

Coastal Cactus Wren & California Gnatcatcher Habitat Restoration Project, Phase III

Year 2 Report

Encanto and Radio Canyons, San Diego, CA



Prepared for

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August 2015

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BACKGROUND

Phase I

In collaboration with Groundwork San Diego-Chollas Creek (Groundwork) and the San Diego Association of Governments (SANDAG), AECOM was selected to enhance and restore existing and potential coastal cactus wren (*Campylorhynchus brunneicapillus*) and coastal California gnatcatcher (*Polioptila californica californica*) habitat in Encanto and Radio Canyons. Groundwork is an independent, not-for-profit environmental organization that works within San Diego's Chollas Creek Watershed to improve the environment, economy, and quality of life in the area through local community projects. Over the past several years, Groundwork has been an integral part of the restoration and enhancement of the Chollas Creek area. The project was funded by SANDAG under the Transnet Environmental Mitigation Program (EMP).

This project was identified as an opportunity to create and enhance habitat for coastal cactus wren (Photo 1) and California gnatcatcher, and to offer a more native landscape for the community. The habitat enhancement and restoration objectives included removal of nonnative plant cover and planting approximately 20,000 new coast cholla cactus (*Cylindropuntia prolifera*), which is the preferred nesting habitat for coastal cactus wren. California gnatcatcher would also benefit from the improved habitat, since this species is also present in the project area and uses maritime succulent scrub habitat in conjunction with coastal sage scrub habitat. Enhancement and expansion of areas with existing occupied California gnatcatcher and cactus wren habitats would improve and expand habitat for both species, and improve the chances for the long-term health of local and regional populations. This project also offered a unique opportunity for students and residents within the surrounding canyon communities to play an important role in planning and implementing the habitat restoration program.



Coastal cactus wren perched on its preferred cactus habitat

AECOM and Groundwork collaborated on the execution of project tasks. AECOM led the site mapping, habitat restoration, monitoring, maintenance, and reporting tasks, and Groundwork led the educational, community involvement, and publicity aspects of the project.

The project is located in the community of Encanto in southern San Diego, California, north of Market Street between Euclid Avenue and Merlin Drive (Figures 1 and 2). The total area of the two canyons that are part of this effort is 73.62 acres. Encanto Canyon consists of 37.24 acres and Radio Canyon consists of 36.38 acres. The entire project area is within the City of San Diego's Multi-Habitat Planning Area and will be preserved in perpetuity. Phase I of the coastal cactus wren habitat restoration project lasted 2 years, beginning in April 2009 and ending in April 2011. Phase I included the following activities:

- Baseline vegetation mapping, species inventories, and cactus wren and California gnatcatcher protocol surveys.
- Coast cholla collection and propagation at Millennial Tech Middle School's EarthLab.
- Dethatching and nonnative species treatment and removal in all planned planting areas (7.8 acres in Encanto Canyon and 9.1 acres in Radio Canyon).
- A “staged” planting strategy was implemented, with a portion of the area planted during Phase I (Stage 1 plantings) and a portion of the area maintained weed free in anticipation of plantings in Phase II (Stage 2 plantings). Coast cholla planting in the Stage 1 cactus planting areas (7.8 acres in Encanto Canyon and 4.4 acres in Radio Canyon) was completed during Phase I.
- Follow-up weed treatment and maintenance visits on all planned planting areas.
- Education and community involvement activities.

A full description of Phase I of the project, including the baseline vegetation mapping and results of the baseline species inventories, can be found in the AECOM and Groundwork report completed in April 2011, titled “Coastal Cactus Wren and California Gnatcatcher Habitat Restoration Project, Encanto and Radio Canyons, Final Report.”

Phase II

Phase II of the coastal cactus wren habitat restoration project began in January 2012 and ended on November 30, 2013. This phase was also funded by SANDAG's Transnet EMP and built on the progress of the restoration program that was begun in Phase I. During both years of Phase

II, weed control was conducted in the planting areas and bird monitoring continued in Radio and Encanto Canyons. The Phase II project areas total 14.6 acres and consisted of the following:¹

- 6.4 acres of Stage 1 cactus planting areas in Encanto Canyon
- 4.0 acres of Stage 1 cactus planting areas in Radio Canyon
- 4.2 acres of Stage 2 cactus planting areas in Radio Canyon

Bird monitoring included avian surveys focused on coastal cactus wren and California gnatcatcher, and also involved installation of wildlife cameras and artificial nest boxes. Habitat diversification was a crucial goal for Phase II, as many of the areas subject to weed removal and dethatching during Phase I supported very little native cover at the end of Phase I. The goal of diversification was to provide more complete habitat for cactus wren and California gnatcatcher within these areas, and more breeding habitat, provided by cholla patches. The majority of the habitat diversification activities were conducted during two volunteer planting events, which Groundwork organized, as a way of matching the funds provided by SANDAG.

During Year 1 of Phase II, coastal sage scrub/maritime succulent scrub (CSS/MSS) container plants were planted in the Stage 1 cactus planting areas to support habitat diversification in Radio Canyon. CSS/MSS container plants and coast cholla were planted in the Radio Canyon Stage 2 cactus planting areas during a second volunteer planting event in Year 2 of Phase II. During Year 2 of Phase II, cholla cactus that had been planted in the City of San Diego's Brush Management Zone (BMZ) in Encanto and Radio Canyons were removed from the BMZ at the request of the City of San Diego and transplanted to Stage 1 cactus planting areas in Encanto Canyon and Stage 2 cactus planting areas in Radio Canyon. During both volunteer planting days, coast prickly pear (*Opuntia littoralis*), propagated at the EarthLab, was planted in the Radio Canyon Stages 1 and 2 cactus planting areas. A CSS/MSS seed mix was also applied to the majority of the project areas during Year 2.

A full description of Phase II of the project is included in the AECOM and Groundwork report completed in November 2013, titled "Coastal Cactus Wren and California Gnatcatcher Habitat Restoration Project, Phase II, Encanto and Radio Canyons, San Diego, CA, Final Report."

Phase III Introduction

Phase III of the project began on July 15, 2013, and ended on August 31, 2015. This phase was also funded by SANDAG's Transnet EMP, to continue the progress made during Phases I and II of the project. The Phase III, Year 1 report discusses activities completed by AECOM between December 1, 2013 and September 1, 2014 (see document titled "Coastal Cactus Wren & California Gnatcatcher Habitat Restoration Project, Phase III Year 1 Report, Encanto and Radio Canyons, San Diego, CA", completed by AECOM in October 2014).

¹ Phase I and Phase II refer to the first and second grant periods, respectively, and Stage 1 and Stage 2 refer to the two stages of effort in the restoration scheme.

