CADIZ VALLEY WATER CONSERVATION, RECOVERY, AND STORAGE PROJECT

Rare Plant Survey Report

Prepared for
Santa Margarita Water District

May 2011

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Cadiz Valley Water Conservation, Recovery, and Storage Project: Rare Plant Survey Report

Summary

Environmental Science Associates (ESA) botanists conducted a rare plant survey for the Cadiz Valley Water Conservation, Recovery, and Storage Project (Project) in April of 2011. The 2011 rare plant surveys were concentrated within the proposed pipeline route and …… This area is referred to as the "study area" throughout this report. <See comment gca3>

Vegetation, particularly the herbaceous layers, has been disturbed to varying degrees throughout the study area, particularly within the southeastern region of the study site in areas adjacent to the access road running along the Danby Dry Lake and south toward the Colorado River Aqueduct. Throughout the study site, shrub diversity is relatively low owing to both the low diversity of habitats encountered within the site and the high level of previous disturbance. The desert habitat communities encountered consisted of creosote bush scrub, desert wash scrub, and desert pavement regions, each of which varied with level of disturbance. The diversity of herbaceous vegetation along the access road was similarly low and appears to have been impacted considerably by dirt movement associated with road grading, off-highway vehicle impacts. In addition, the preceding four years have been drought years for the state of California, resulting in an overall lower yield of annuals. However, precipitation for the 2009-2010 water-year was above average in the Project region and precipitation for Southern California overall for 2011 wet season was above average; therefore, floristic survey results in the spring of 2011 were anticipated to be by and large representative of the flora of the study area.

A total of 21 special-status plant species were determined to have potential to occur within the rare plant study area. None of those plant species are federal- or state-listed as threatened or endangered and therefore have no designated status or protection under federal or state endangered species legislation. However, 8 of those species are recognized as "rare or endangered, or potentially at risk of becoming so" by the California Native Plant Society (CNPS). Consideration of impacts to those species during CEQA review is warranted.

No special-status plant species were found within the rare plant study area. Based on the results of this 2011 survey, a 2010 survey, and the levels of past disturbance throughout the study area, special-status plant species are absent from the study site. Therefore, it is our professional opinion that construction related activities for Cadiz Valley Water Conservation, Recovery, and Storage Project and usage of associated access roads will have no impacts on special-status plants.

Introduction

Objective

This Rare Plant Survey Report was conducted in order to determine the presence and/or absence of special-status plant species within the proposed pipeline route of the Project, so that impacts to special-status plants can be analysis in the proposed project's Draft Environmental Impact Report

