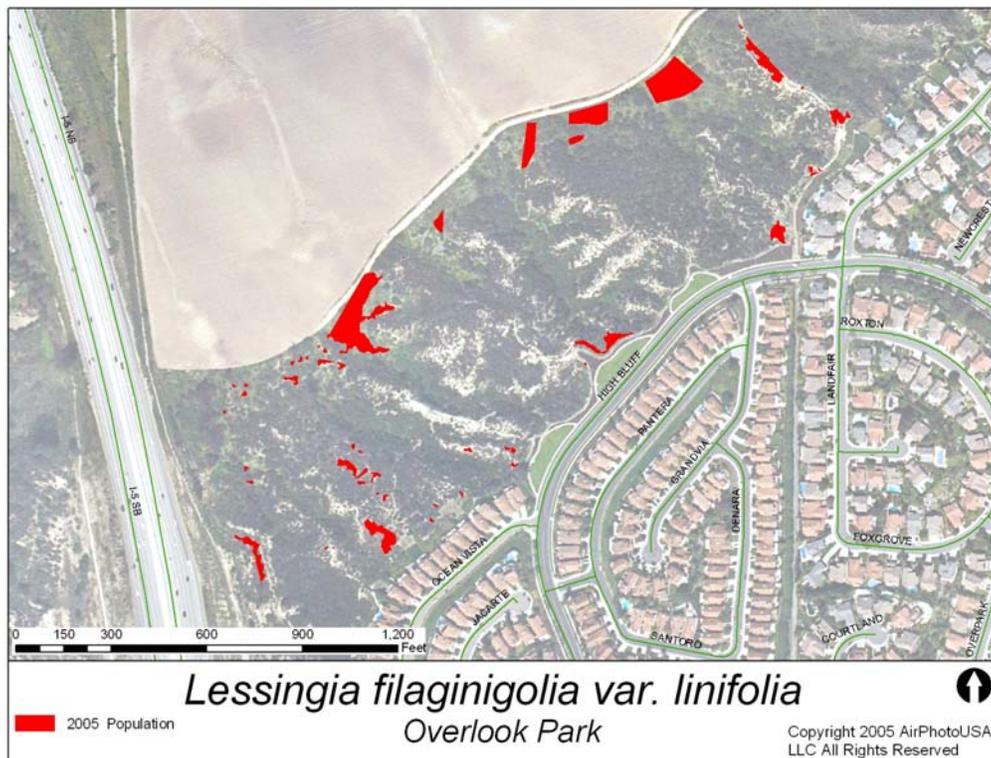


Figure 43. City of San Diego *Lessingia filaginifolia* var. *linifolia* Monitoring Location, Torrey Highlands

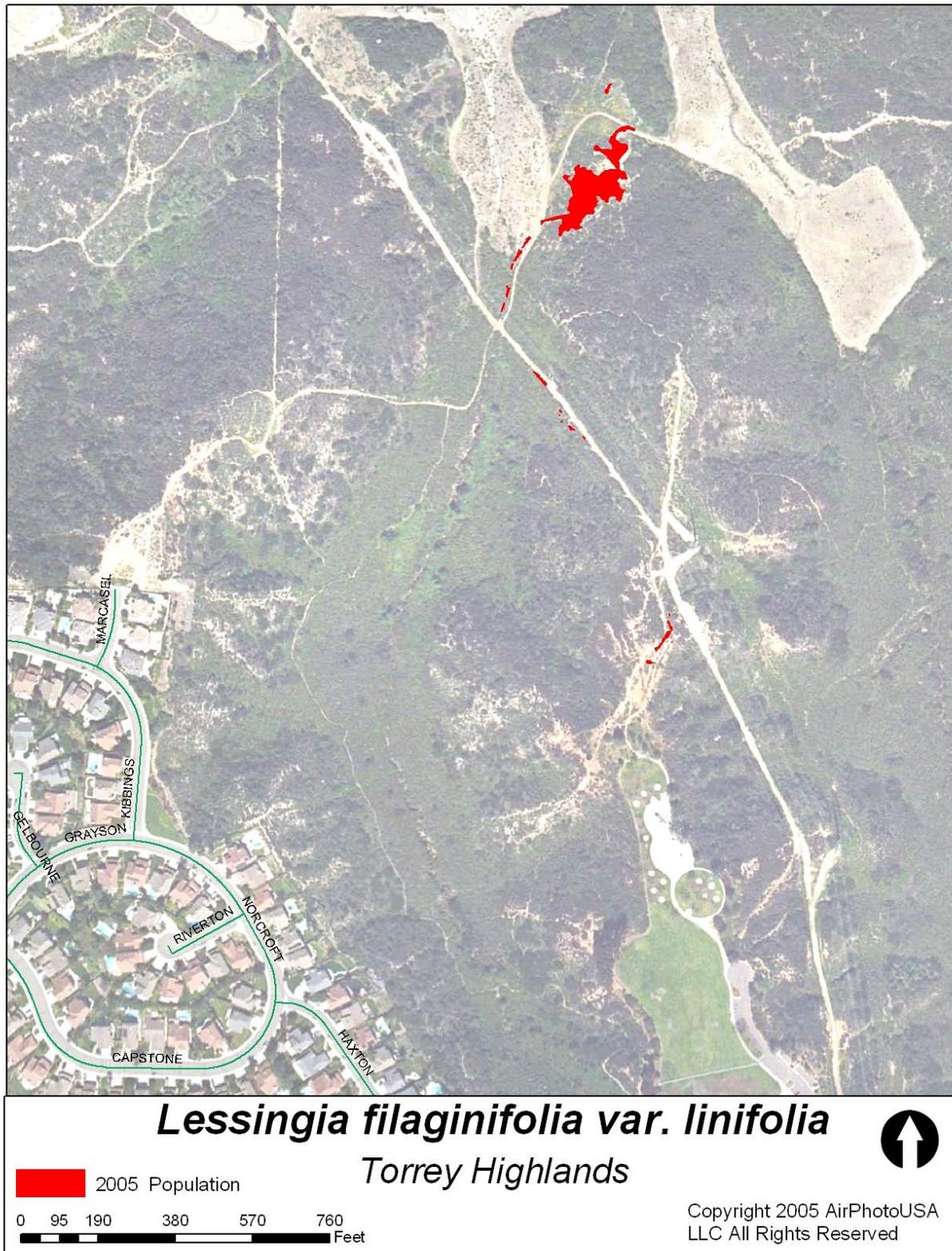
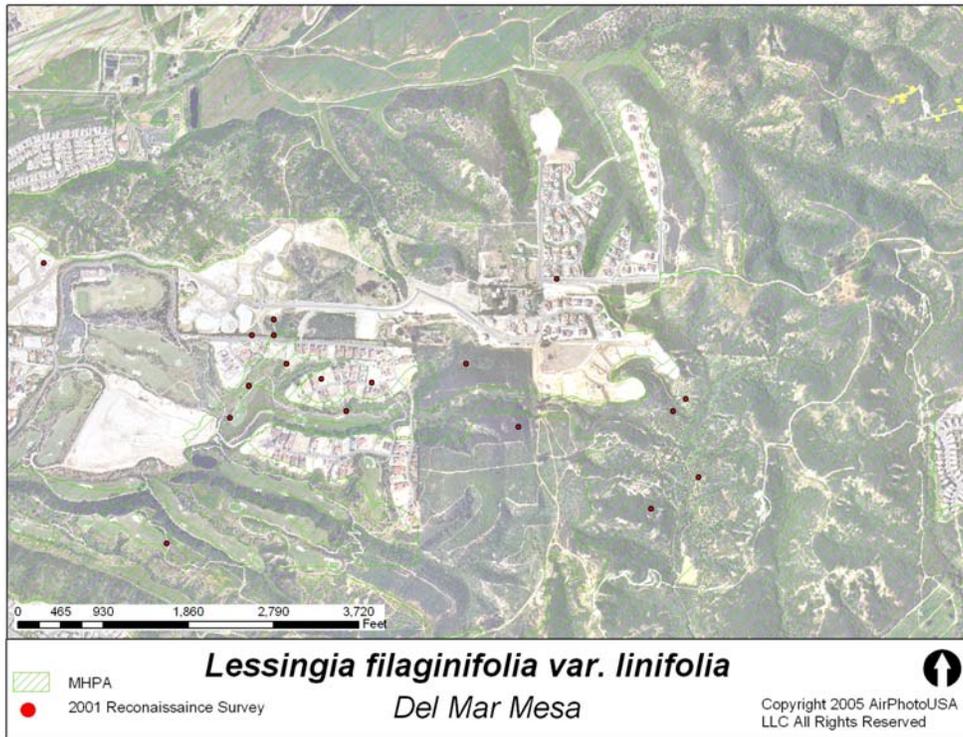