Although Phase III funding began on July 15, 2013, project activities conducted by AECOM between July 15, 2013 and November 30, 2013 are considered part of Phase II and are discussed in the Phase II final report (see AECOM and Groundwork report completed in November 2013, titled “Coastal Cactus Wren and California Gnatcatcher Habitat Restoration Project, Phase II, Encanto and Radio Canyons, San Diego, CA, Final Report”). This document summarizes maintenance activities and monitoring results from Year 2 of Phase III, defined as September 2, 2015 through August 31, 2015.

AECOM's work during Years 1 and 2 of Phase III focused on maintenance and monitoring of the Stages 1 and 2 cactus planting areas in Radio and Encanto Canyons, a total of 14.6 acres (Figures 3, 4, and 5). Continuing maintenance is critical to the success of the restoration efforts that have been implemented in Radio and Encanto Canyons to date. Weed management removes nonnative competition and allows the native plantings to thrive, increasing the habitat value for cactus wren and providing for the full lifecycle needs of the species (e.g., vegetation appropriate for nesting, fledging, foraging, and dispersal). Vegetation monitoring is implemented to guide the maintenance activities and assess the success of the habitat restoration effort.

MAINTENANCE ACTIVITIES

The AECOM maintenance crew conducted six maintenance visits in Radio Canyon and four maintenance visits in Encanto Canyon during Year 2 of Phase III. Maintenance consisted primarily of continued weed treatment within the Stages 1 and 2 cactus planting areas (i.e., restoration areas). Weeds represent one of the greatest threats to the successful establishment of native species and the long-term habitat value of the restored habitat. Given the high density of nonnative and invasive species within and surrounding the restoration areas, diligent weed control efforts are considered crucial to restoration success. Nonnative species targeted for treatment and removal included seedling acacia (*Acacia* sp.), castor bean (*Ricinus communis*), short-pod mustard (*Hirschfeldia incana*), seedling hottentot fig (*Carpobrotus edulis*), chrysanthemum (*Glebionis coronaria*), Russian thistle (*Salsola tragus*), fennel (*Foeniculum vulgare*), tree tobacco (*Nicotiana glauca*), and nonnative grasses (*Avena* spp., *Bromus* spp., and others).

Maintenance activities included a combination of manual and mechanical weed removal and herbicide treatments (Round-up®; active ingredient glyphosate). All weed material was removed from the site and properly disposed of. AECOM restoration ecologists monitored weed conditions during the growing season of each year (approximately December through June) so that weeding efforts could be strategically timed to treat the widest possible range of weed species before they began producing seed. Table 1 summarizes the maintenance activities conducted during Year 2 of Phase III.

Table 1
Phase III, Year 2 Maintenance Activities for Encanto and Radio Canyons

Date	Activity Performed
October 2014	Weed treatment of Radio Canyon cactus planting areas
January 2015	Weed treatment of Radio and Encanto Canyon cactus planting areas
April 2015	Weed treatment of Radio and Encanto Canyon cactus planting areas
June 2015	Weed treatment of Radio Canyon cactus planting areas
July 2015	Weed treatment of Radio and Encanto Canyon cactus planting areas
August 2015	Weed treatment and debris removal in the Radio and Encanto Canyon cactus planting areas

MONITORING RESULTS

During Phase III, AECOM restoration ecologists completed qualitative site monitoring visits approximately every two months. Monitoring focused on the Stages 1 and 2 cactus planting areas, as these areas were planted during Phase II and are subject to weed control during Phase III. During each monitoring visit, the restoration ecologist walked the Stages 1 and 2 cactus planting areas in Radio and Encanto Canyons, noting site conditions and areas that required maintenance. The results of the monitoring visits were used to schedule maintenance visits and inform Groundwork of any concerns within the project areas. Qualitative monitoring photos were taken during the site monitoring visits to document areas of concern. These photos were provided to Groundwork, when necessary.

In addition, during the July 2015 monitoring visit, the restoration ecologist took photos at permanent photo-documentation points established throughout the Stages 1 and 2 cactus planting areas in Radio and Encanto Canyons. The locations of the permanent photo points are shown in Figures 4 and 5, and the photos taken from these points are included in Appendix 1. These photo points may be continued to be used by Groundwork in the future to document the progress of the restoration areas.

Also, during the July 2015 site visit, the restoration ecologist recorded the flora and fauna observed within the restoration areas and made ocular estimates of native and nonnative vegetative cover. The floral and faunal inventories are presented in Tables 2 and 3, respectively. A description of the vegetative cover within the project areas is provided below.

Table 2
Plant Species Observed in the Radio and Encanto Canyon Restoration Areas

Scientific Name	Common Name
Native Species	
<i>Acmispon glaber</i>	deerweed
<i>Adolphia californica</i> *	California adolphia
<i>Ambrosia psilostachya</i>	western ragweed
<i>Artemisia californica</i>	California sagebrush
<i>Astragalus</i> sp.	locoweed
<i>Baccharis pilularis</i>	coyote brush
<i>Baccharis salicifolia</i>	mule fat
<i>Baccharis sarothroides</i>	broom baccharis
<i>Bahiopsis lacinata</i> *	San Diego viguiera
<i>Chamaesyce polycarpa</i>	small seed sandmat
<i>Conyza canadensis</i>	horseweed
<i>Conyza coulteri</i>	Coulter's fleabane
<i>Corethrogyne filaginifolia</i>	sand aster
<i>Croton setigerus</i>	doveweed
<i>Cylindropuntia prolifera</i>	coast cholla
<i>Datura wrightii</i>	jimsonweed
<i>Dienandra fasciculata</i>	fascicled tarweed
<i>Eriogonum fasciculatum</i> var. <i>fasciculatum</i>	California buckwheat
<i>Gutierrezia californica</i>	California matchweed
<i>Hazardia squarrosa</i> var. <i>squarrosa</i>	southern sawtooth goldenbush
<i>Heteromeles arbutifolia</i>	toyon
<i>Lycium andersonii</i>	desert thorn
<i>Malacothamnus fasciculatus</i>	chaparral bushmallow
<i>Malosma laurina</i>	laurel sumac
<i>Opuntia littoralis</i>	coast prickly pear
<i>Peritoma arborea</i>	bladderpod
<i>Populus fremontii</i> ssp. <i>fremontii</i>	western cottonwood
<i>Pseudognaphalium canescens</i>	Wright's cudweed
<i>Quercus agrifolia</i>	coast live oak
<i>Rhus integrifolia</i>	lemonadeberry
<i>Salix goodingii</i>	black willow
<i>Salix lasiolepis</i>	arroyo willow
<i>Salvia apiana</i>	white sage
<i>Salvia mellifera</i>	black sage
<i>Sambucus nigra</i> spp. <i>caerulea</i>	Mexican elderberry
<i>Simmondsia chinensis</i>	jojoba