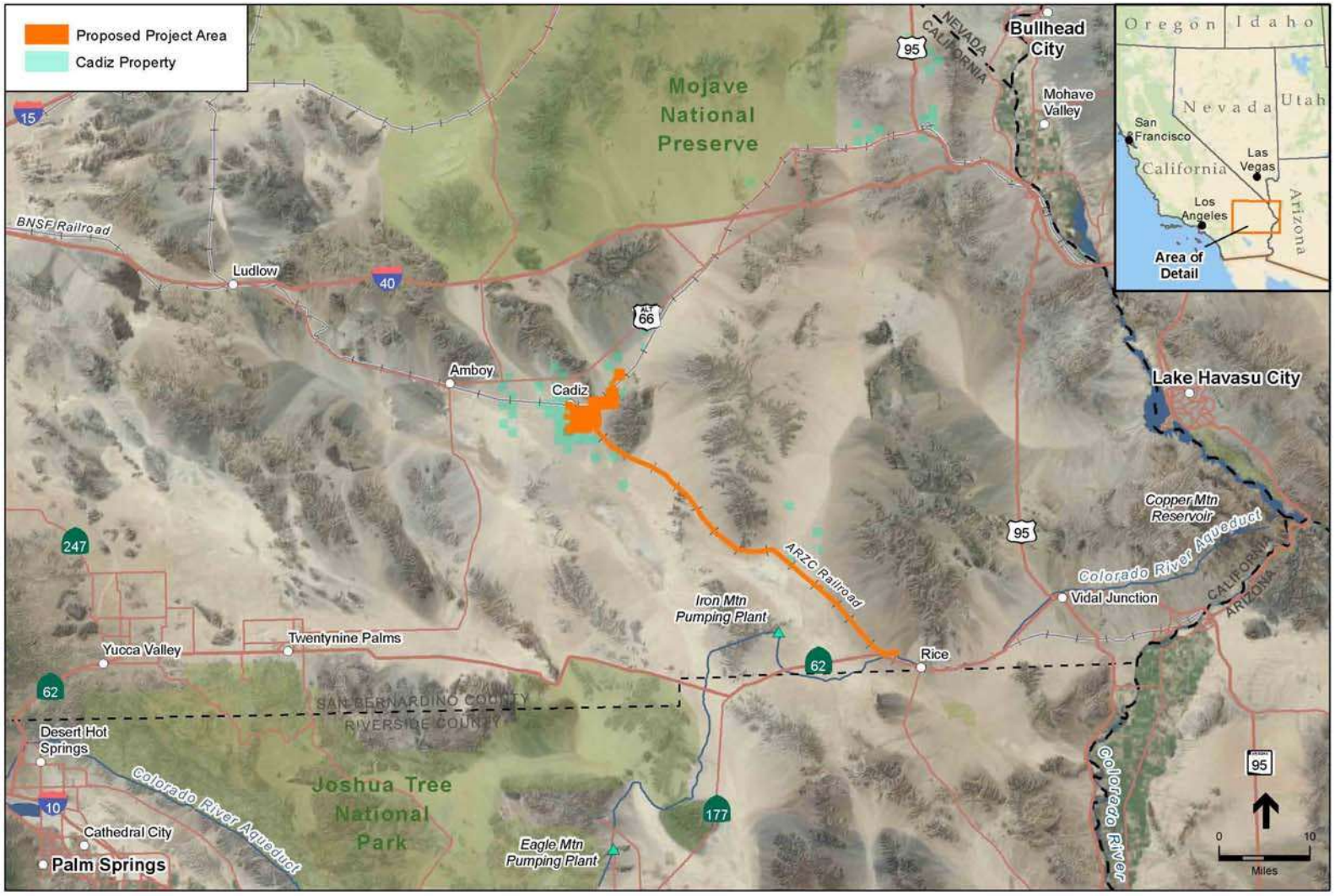
Project Location and Description

Project Location

The study area is located within the Fenner Watershed in the eastern Mojave Desert of San Bernardino County, California, approximately 200 miles east of Los Angeles, 60 miles southwest of Needles, and 40 miles northeast of Twentynine Palms. The Fenner Valley is a large northeast to southwest trending valley that intersects Cadiz Valley at the Fenner Gap located between the Marble and Ship mountains (Metropolitan Water District 2001).

Project Description

The Project is a water supply and conjunctive use storage project that would actively manage the groundwater basin within the Fenner Watershed in the eastern Mojave Desert for the purposes of developing a new reliable water supply and storage facility for the Santa Margarita Water District (SMWD) and other participating water agencies. The Project would be operated by Cadiz, which owns 34,000 acres in the Cadiz and Fenner valleys of the eastern Mojave Desert in San Bernardino County, California.



SOURCE: Bing Maps, 2011; ESRI, 2010; DeLorme, 2011; Cadiz Inc., 2011; and ESA, 2011