Figure 44. City of San Diego *Lessingia filaginifolia* var. *linifolia* Monitoring Location, Del Mar Mesa



***Lotus nuttallianus* (Nuttall's lotus)**

MSCP Biological Monitoring Plan (BMP) Priority Listing and Required Monitoring Frequency [CBI Recommended Monitoring Frequency]:

First priority, Annually [Annually]

BMP Required City Monitoring Locations:

None

CBI Recommended Monitoring Location:

San Diego River Flood Control Channel ('Hospitality Point – Riprap' or 'Site 3' of Mission Bay)

Additional Locations Monitored in the City:

Non-flood control portions of Mission Bay ('Sites 1-2 and 4-6')

Years Monitored:

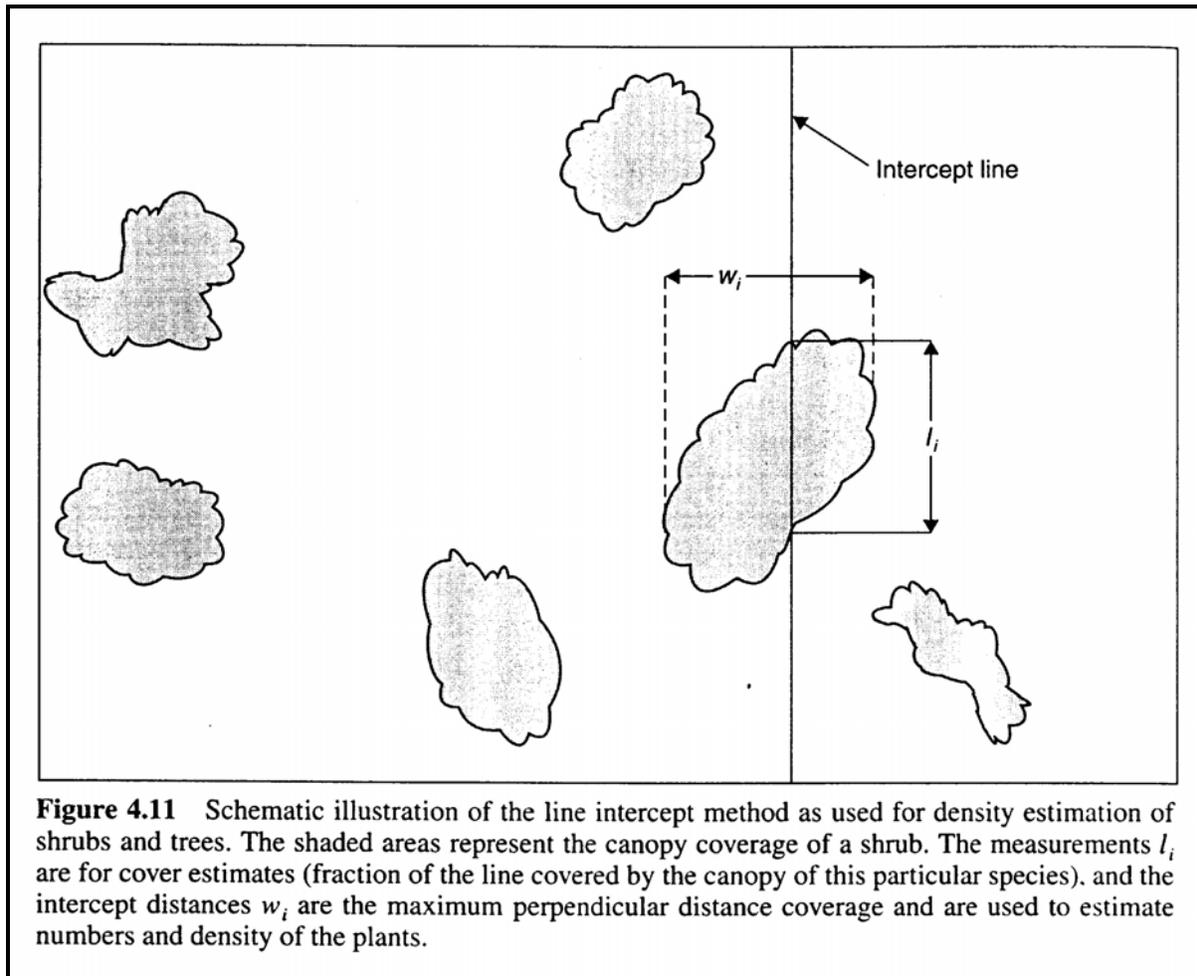
2000-2005 (Mission Bay, 'Sites 1-6')

Methods:

There are six *L. nuttallianus* populations monitored within Mission Bay Park, including: a) No Men's Land ('Site 1'), which overlays an historic landfill; b) West No Men's Land ('Site 6'), which may partially overlay the historic landfill; c) Hospitality Point- Volleyball Court ('Site 2'); d) Hospitality Point-Riprap ('Site 3'); and e) Mariner's Point/Least Tern Nesting Site ('Site 4'). An area referred to as 'Site 5' is a small population growing in pavement cracks near Mission Beach School; this site is visited only if time allows due to generally low population numbers and the disturbed nature of the area.