Scientific Name	Common Name
<i>Sisyrinchium bellum</i>	blue-eyed grass
<i>Solanum</i> sp.	nightshade
<i>Stephanomeria virgata</i>	wire lettuce
<i>Stipa pulchra</i>	purple needlegrass
<i>Yucca schidigera</i>	Mojave yucca
Nonnative Species	
<i>Acacia melanoxylon</i>	Tazmanian blackwood
<i>Acacia redolens</i>	desert carpet
<i>Amaranthus retroflexus</i>	rough pigweed
<i>Amaranthus albus</i>	white tumbleweed
<i>Anagallis arvensis</i>	scarlet pimpernel
<i>Brachypodium distachyon</i>	purple false brome
<i>Bromus</i> spp.	bromes
<i>Carpobrodus edulis</i>	hottentot fig
<i>Centaurea melitensis</i>	toalote
<i>Cynodon dactylon</i>	Bermuda grass
<i>Erodium cicutarium</i>	red-stem filaree
<i>Fraxinus</i> sp.	ash
<i>Glebionis coronaria</i>	chrysanthemum
<i>Hirschfeldia incana</i>	short-pod mustard
<i>Lactuca serriola</i>	prickly lettuce
<i>Lycopersicon esculentum</i>	garden tomato
<i>Marrubium vulgare</i>	horehound
<i>Medicago polymorpha</i>	bur clover
<i>Nicotiana glauca</i>	tree tobacco
<i>Opuntia ficus-indica</i>	mission prickly pear
<i>Phoenix canariensis</i>	Canary island date palm
<i>Polygonum arenastrum</i>	common knotweed
<i>Pseudognaphalium luteoalbum</i>	Jersey cudweed
<i>Ricinus communis</i>	castor bean
<i>Salsola tragus</i>	tumbleweed
<i>Shinus molle</i>	Peruvian pepper tree
<i>Schinus terebinthifolius</i>	Brazilian pepper tree
<i>Sonchus asper</i>	sow-thistle
<i>Tribulus terrestris</i>	puncture vine
<i>Washingtonia robusta</i>	Mexican fan palm

* Special-status species

Table 3
Wildlife Species Observed in the Radio and Encanto Canyon Restoration Areas

Scientific Name	Common Name
Birds	
<i>Carpodacus mexicanus</i>	house finch
<i>Mimus polyglottos</i>	northern mockingbird
<i>Pipilo crissalis</i>	California towhee
<i>Zenaida macroura</i>	mourning dove
Mammals	
<i>Spermophilus beecheyi</i>	California ground squirrel
<i>Sylvilagus audubonii</i>	Audobon's cottontail

Although not detected during the July 2015 monitoring visit, a pair of coastal California gnatcatchers (*Polioptila californica californica*) was observed in the Radio Canyon Stage 1 cactus planting area in October 2014. This sensitive species had not been previously recorded from Radio Canyon for at least the duration of the project, and its appearance in the cactus planting areas represents a significant milestone for the project. A California Natural Diversity Database form documenting the gnatcatcher observation is included as Appendix 2.

Native vegetative cover was visually estimated to be 60–70% within the main portion of the Radio Canyon Stage 1 cactus planting area. All other cactus planting areas in Radio Canyon were estimated to support 15–20% native vegetative cover. The Stage 1 cactus planting areas in Encanto Canyon were estimated to support 20–25% native vegetative cover, consisting primarily of coast cholla. Nonnative cover was visually estimated to be less than 5% (excluding established perennial nonnatives, such as acacia shrubs and nonnative trees) in all of the restoration areas.

Comparison to Success Standards

A comparison to the final Phase III success standards is provided below. The Phase III success standards for the restoration areas, per Groundwork's Phase III EMP grant application, include the following:

1. Less than 10% weed cover in the Radio Canyon and Encanto Canyon restoration areas by the end of the project.
2. Successful eradication of 3 acres of perennial invasives, primarily acacia, from the Radio Canyon and Encanto Canyon restoration areas by the end of the project.
3. Significant increase in cover of cholla cactus and CSS/MSS species in the Radio Canyon and Encanto Canyon restoration areas by the end of the project.

The restoration areas are meeting success standard #1 at the end of Phase III, as they currently support less than 5% weed cover (excluding established perennial nonnative species). Several patches of preexisting acacia shrubs and mature palm trees are present within the Radio Canyon planting areas, and a patch of nonnative trees, including Brazilian peppertree (*Schinus terebinthifolius*), is present in Encanto Canyon, although not within the cactus planting areas. However, all seedlings of these perennial exotic species were treated by the AECOM maintenance crew when observed, thereby preventing their spread within the restoration areas.

Progress was made toward meeting success standard #2 during Phase III, although a full 3 acres of perennial invasives was not removed, due to the project's limited resources. In Year 1 of Phase III, Groundwork began to remove the patch of Brazilian peppertree from Encanto Canyon. The AECOM maintenance crew continued to treat any resprouts with herbicide for the duration of Phase III. During the volunteer planting events in Years 1 and 2 of Phase III, Groundwork contractors and volunteers cut down and removed approximately 10 to 20 large acacia shrubs from the Stages 1 and 2 cactus planting areas in Radio Canyon. The AECOM maintenance crew treated resprouting acacia seedlings in the areas where mature acacia were removed through the end of Phase III. As of the July 2015 monitoring visit, several of the areas where mature acacia were removed supported native seedlings. Future volunteer events within the canyons may include the removal of additional mature acacia or other perennial invasives, as resources permit.

The majority of the cactus planting areas have experienced increases in cholla cactus and CSS/MSS species cover since Year 1 of Phase III. In January 2015, Groundwork conducted a volunteer planting day in portions of the Radio Canyon Stage 2 cactus planting areas that had low native cover. Many of the CSS/MSS species planted during that event are thriving and contributing to the native cover within the planting areas. In addition, volunteer seeding efforts and seed dispersal from established native species have contributed to a growing native seed bank in the planting areas. Seedling San Diego viguiera (*Bahiopsis lacinata*), California buckwheat (*Eriogonum fasciculatum* var. *fasciculatum*), jojoba (*Simmondsia chinensis*), and other native species were observed germinating in the planting areas during Year 2 of Phase III. In addition, many of the cholla planted during Phases I and II have put on new growth.

Southern California continued to experience severe drought conditions during the 2014/2015 rainy season, although the region did receive more rainfall than the previous rainy season, which was exceptionally dry. However, the lower than average rainfall likely continued to affect the condition of the restoration areas, leading to lower native and nonnative annual cover, reducing the recruitment of native perennial species, and leading to higher mortality of container stock planted during the volunteer planting days. The restoration areas will likely exhibit greater increases in native cover (and more weed issues) during subsequent years that receive higher rainfall.

Additional success standards for Phase III, per Groundwork's Phase III EMP grant application, are as follows:

1. Observed presence of cactus wrens in Radio Canyon. This objective may not be achievable within the grant period due to the inherently slow maturation rate of the habitats being installed by the project.
2. Observed successful nesting of cactus wrens in Radio Canyon. This is also a long-term objective that may not be achieved within the grant period.
3. New institutionalized and sustainable relationships with the surrounding property owners and residents, and education of students and residents on conservation issues, evidenced in part by generating at least 400 student volunteer hours and 600 adult volunteer hours annually.