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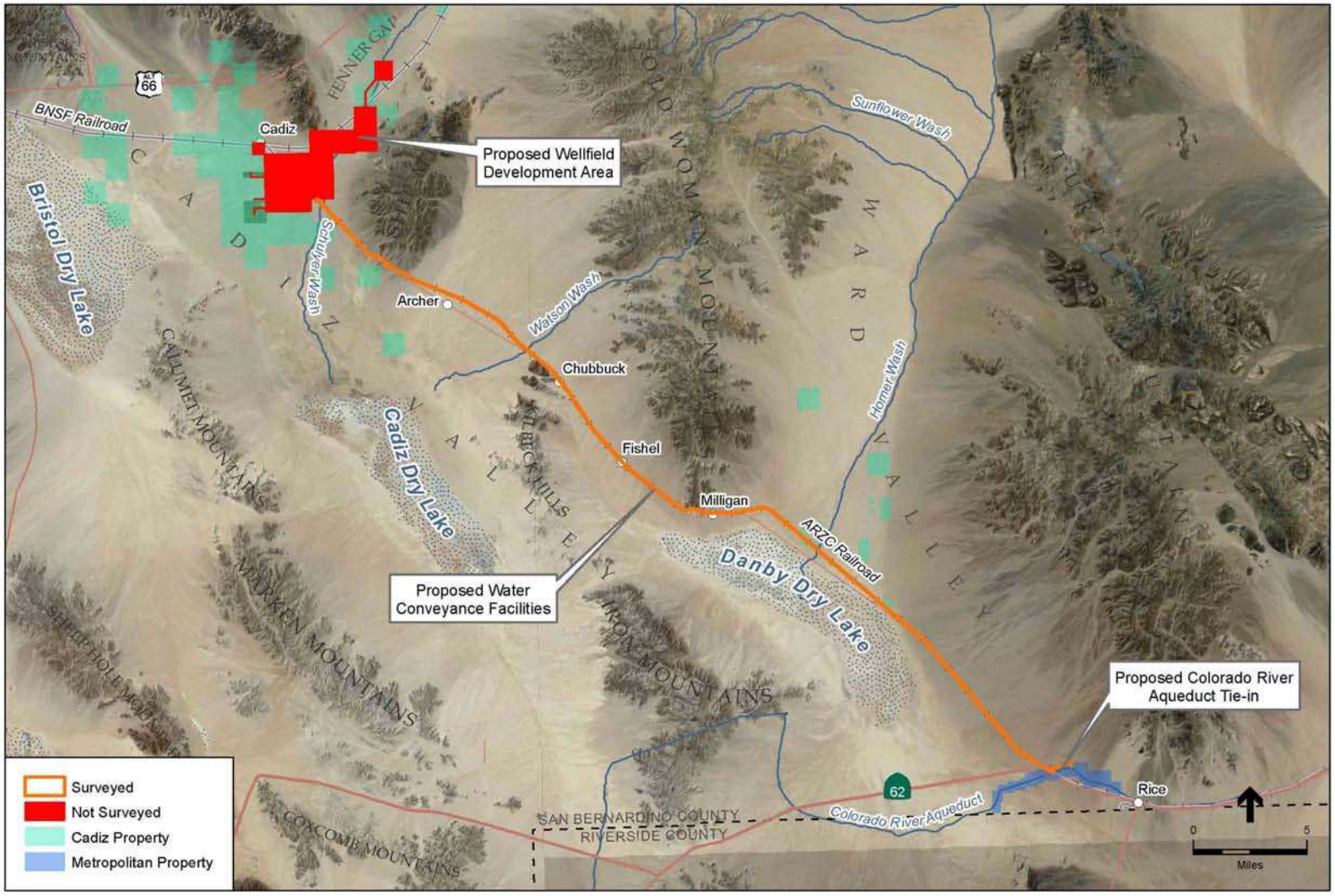
Figure 1
Regional Location



SOURCE: Bing Maps, 2010; BLM, 2009; ESRI, 2010; Cadiz Inc., 2010; and ESA, 2010

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Figure 2
Survey Areas

Setting

Climate

The eastern Mojave Desert is characterized as an arid desert climate with low annual precipitation, low humidity, and relatively high temperatures. Winters are mild and summers are hot, with a relatively large range in daily temperatures. Temperature and precipitation vary greatly with altitude, with higher temperatures and lower precipitation at low altitudes and lower temperatures and higher precipitation at higher altitudes. Average annual precipitation varies from about 4 inches in Bristol Valley to more than 12 inches in the New York Mountains.[1]

Topography and Soils

Elevations along the pipeline right-of-way range from approximately 830 feet at the north end down to 640 feet east of Danby Lake back up to 950 feet where the pipeline terminates at the CRA.[2]

The groundwater recharge and storage study conducted in 2010 included acquiring input for the soil types and properties within the watershed.[3] Areas of low topographic relief consist of the Carrizo-Rositas-Gunsight soil series and are typically described as light colored, red, desert alluvial, sandy soils. Areas along the mountain slopes adjacent to the proposed water conveyance facilities consist of the Gunsight-Rillito-Chuckwalla soil series and are typically described as alluvium, colluvium, and residuum from granite, gneiss, quartzite and limestone formations.[4] The majority of the Project footprint consists of the Carrizo-Rositas-Gunsight soil units.

The Carrizo soils include floodplains, alluvial fans, and associated formations formed in mixed alluvium, with slopes ranging from 0 to 15 percent. Typical profiles range from extremely gravelly sand to very gravelly course sand, with low shrink-swell capacity, rapid to very rapid drainage, and negligible to low runoff potential.

The Rositas soils consist of sand sheets to dunes formed of eolian material, with slopes ranging up to 30 percent in dune areas. Typical profiles include sand depths of about 60 inches, with less than 15 percent course to very course sand. These soils have rapid permeability, low shrink-swell capacity, and negligible to low runoff potential.

The Gunsight and Rillito soils consist of mixed alluvium with mostly moderate slopes but isolated areas up to 60 percent, gravelly sandy loam to extremely gravelly sandy loam, somewhat excessively drained, with low shrink-swell capacity, and runoff potential from very low to high.

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1 CH2MHill, Cadiz Groundwater Conservation and Storage Project, July 2010, page 2-3; see also www.prism.oregonstate.edu

2 Circle Mountain Biological Consultants, Inc. (CMBC), *Focused Survey for Desert Tortoise, Habitat Evaluation for Burrowing Owl, and General Biological Resource Assessment for the Cadiz Groundwater Conservation and Storage Project*. November 2010, page 15.