Prior to 2003, all populations were censused. However, in 2003 the populations at No Men's Land and West No Men's Land ('Sites 1 and 6', which are bisected by Sea World Drive) were too large to census. For these sites, 100-foot permanent line using a random numbers table in 2003. The populations are now surveyed using the T-square line intercept method (Krebs, 1998). A string is placed along the transect in the field, and each individual plant that crosses the line transect is measured along the length of the transect (e.g., distance that *L. nuttallianus* individual is in contact with transect) as well as perpendicular to the transect (e.g., maximum plant width of plant perpendicular transect). See figure from Krebs, below.

Figure 45. Illustration of Line Intercept Method (Krebs, 1998)



This information is recorded on standard data sheets and is then used to estimate the population density based on the following equation:

$$\text{Density} = (1/\text{total length of transects})(\text{Sum of } [1/\text{perpendicular width of plants intercepted}])$$

Additionally, in 2005 each transect was photographed and labeled in the office with its corresponding transect number. In the field, a photo of the transect datasheet or other indicator of transect number is taken immediately prior to the transect photo (for transect # identification in the office), and each transect is photographed with line-intersect string visible when possible. Transect photography and labeling was initiated in 2005. Though some monitoring photos were taken in previous years, they are unlabeled and therefore may not be useful for comparison unless the photo point can be determined using horizon landmarks.

L. nuttallianus populations at the Hospitality Point sites ('Sites 2 and 3') are determined by full census (e.g., counting all individuals present). However, it was noted at the Hospitality Point 'rip rap' site, the population appears to extend beyond the monitored area. Due to staff and time constraints, the full additional area was not added to the monitoring survey; however, should be

considered for additional monitoring. This may require a sub-sampling methodology, especially in high rainfall years.

The Mariner’s Point site (‘Site 4’), is entirely fenced to protect Least Terns, which are known to nest at the site. This population is visited and viewed through the fence so as not to disturb nesting. A qualitative assessment is made of the area. Because the area is fenced and protected from foot traffic and is regularly weeded by volunteers to protect terns at the site, this site does not typically have any significant management issues.

General Note that the 2001 CBI report suggests preserve-wide “mapping species distribution and quantitative or semi-quantitative surveys to assess resource abundance, density or other indices to monitor status and trends through time” for *Lotus nuttallianus*. The report lists only the San Diego River Flood Control Channel in its ‘summary of species locations recommended for qualitative monitoring.’”

Figure 46. City of San Diego *Lotus nuttallianus* Monitoring Location, Vicinity Map

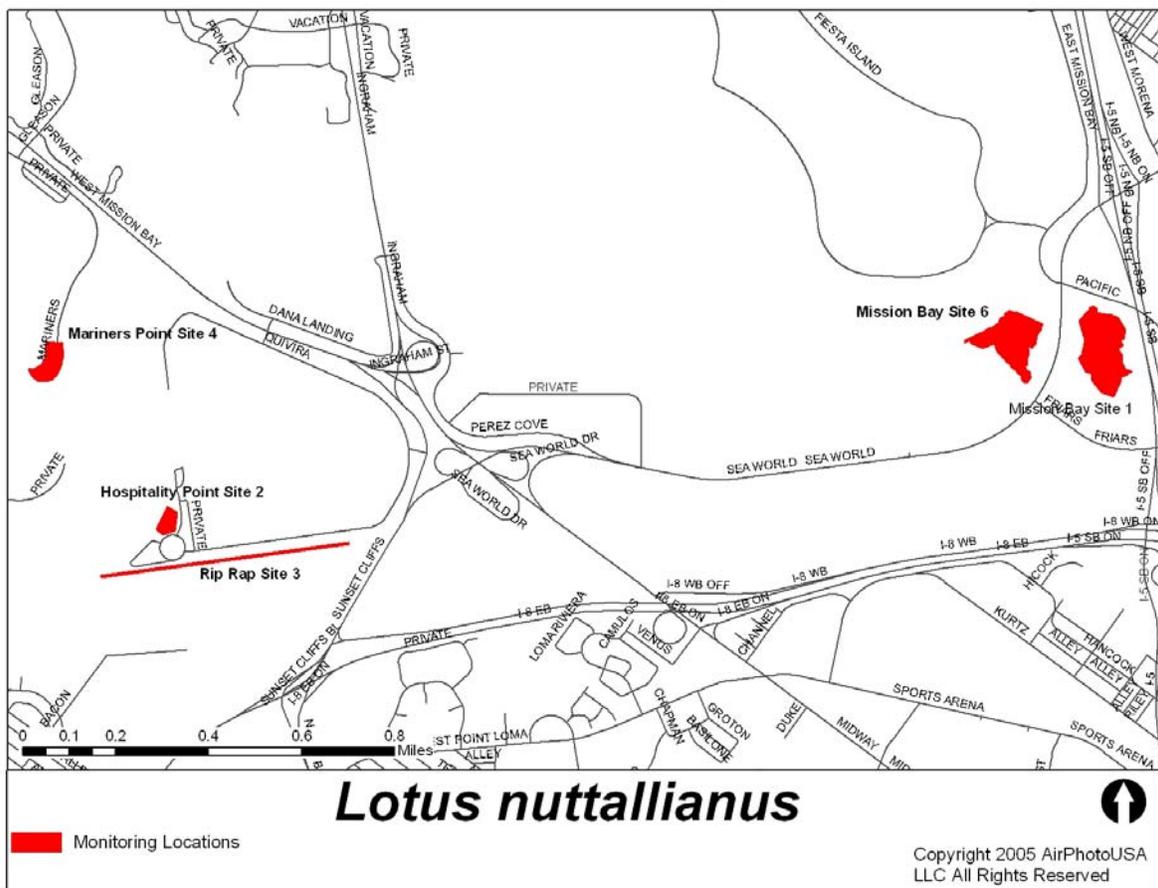


Figure 47. City of San Diego *Lotus nuttallianus* Monitoring Location, Mariner's Point



Figure 48. City of San Diego *Lotus nuttallianus* Monitoring Location, No Men's and S. Shores