Funding for continuation of bird monitoring was not authorized in the Phase III grant; therefore, presence and nesting bird data will need to be obtained from regional cactus wren monitoring efforts or other sources. Information regarding community involvement may be provided by Groundwork.

COMMUNITY-DRIVEN RESTORATION AND EDUCATION

Biodiversity Education

Building upon Phases I and II Transnet funding, Phase III ensured integration of a biodiversity lessons and informal science education units into the 6th grade science curriculum at Millennial Tech Middle School. Curriculum was developed in alignment with new Common Core and Next Generation Science Standards that featured the cactus wren in the context of the Radio/Encanto biodiversity existing conditions and restoration/maintenance needs. The unit includes three in-class lessons, and three field trips. Field trip activities engage students with seed collection at the canyons, native plant propagation at the EarthLab's Transnet-funded Propagation Center, and installation of the plants at the annual Radio Canyon Day community planting event. Students are also introduced to related career opportunities by USFWS professionals, restoration biologists, and horticulturists.

Transnet Grant Leveraging

As indicated in the Anticipated Outcomes section of the Phase III application, grant leveraging was a central goal of the grant. The grant was successful in leveraging an \$800,000 Urban Greening grant, The Neighborhood Canyons Access and Enhancement Project.. This grant will complete all habitat restoration in Radio Canyon, and will build upon the goals and protocols of the Transnet-funded restoration, including the creation of a cactus wren corridor across the SR 94 to chollas habitat.

The Neighborhood Canyons Access and Enhancement Project will also improve a 3.3 mile route of existing eroded open space trails providing safe access and connectivity to Radio Canyon, Emerald Hills Canyon and Encanto Canyon through the Encanto residential community. The public is currently able to access these three canyons, but access is limited due to unsafe trails which often traverse steep, slippery canyon slopes. Trail improvements would significantly enrich public access to over 140 acres of open space throughout the three canyon areas. Trail improvement is also coupled with proposed habitat restoration which together will have many environmental and social benefits, through increased recreational and ecological value of the canyons.

Monitoring Protocols

Transnet Phase III has completed both a Radio Canyon Monitoring Strategic Plan and a Radio Canyon Enhancement Action Plan to maintain all existing Transnet investment funding in the Radio/Encanto Complex, and to guide future maintenance, monitoring, and restoration efforts. The monitoring strategy is informed by the *CNPS Relevé* protocols. The canyons will be surveyed using this technique, to include recording estimates of percentage cover for each taxon in five layers (tree over-story, tree understory, shrub, herb, and non-vascular). A comprehensive species list of all vascular plants within the relevé will be completed. Each individual plant will be recorded in only one layer, the layer in which the tallest portion of the individual is found. *Point-intercept transects*: Point-intercept transects have been used widely as a method for establishing plant survivability in open coastal sage scrub habitats. Point Transect locations were established in May 2015 to estimate percentage cover of vegetation in restored areas and were recorded using a GPS.

Canyon Stewardship and Plant Propagation

A state-of-the art native plant propagation center has been funded through Phase III of the Transnet grant funding. Seed collection manuals and protocols have been established, with regular student and volunteer collection occurring in the radio/Encanto Canyon complex. The propagation center is supported by San Diego Unified School District through provision of water in support of student horticulture and science education, and is staffed largely through a volunteer internship program with Cuyumaca College. These in-kind contributions provide for a low cost, sustainable source of locally sourced native plants for installation in creeks and canyons throughout the Chollas Creek Watershed, with a growing capacity of 10,000 plants per year. This availability of restoration plants has supported the now annual Radio Canyon Day in January of each year, at which time canyon residents install over 2000 plants in support of ongoing restoration and maintenance. This Transnet-funded stewardship program design is now being expanded to include other sites in the Chollas Creek Watershed.

CONCLUSIONS

Particularly in light of the ongoing drought conditions, the habitat restoration and enhancement efforts during Year 2 of Phase III should be considered very successful. Although not all of the container stock planted during the volunteer planting day has survived, the additional CSS/MSS species, both from container plants and seeding, have improved the quality of the canyon environments and increased potential habitat for coastal cactus wren, California gnatcatcher, and other native plant and animal species. Native plant cover in the restoration areas has increased and nonnative cover has decreased, thereby expanding food sources and providing more complete ecosystem services for native wildlife. Site maintenance activities have been successful in controlling weeds within the planting areas and improving the potential for native species to continue to occupy these areas. In addition, improving the quality of habitat in these canyons helps to address the goals of the City of San Diego's Multiple Species Conservation Program by contributing to the native habitat and habitat connectivity in the region. Although it is likely still too early in the restoration program for coastal cactus wren to occupy the restored habitat, California gnatcatcher was observed within the Radio Canyon cactus planting areas during Year 2 of Phase III. This demonstrates the significant improvements in habitat quality that have been realized in the restoration areas and the many ecological benefits have already been provided by the project.

RECOMMENDATIONS AND FUTURE PLANS

Priorities for the canyons should be protecting and improving the Stages 1 and 2 cactus planting areas, continuing avian and restoration monitoring, and creating a detailed long-term management plan for the entirety of the two canyons.

Planning is currently underway for additional restoration activities in Radio Canyon as part of the State of California's Urban Greening Grant Program. This project would include the removal of invasive species and restoration of CSS/MSS in portions of Radio Canyon that are currently dominated by nonnative species (particularly acacia and nonnative grasses). This restoration effort is planned to begin in the fall of 2015, pending approval of the project's California Environmental Quality Act documents. This effort will benefit the Stages 1 and 2 cactus planting areas in Radio Canyon by removing adjacent sources of nonnative propagules, thereby inhibiting the spread of adjoining populations of nonnative species back into the cactus planting areas. However, this project does not currently include continuing restoration activities in the Stages 1 and 2 cactus planting areas of Radio or Encanto Canyons. Therefore, AECOM recommends that the following activities, which would protect and improve upon the restoration

efforts to date in the Stages 1 and 2 cactus planting areas, be considered for future funding and prioritization.

Continued Enhancement and Maintenance

Phases I through III of the project have included the removal of perennial invasive species, primarily from the Radio Canyon cactus planting areas, when feasible. However, several species of perennial exotics are still present within the restoration areas, and the canyons would benefit from the removal of these species. This effort would be especially effective in improving the self-sufficiency of the cactus planting areas and reducing the need for future maintenance, through the removal of nonnative propagule sources that could recolonize areas that have already been restored.