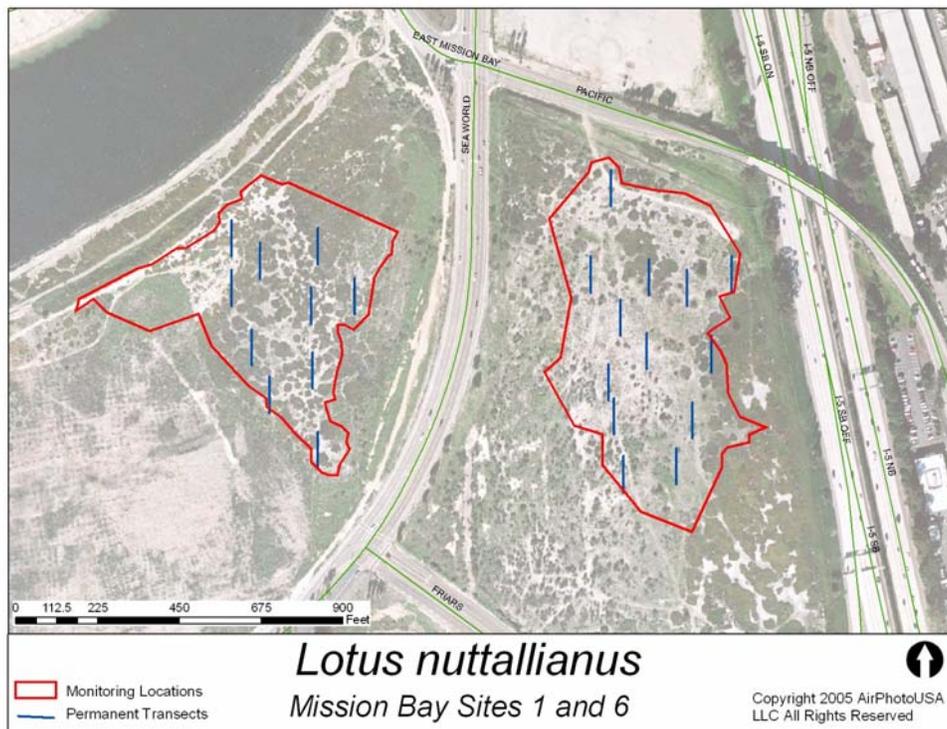
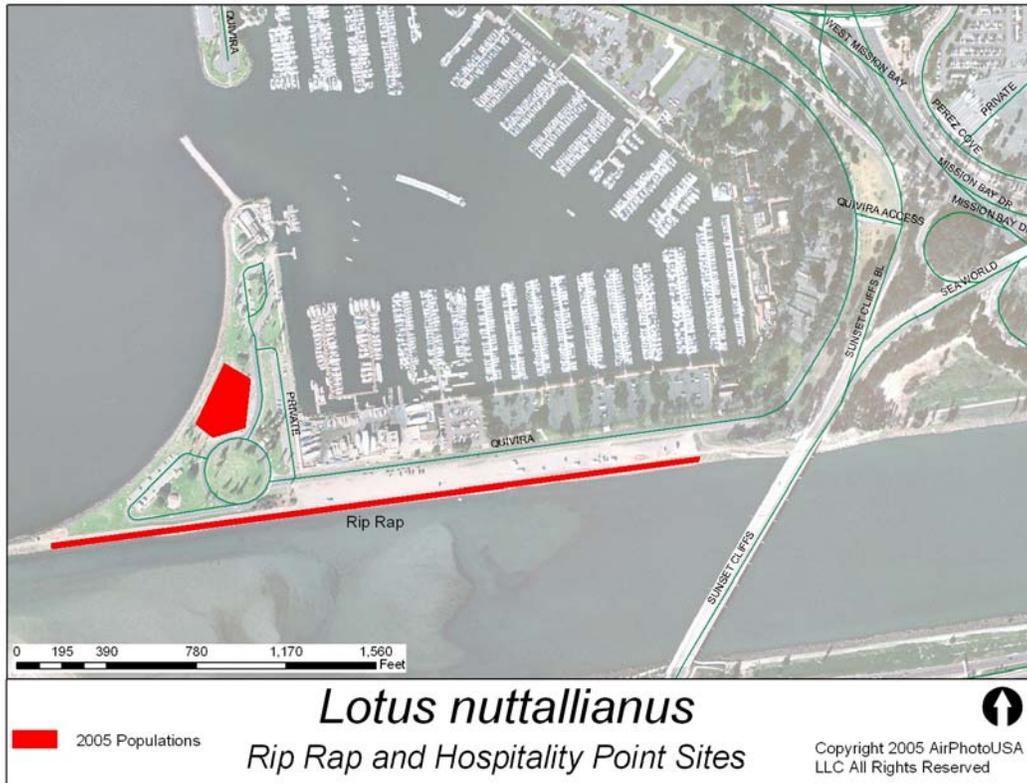


Figure 49. City of San Diego *Lotus nuttallianus* Monitoring Location, SD River Rip Rap and Hospitality Pt.



***Monardella viminea* (Willowy Monardella)**

Formerly *Monardella linoides* ssp. *viminea*, recent taxonomic work by Sanders and Elvin supports species classification

MSCP Biological Monitoring Plan (BMP) Priority Listing and Required Monitoring Frequency [CBI Recommended Monitoring Frequency]:

First priority, Annually [Annually]

BMP Required Monitoring Locations:

None

CBI Recommended Monitoring Location:

Marron Valley

Additional Locations Monitored in the City:

Sycamore Canyon

Lopez Canyon

Otay Lakes

Note that the Sycamore Canyon/P-14 population is the responsibility of the City of Santee; City staff monitor the small population west of Goodan Ranch in the Rancho Encantada area open space owned by the City of San Diego.

Years Monitored:

2000-2004 (all)

2005 (Lopez Cyn, Marron Valley, Sycamore Cyn)

Methods:

All plants are mapped using sub-meter GPS technology. If there are relatively low numbers of the plant, this can be done as point counts and either noting in the GPS layer whether each individual is flowering or non-flowering, or by assigning point numbers and using standard field sheets to note flowering status. For larger populations, the population boundaries can be mapped with polygons, and clump/plant counts and flowering status can be recorded in GPS fields or on standard field note sheets.

Because of this plant's clumping pattern of growth and tendency to have underground stems, individual plant extents can be difficult to determine. For consistency, a plant is considered one individual plant, or plant clump, if no other *M. viminea* stem bases are located within one foot of the plant's (clump's) stem base.

Note that the 2001 CBI report suggests preserve-wide "mapping species distribution and quantitative or semi-quantitative surveys to assess resource abundance, density or other indices to monitor status and trends through time." However, the report lists only Marron Valley for City of SD monitoring in its 'summary of species locations recommended for qualitative monitoring.'

It should also be noted that the southern populations of this species, including the Marron Valley population, have been described as a new species, *M. stoneana* (Novan).

Special Instructions and Driving Directions:

For the City’s Rancho Encantado lands near Sycamore Canyone, Coordinate entry through the County’s Sycamore Canyon/Goodan Ranch Park gate with Ranger Maureen Abare-Laudy prior to fieldwork [Goodan General #: 858/513-4737; Ranger Maureen Cell # 619/981-6438; email: Maureen.Abare-Laudy@sdcounty.ca.gov].

From downtown, take SR-163 North, then I-15 North. Take Poway Road east (right) to Garden Road; there is a 7-11 at the southeast corner of this intersection. Go right (south) on Garden Road. Garden will wind around to the east and come to a fork near Morning Star Ranch. Veer south (right) at this fork and continue on Sycamore Canyon Road. Pass through the Sycamore Canyon/Goodan Ranch Park gate and enter the Park. Pass historic structures and the Ranger’s trailer (may want to check in with ranger here), then pass into a large meadow. The trail to the Monardella canyon will be on the right near the southern portion of the meadow.

Figure 50. City of San Diego *Monardella viminea* Monitoring Locations, Regional Map

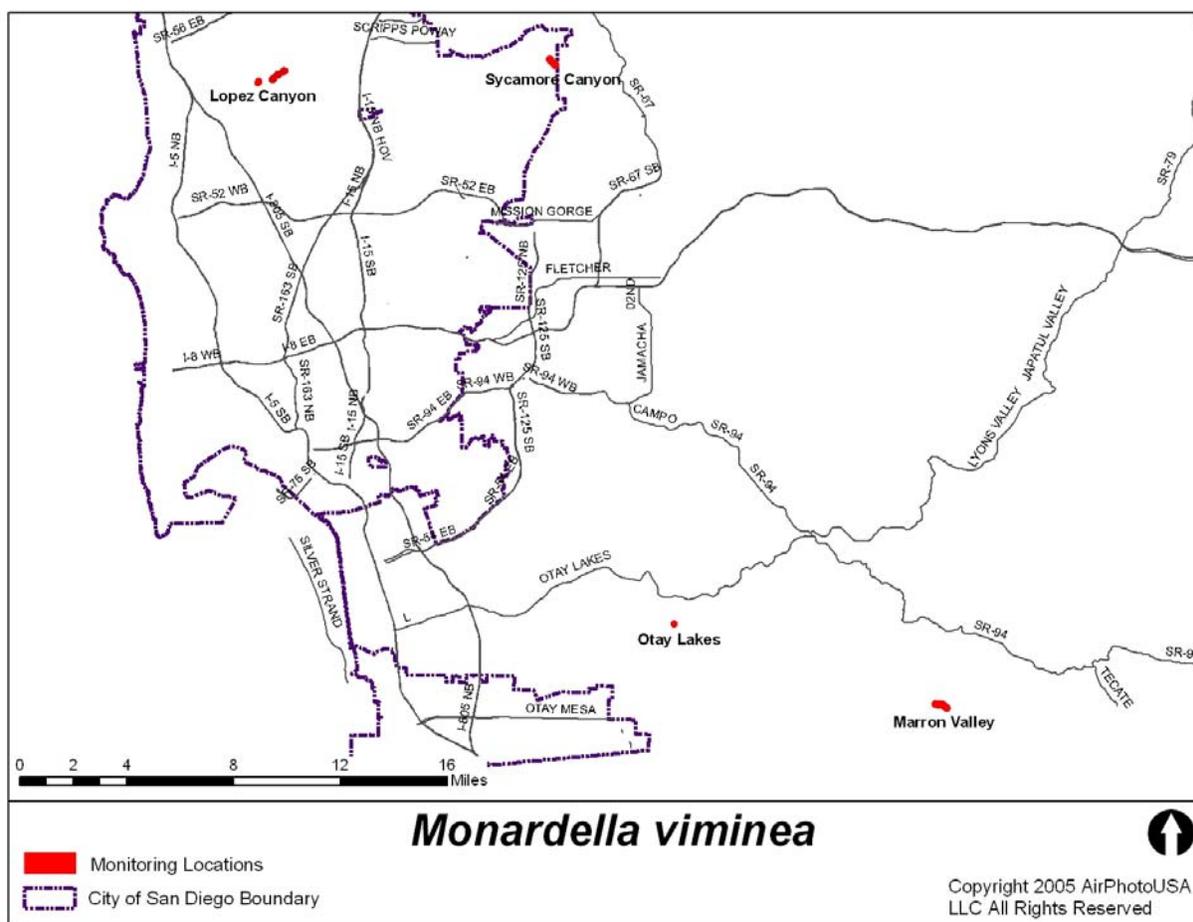


Figure 51. City of San Diego *Monardella viminea* Monitoring Location, Lopez Canyon

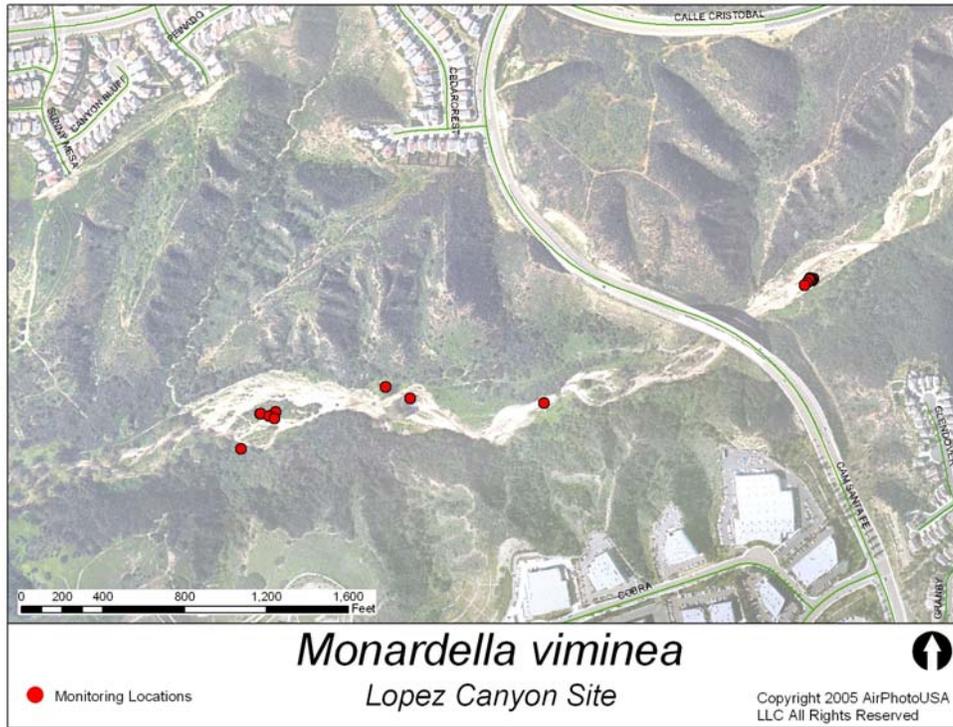


Figure 52. City of San Diego *Monardella stoneana* Monitoring Location, Marron Valley Vicinity Map

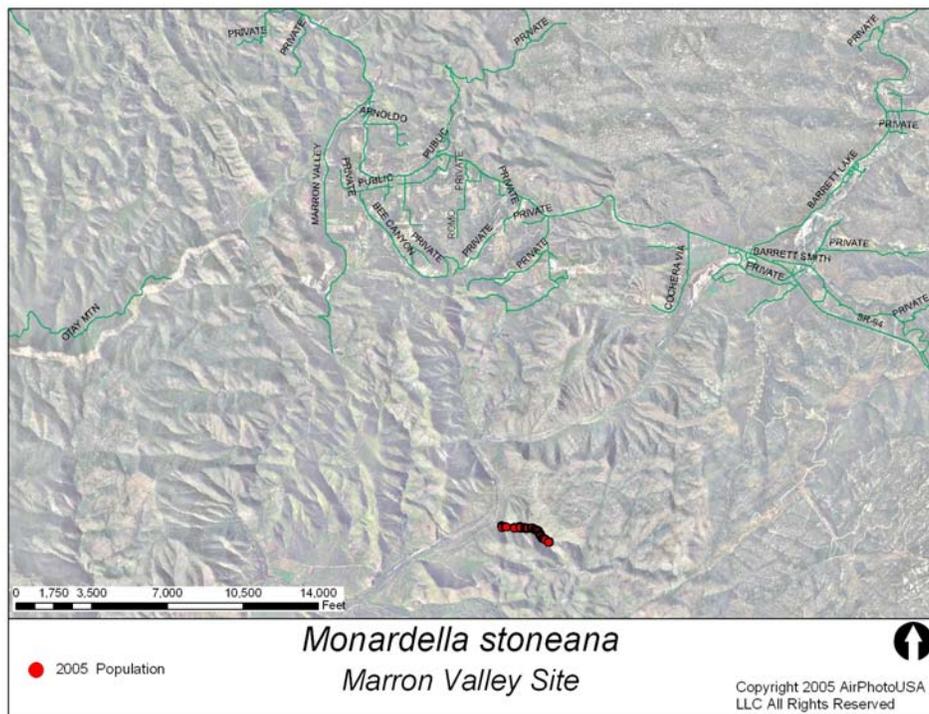


Figure 53. City of San Diego *Monardella stoneana* Monitoring Location, Marron Valley