AECOM recommends that any areas that are subject to perennial exotics removal be planted and/or seeded with patches of cholla and native CSS/MSS species to prevent these areas from being reclaimed by exotics. This additional restoration will continue to build on the progress made during Phases I through III, and will add to the habitat for coastal cactus wren, California gnatcatcher, and other native species in the canyons. If possible, it is also recommended that portions of the Stages 1 and 2 cactus planting areas that have low native cover be subject to enhancement activities, including additional planting and/or seeding with native CSS/MSS species. The areas recommended for supplemental planting/seeding are shown in Figure 6, and a list of plant species that are appropriate for the canyons is provided in Table 4.

Table 4
Species Appropriate for Planting/Seeding On-site

Scientific Name	Common Name
<i>Acmispon glaber</i> ¹	deerweed
<i>Adolphia californica</i> *	California adolphia
<i>Artemesia californica</i> ^{1, 2}	California sagebrush
<i>Bahiopsis laciniata</i> * ¹	San Diego viguiera
<i>Calandrinia maritima</i> *	seaside calandrinia
<i>Cylindropuntia californica</i> var. <i>californica</i> *	snake cholla
<i>Cylindropuntia prolifera</i>	coast cholla
<i>Encelia californica</i> ²	California encelia
<i>Eriogonum fasciculatum</i> var. <i>fasciculatum</i>	California buckwheat
<i>Euphorbia misera</i> *	cliff spurge
<i>Ferocactus viridescens</i> var. <i>viridescens</i> *	coast barrel cactus
<i>Isomeris arborea</i>	bladderpod
<i>Lycium californicum</i>	desert thorn
<i>Mimulus auranticus</i>	monkeyflower

Scientific Name	Common Name
<i>Optunia littoralis</i>	coast prickly-pear
<i>Salvia apiana</i>	white sage
<i>Salvia mellifera</i>	black sage
<i>Sambucus nigra</i> ssp. <i>caerulea</i>	Mexican elderberry
<i>Simmondsia chinensis</i> ¹	jojoba
<i>Sisyrinchium bellum</i>	blue-eyed grass

* Special-status species

¹ Included in original CSS/MSS seed mix for the canyons.

² Plant in low densities to avoid species becoming too abundant.

Given the poor baseline condition of the cactus planting areas and surrounding habitats, weed issues will certainly remain a significant threat to the success of additional planting areas for several years until the restored habitat fully matures. Therefore, any additional areas of the canyons that are subject to restoration should also be maintained for a minimum of 2 years (ideally 5 years) following planting. Continued maintenance and weed control will ensure that restoration efforts are not lost to weeds and/or urban pressures.

Bird Monitoring

The continuation of the coastal cactus wren and California gnatcatcher monitoring started in Phase I of the project is critical for monitoring the performance and effectiveness of habitat restoration in relation to project goals. For this project, the key monitoring question is to determine whether and at what point coastal cactus wren and coastal California gnatcatcher begin foraging and/or nesting in the restored habitat. In the absence of continued avian monitoring, the actual effects of habitat restoration on these species will not be known, and this information will not be available for future restoration efforts.

If feasible, AECOM highly recommends that Groundwork seek additional funding and/or professional volunteers to continue the avian monitoring program following the end of Phase III and into the next restoration project. Ideally, a robust monitoring program would be implemented that documents coastal cactus wren and California gnatcatcher use of the project areas for a minimum of 5 years.

Avian monitoring methods should be coordinated with regional coastal cactus wren monitoring programs to ensure consistency of data and efficiency of effort. Potential methods for monitoring could include banding, global positioning system/telemetry tracking, or motion-activated remote cameras aimed at active nests. Banding methods are generally the easiest to implement but are most effective when monitoring of banded birds occurs over an area broader than the immediate project area. Broader monitoring for banded birds allows the monitoring program greater probability of capturing regional dispersal patterns of birds beyond Encanto and Radio

Canyons. Avian monitoring must be performed by qualified biologists in possession of the appropriate permits.

Master Plan

San Diego's urban canyons experience a complex mix of pressures and support. They are expected to support biological values and public access/recreation values. A holistic conceptual master plan that provides a comprehensive view of the issues and opportunities and long-term goals for an entire canyon would provide multiple benefits for future native habitat and coastal cactus wren restoration efforts. A master plan would provide an opportunity to lay out the most ecologically beneficial pattern of habitat; identify a reasonable public access plan that is informed by ecological sensitivities; and establish an organized implementation strategy that addresses inter-stakeholder coordination, phasing strategies, cost estimates, regulatory needs, and potential funding sources. It would allow community and nonprofit groups to efficiently and effectively apply volunteer efforts to long-term goals. It would also provide a high level of confidence to funding agencies that their contributions will be effectively applied to targeted goals. The plan would outline the intended goals for the canyons and would provide an implementation roadmap that could be followed by contractors, community stewards, and students.

Future Habitat Restoration

As restoration success is achieved in the Stages 1 and 2 cactus planting areas and the next round of restoration areas, additional restoration efforts should be considered for the northern portion of Radio Canyon as a tool to facilitate safe movement of coastal cactus wrens between populations elsewhere in the region. It is recommended that additional restoration implemented in the canyons be guided by the master plan discussed above to ensure that appropriate habitats are planned and that the restoration design will provide for the ecological needs of coastal cactus wren and California gnatcatcher.

Generally, additional restoration in the canyons should address the following:

- Coastal cactus wren habitat, specifically MSS patches dominated by cholla cactus, should be further expanded by increasing the size of the current patches and/or creating new patches. Coastal cactus wren habitat should be carefully located to maximize benefit to the species and facilitate safe movement throughout the two canyons.
- Coastal sage scrub habitat should be restored to support California gnatcatcher. This habitat should ideally become the background matrix habitat in Radio Canyon, with MSS habitat established on the hot, dry (generally south-facing) slopes most suited to that habitat.

- The ephemeral drainages defining the spine of each canyon should be restored, including the removal of arundo (*Arundo donax*) and other invasive exotics, and the establishment of riparian scrub habitats where hydrology will support them. Existing storm drain and street runoff problems currently causing erosion should be addressed as well. Riparian habitat restoration should avoid establishing large tree species that could facilitate raptor predation on coastal cactus wren and California gnatcatcher populations.
- As noted above, any areas subject to additional restoration activities should be maintained for a period of 2 to 5 years following planting. Weed abatement programs for large restoration areas are typically most effective when they focus primarily on chemical methods. All chemical use must be performed under the supervision of a person who holds a Qualified Applicator License and is highly knowledgeable in native plant identification and weed eradication programs.
- It is also recommended that the City of San Diego target the portions of the BMZ adjacent to the restoration areas for weed control efforts, if possible, to prevent the spread of nonnative species from these areas into the restored habitat.