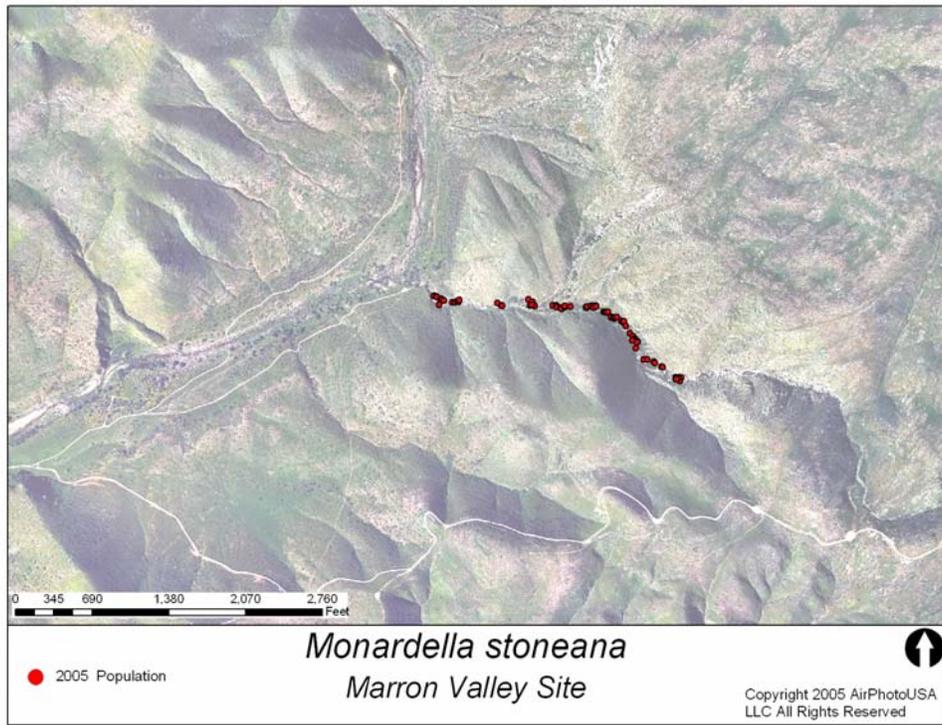
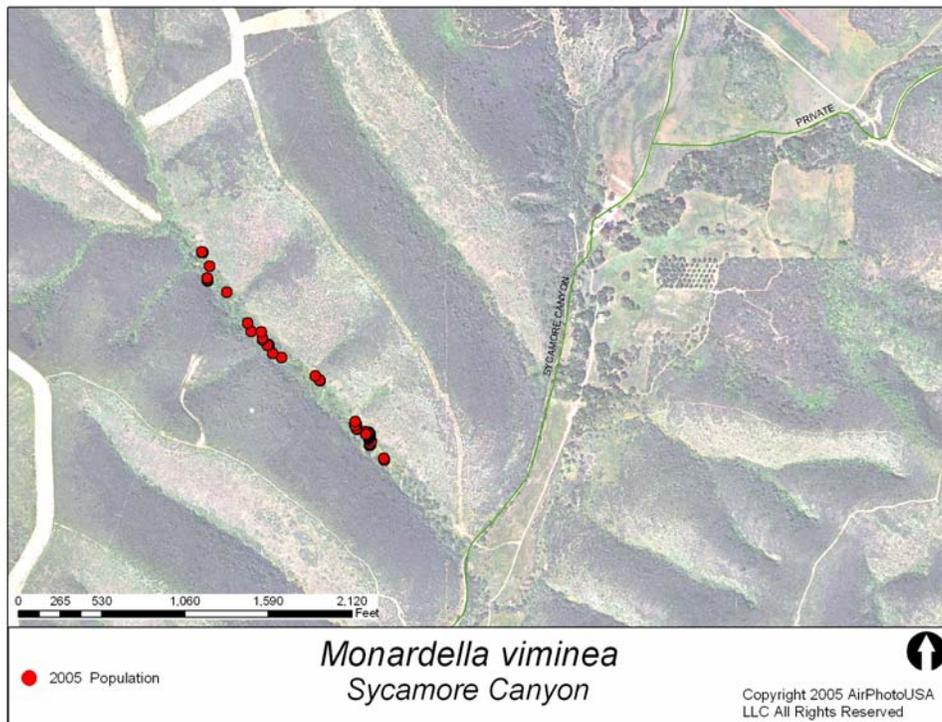


Figure 54. City of San Diego *Monardella viminea* Monitoring Locations, Sycamore Canyon



***Muilla clevelandii* (San Diego Goldenstar)**

MSCP Biological Monitoring Plan (BMP) Priority Listing and Required Monitoring Frequency [CBI Recommended Monitoring Frequency]:

Second priority, Every two years [Annually]

BMP Required and CBI Recommended City Monitoring Locations (BMP Point and Site Priority):

Del Mar Mesa (P-11; Moderate priority)

Sycamore Canyon/East Elliot (P-15; High priority)

Additional CBI Recommended Monitoring Location:

Marron Valley

Additional Locations Monitored in the City:

Otay Lakes

Mission Trails Regional Park (MTRP)

Years Monitored:

2000 (Marron Vly)

2001 (Del Mar Mesa, MTRP, Otay Lakes)

2002 (Del Mar Mesa, Marron Vly, MTRP, Otay Lakes)

2003 (Del Mar Mesa, MTRP)

2004 (Marron Vly, Otay Lakes)

2005 (Otay Lakes)

Methods:

Del Mar Mesa and MTRP The Del Mar Mesa population was censused in 2003, as was the Mission Trails population from 2001-2003. Because of the low numbers in the Mission Trails population (12, zero, and six, respectively), this site is no longer monitored.

Otay Lakes Sixteen permanent transects were established randomly using a random numbers table within the *D. variegata* and *Muilla clevelandii* populations in 2001. The transects are maintained as a GIS file and are relocated and flagged in the field. The transects are used for belt transect monitoring; the center line of the transect serves as the center point of a one-meter wide belt. The transect is walked with a one-meter wide plastic pipe (approximately 2 wide pvc irrigation pipe, with the center line marked), and each *M. clevelandii* located within the one-meter wide belt is counted and recorded on standard data sheets. Flowering status is also recorded for each plant counted: An individual is considered flowering if internal flowering structures are visible (i.e., stamens, pistils) or if the plant has flowered (e.g., dried flower). It is non-flowering if no floral structures are present or if the plant is in bud stage only, with no internal flowering structures present. Note that this method works fairly well in normal or below-average rainfall; however in 2005 following high rainfalls, one transect took over three hours to complete, making the method extremely time-consuming. A sub-sampling is being considered in these years.

Marron Valley According to past monitoring reports, the Marron Valley population was monitored as follows: "At Marron Valley, six transects were randomly allocated with the

Figure 56. City of San Diego *Muilla clevelandii* Monitoring Location, Del Mar Mesa

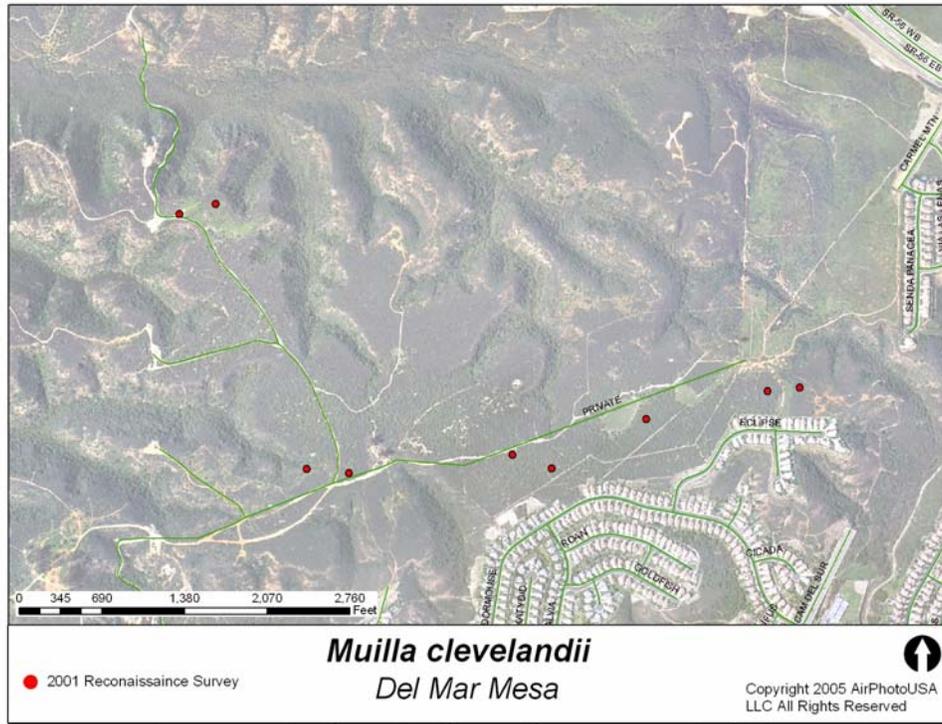


Figure 57. City of San Diego *Muilla clevelandii* Monitoring Location, East Elliot

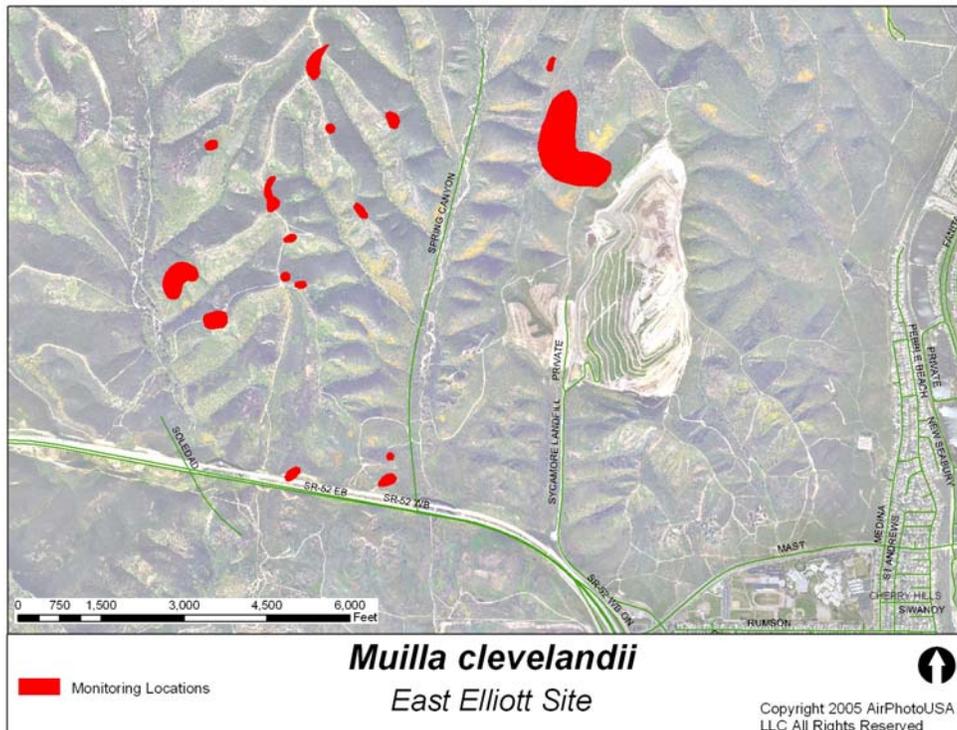


Figure 58. City of San Diego *Muilla clevelandii* Monitoring Location, Marron Valley Vicinity Map

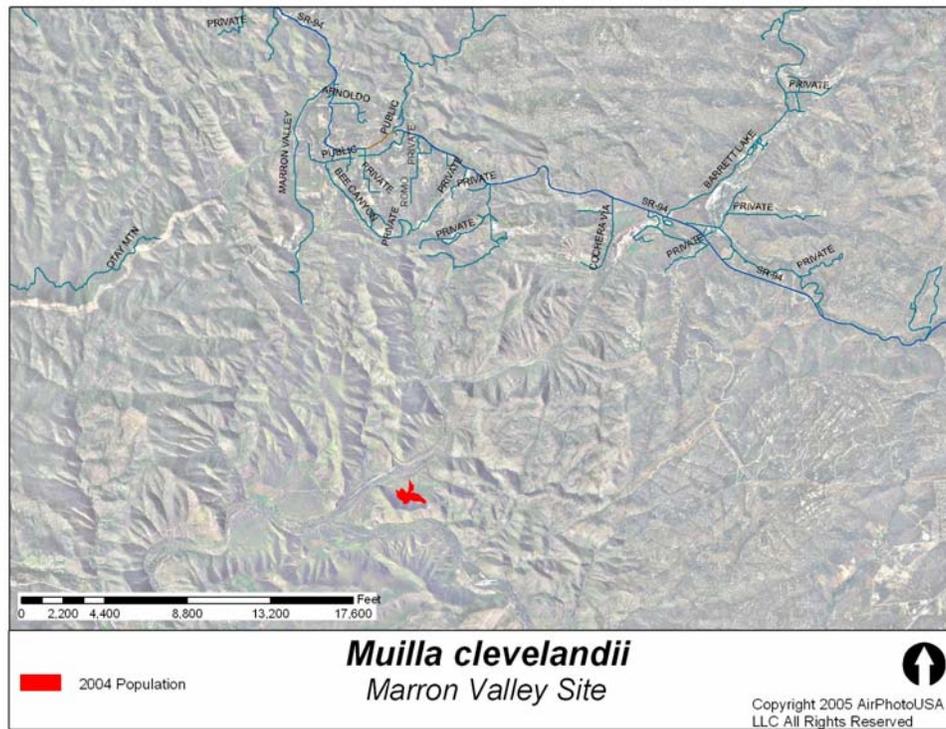


Figure 59. City of San Diego *Muilla clevelandii* Monitoring Location, Marron Valley