FIGURES

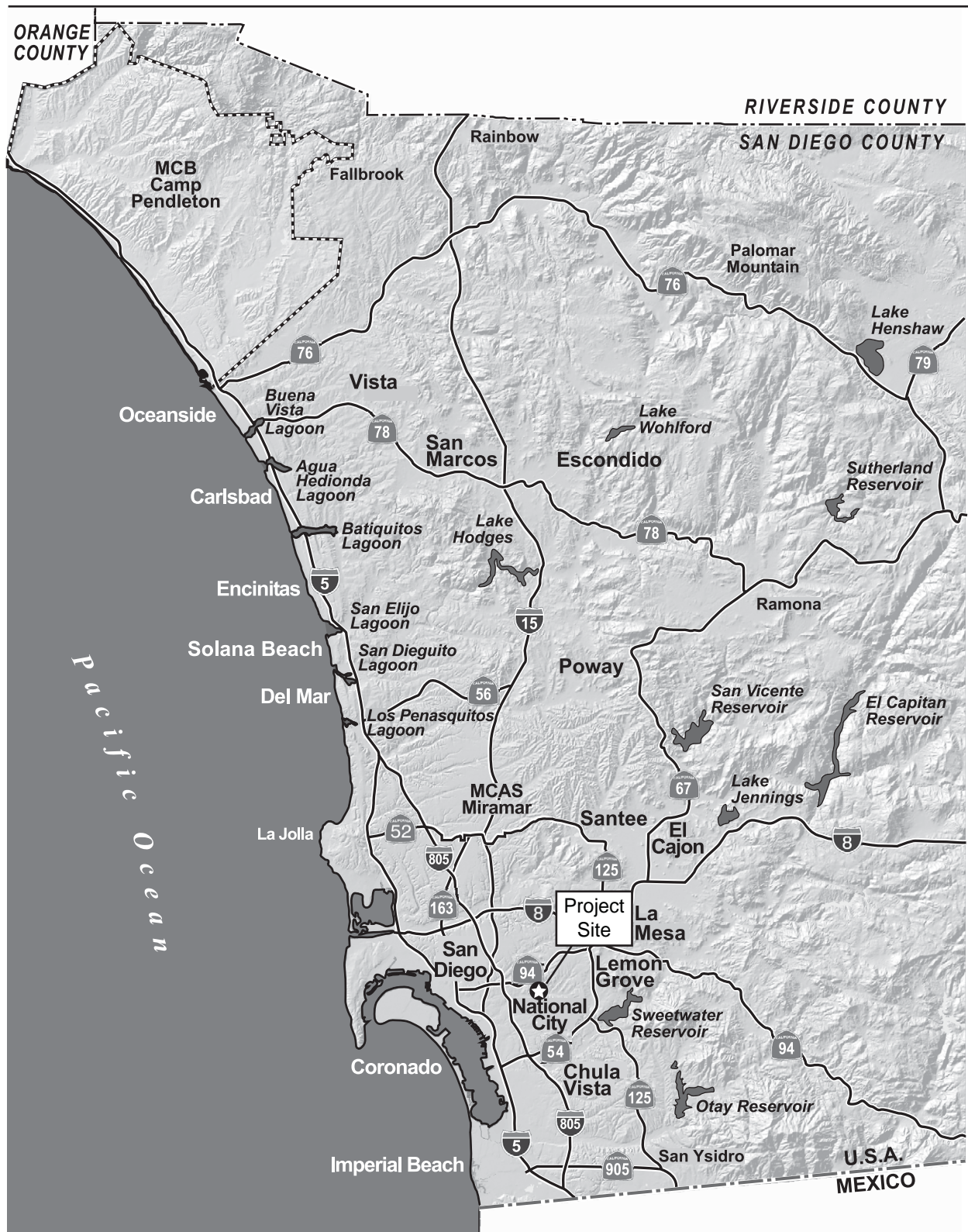


Figure 1
Regional Map

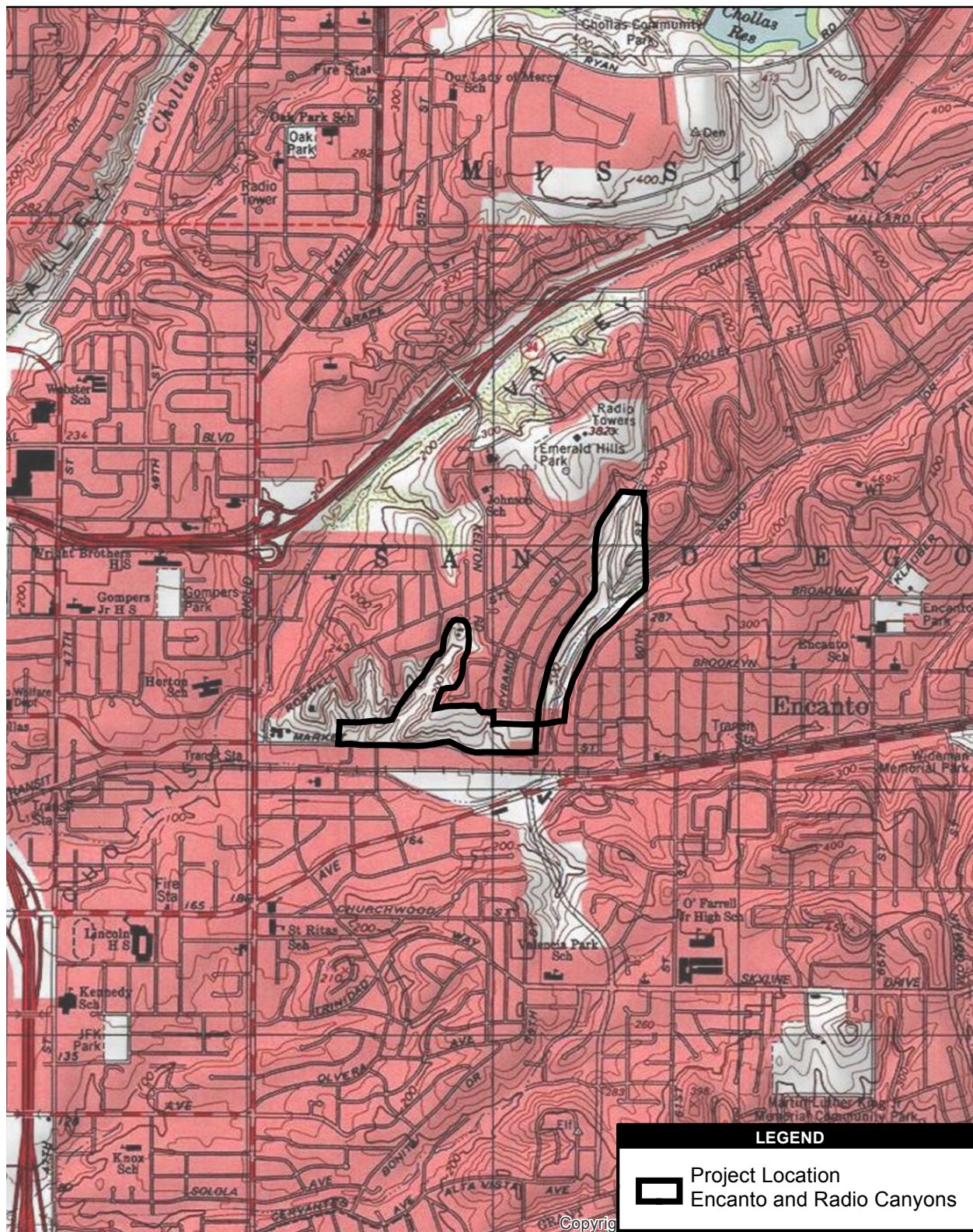
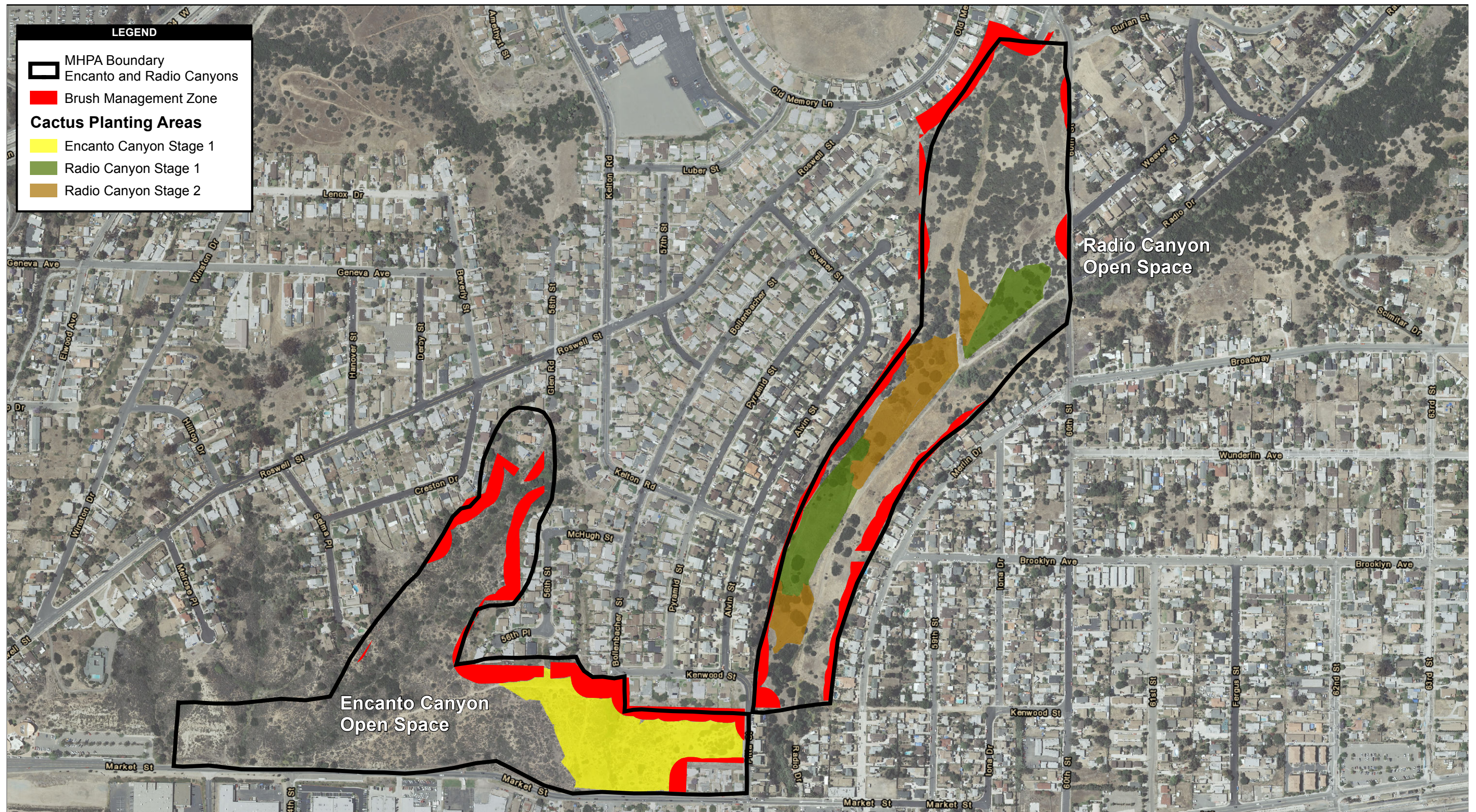


Figure 2
Project Location

Coastal Cactus Wren & California Gnatcatcher Habitat Restoration Project – Phase III, Year 2

Path: P:\2009\09080138 Cactus Wren\6.0 GIS\6.3 Layout\Figures\PhaseIII_Y2\Fig2_proj_location.mxd, 8/20/2015, paul_moreno



Source: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors; SanGIS 2009; SANDAG 2012; AECOM 2014

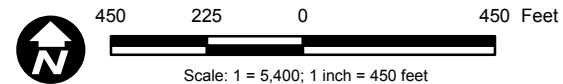


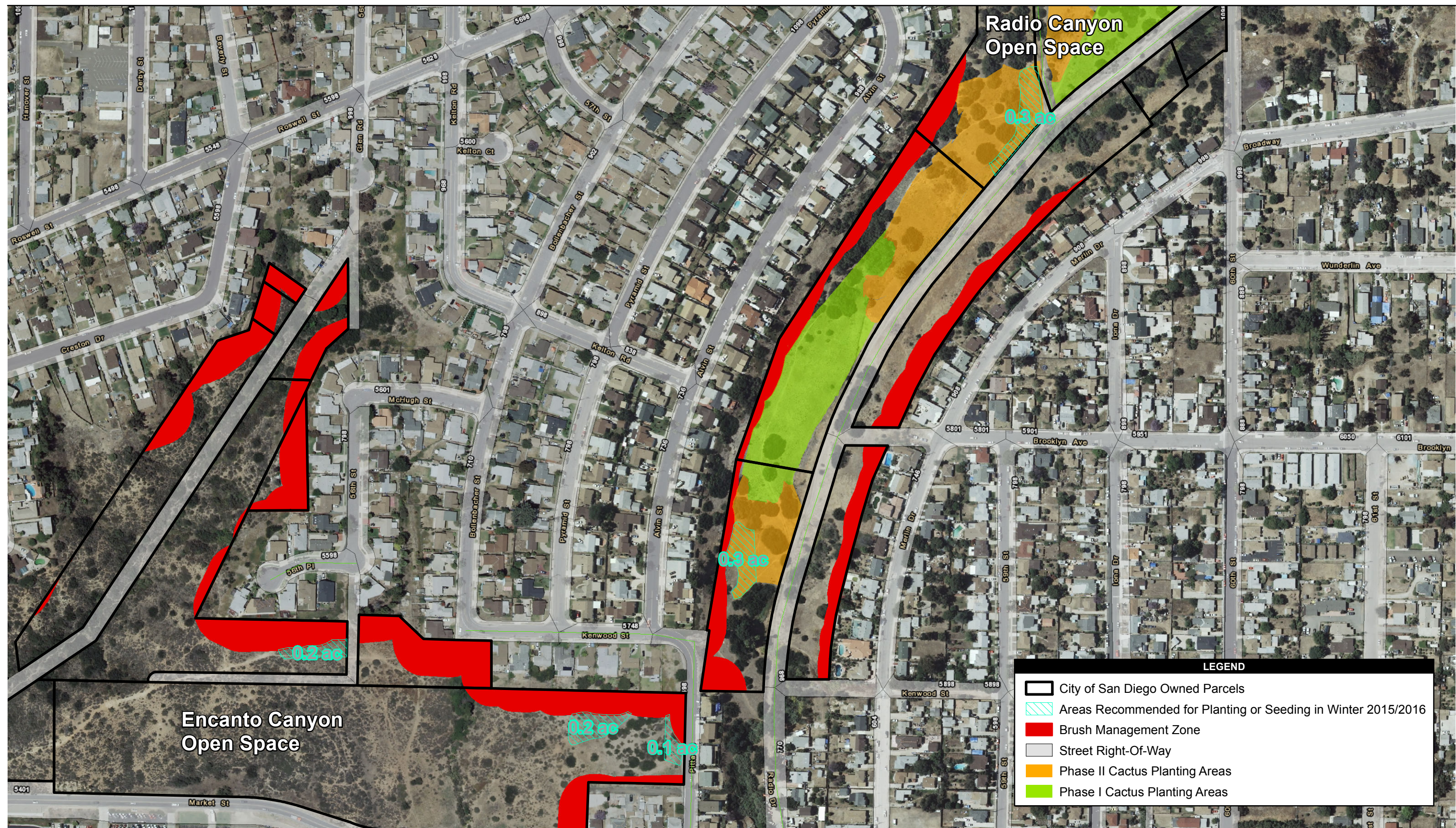
Figure 3
Project Areas and Restoration Site Boundaries

Coastal Cactus Wren & California Gnatcatcher Habitat Restoration Project – Phase III, Year 2

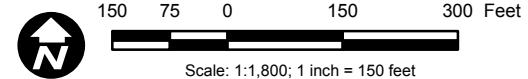
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Figure 4
Radio Canyon Project Areas Detail



Source: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors; SanGIS; SANDAG; AECOM 2013



Coastal Cactus Wren & California Gnatcatcher Habitat Restoration Project – Phase III, Year 2

Path: P:\2009\09080138 Cactus Wren\6.0 GIS\6.3 Layout\Figures\PhaseIII_Y2\Fig6_RecommendedSupplemental.mxd, 8/20/2015, paul_moreno

Figure 6
Project Areas Recommended for Supplemental Planting or Seeding

APPENDIX 1
PHOTO DOCUMENTATION
JULY 2015



Photo Point 1, Year 1. Stage 1 cactus planting area in Radio Canyon (July 2014).



Photo Point 1, Year 2. Stage 1 cactus planting area in Radio Canyon (July 2015).



Photo Point 2, Year 1. Stage 2 cactus planting area in Radio Canyon (July 2014).



Photo Point 2, Year 2. Stage 2 cactus planting area in Radio Canyon (July 2015).



Photo Point 3, Year 1. Stage 1 cactus planting area in Radio Canyon (July 2014).



Photo Point 3, Year 2. Stage 1 cactus planting area in Radio Canyon (July 2015).



Photo Point 4, Year 1. Stage 2 cactus planting area in Radio Canyon (July 2014).



Photo Point 4, Year 2. Stage 2 cactus planting area in Radio Canyon (July 2015).



Photo Point 5, Year 1. Stage 2 cactus planting area in Radio Canyon (July 2014).



Photo Point 5, Year 2. Stage 2 cactus planting area in Radio Canyon (July 2015).



Photo Point 6, Year 1. Stage 1 cactus planting area in Radio Canyon (July 2014).



Photo Point 6, Year 2. Stage 1 cactus planting area in Radio Canyon (July 2015).



Photo Point 7, Year 1. Stage 1 cactus planting area in Radio Canyon (July 2014).



Photo Point 7, Year 2. Stage 1 cactus planting area in Radio Canyon (July 2015).



Photo Point 8, Year 1. Stage 1 cactus planting area in Radio Canyon (July 2014).



Photo Point 8, Year 2. Stage 1 cactus planting area in Radio Canyon (July 2015).



Photo Point 9, Year 1. Stage 2 cactus planting area in Radio Canyon (July 2014).



Photo Point 9, Year 2. Stage 2 cactus planting area in Radio Canyon (July 2015).



Photo Point 10, Year 1. Stage 2 cactus planting area in Radio Canyon (July 2014).



Photo Point 10, Year 2. Stage 2 cactus planting area in Radio Canyon (July 2015).



Photo Point 11, Year 1. Stage 2 cactus planting area in Radio Canyon (July 2014).



Photo Point 11, Year 2. Stage 2 cactus planting area in Radio Canyon (July 2015).



Photo Point 12, Year 1. Stage 2 cactus planting area in Radio Canyon (July 2014).



Photo Point 12, Year 2. Stage 2 cactus planting area in Radio Canyon (July 2015).



Photo Point 13, Year 1. Stage 1 cactus planting area in Encanto Canyon (July 2014).



Photo Point 13, Year 2. Stage 1 cactus planting area in Encanto Canyon (July 2015).



Photo Point 14, Year 1. Stage 1 cactus planting area in Encanto Canyon (July 2014).



Photo Point 14, Year 2. Stage 1 cactus planting area in Encanto Canyon (July 2015).



Photo Point 15, Year 1. Stage 1 cactus planting area in Encanto Canyon (July 2014).



Photo Point 15, Year 2. Stage 1 cactus planting area in Encanto Canyon (July 2015).



Photo Point 16, Year 1. Stage 1 cactus planting areas in Encanto Canyon (July 2014).



Photo Point 16, Year 2. Stage 1 cactus planting areas in Encanto Canyon (July 2015).



Photo Point 17, Year 1. Stage 1 cactus planting area in Encanto Canyon (July 2014).



Photo Point 17, Year 2. Stage 1 cactus planting area in Encanto Canyon (July 2015).



Photo Point 18, Year 1. Stage 1 cactus planting area in Encanto Canyon (July 2014).



Photo Point 18, Year 2. Stage 1 cactus planting area in Encanto Canyon (July 2015).



Millennial Tech Middle school students study all aspects of plant identification, propagation, and installation.



EarthLab Propagation Center uses locally-collected seeds to propagate 10,000 natives annually.



Radio Canyon Day is now an annual community and student stewardship restoration event.

APPENDIX 2

CALIFORNIA NATURAL DIVERSITY DATABASE FORM FOR CALIFORNIA GNATCATCHER SIGHTING