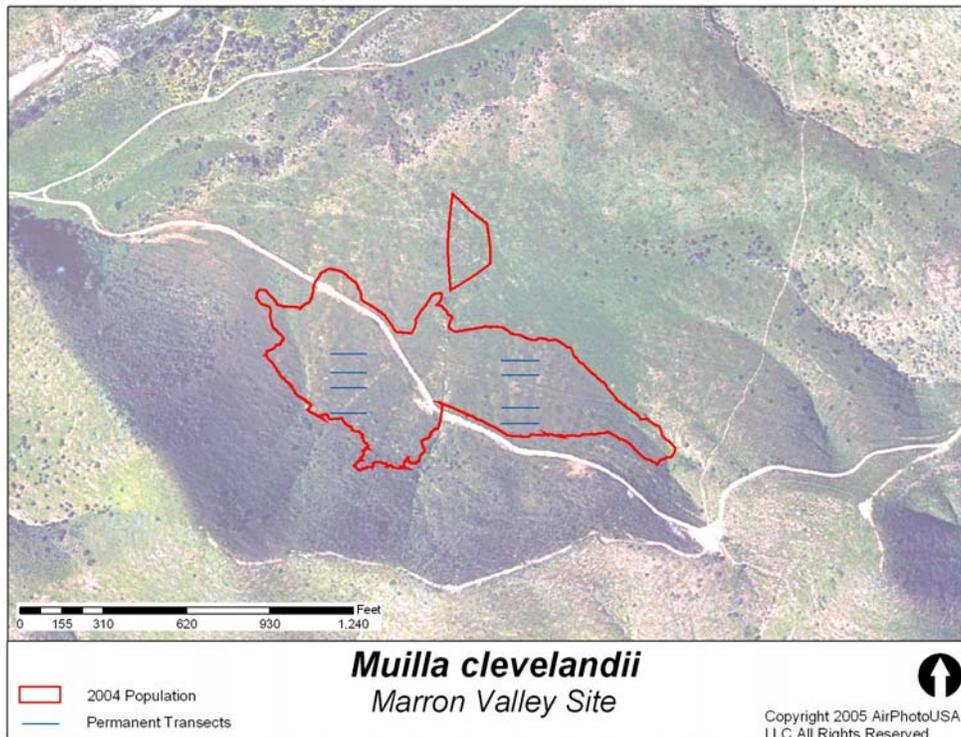
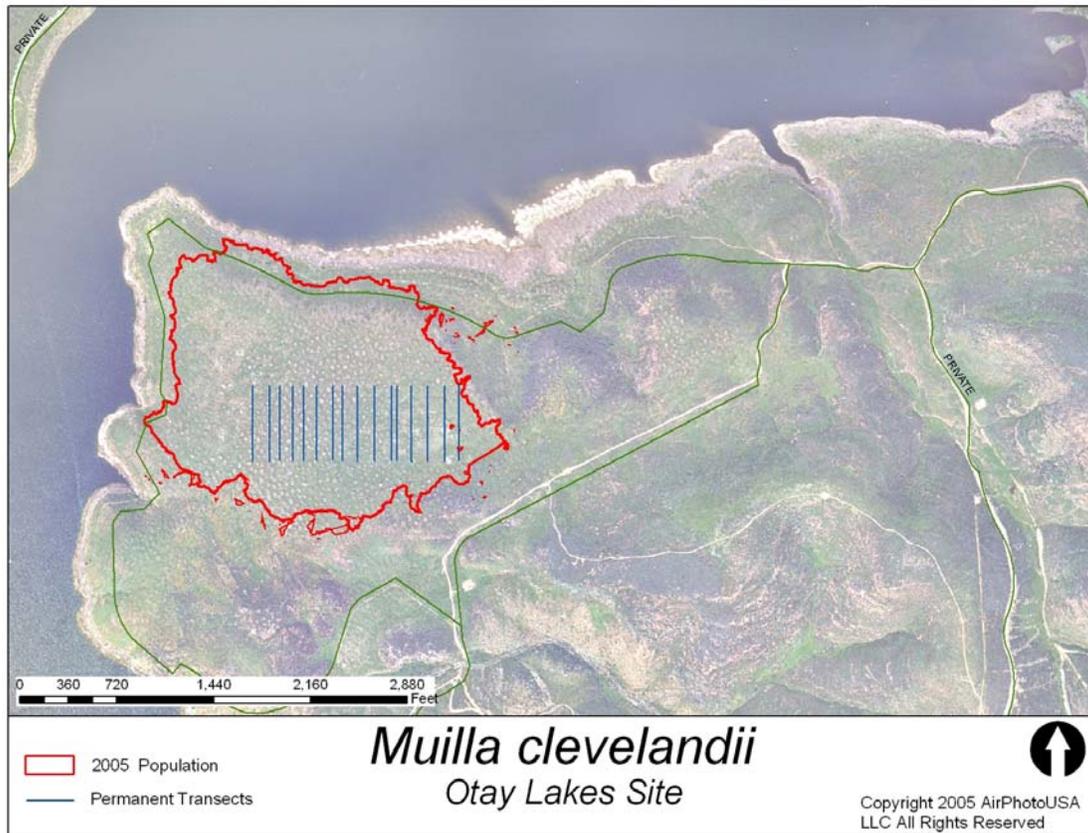


Figure 60. City of San Diego *Muilla clevelandii* Monitoring Location, Otay Lakes



***Rosa minutifolia* (Desert/Small-Leaf Rose)**

Priority Listing/Required Monitoring Frequency:

Third priority/Every five years

Required Monitoring Locations:

Otay River Valley/West Otay Mesa (P-25) – Low priority

Monitoring is not performed by City staff due to the fact that only known *R. minutifolia* population is on mitigation site that is currently monitored and managed by permittee. If the land is transferred to the City of San Diego in the future, the City will assume monitoring of these lands.

Note that the 2001 CBI report suggests preserve-wide “mapping species distribution and quantitative or semi-quantitative surveys to assess resource abundance, density or other indices to monitor status and trends through time.” According to the report, such preserve-level monitoring would be used “to inform management decisions – required of all preserve managers at all preserve units and monitoring directives.”