3 CH2M Hill, July 2010, *Cadiz Groundwater Conservation and Storage Project*, Pages 2-7 and 4-6, Table 4-3

4 Metropolitan Water District of Southern California (Metropolitan) and Cadiz, September 2001. *Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the Cadiz Groundwater Storage and Dry-Year Supply Program*. Pages 5-34 and 5-35

Other associations that could be intersected in proportionally small amounts include Tecopa Rock Outcrop-Lithic Torriorthents (Tecopa formation comprises very shallow soils of recently weathered material, on low hills and low mountain slopes with 15 to 75 percent slope, as well as rock outcrops and torriorthents), along the northwestern edge of the wellfield development area and the southern tip of the Old Woman Mountains along the pipeline; and the Rillito-Gunsight association (mixed alluvium with mostly moderate slopes but isolated areas up to 60%, gravelly sandy loam to extremely gravelly sandy loam, somewhat excessively drained, and runoff potential from very low to high) along the pipeline to the southeast of the wellfield area, and where the pipeline approaches the Old Woman Mountains.

Plant Communities

Plant communities observed within the study site were compared to the Holland Code of Terrestrial Natural Communities of California (1986). The study site was generally dominated by Mojave Creosote Bush Scrub. This habitat varied slightly between areas within the study site but was consistently dominated by creosote bush (*Larrea tridentata*) with few other species, occasionally forming a monoculture of creosote bush. Various small washes run through the study site usually in a north-south direction, but the vegetation compositions of most of those washes differed only slightly from the surrounding habitat and were observed as generally containing the same principal species composition as the surrounding (creosote bush) scrub. A small amount of those washes displayed slightly higher plant diversity than the surrounding scrub and fit the description for Mojave Wash Scrub. Additionally, various portions of the study site that have been subjected to prior human disturbances (e.g., off highway vehicle (OHV) disturbance or grading) contained mainly non-native, weedy annuals or bare ground and most closely could be described as disturbed habitat, which were typically observed directly along the railroad and access roads but that occasionally accounted for up to or beyond 100 feet on either side from center.

Vegetation, particularly the herbaceous layers, has been disturbed to varying degrees throughout the study area, particularly along the region south and east of Browns Wash, along the Kilbeck Hills, where the site runs along the north side of Danby Dry Lake and in the southeastern most area of the site closest to the Colorado River Aqueduct. The rate of recovery in desert habitats that have been impacted by human activities depends on the intensity and duration of the impacts, as well as climatic factors. Lovige and Bainbridge (1999) state that, "Recovery to predisturbance plant cover and biomass may take 50–300 years, while complete ecosystem recovery may require over 3000 years." Their further review of impacts to, and recovery rates for, desert vegetation cites several studies showing that a) shrub cover is greater in areas that have never been grazed than in grazed areas, b) plots protected from grazing for ten years showed no difference from heavily grazed areas, suggesting generally slow rates of recovery and c) exclusion of grazing for 14–19 years was not sufficient time for recovery of native perennial grasses in southeastern Arizona. In addition, Lovige and Bainbridge suggest that degradation of arid lands does not necessarily stop following cessation of human activities and that drought, combined with erosion and sand encroachment precipitated by disturbance, can continue to degrade areas already impacted for many years (Lovige and Bainbridge, 1999). While vegetation within the study site exhibits shrub species composition that is generally consistent with Mojave creosote bush scrub,

the diversity of herbaceous vegetation appears to have been impacted to a considerable degree by human activities within the study site.

Mojave Creosote Bush Scrub (Holland Code 34100)

Mojave creosote bush scrub is an open community dominated by the perennial creosote bush and often by white bursage (*Ambrosia dumosa*), typically with abundant bare ground space between shrubs. Soils are generally well drained, have a low water holding capacity, and occur on bajadas, slopes, fans, and relatively flat valley floors. Throughout most of the study site, creosote bush was the predominant species and in some areas was the only shrub species visible for up to or more than 100 feet from the centerline of the site. Much of this habitat also included smaller shrub associates such as white bursage, littleleaf rattany (*Krameria erecta*), and rabbitbrush (*Hymenoclea salsola*). Less frequently, the smaller shrubs also included Mormon tea (*Ephedra nevadensis*), and where the study site occurred within a mile of Danby Dry Lake, the shrub associates often included four-winged saltbush (*Atriplex canescens*) and tamarisk (*Tamarix rammossissima*), especially close to where small washes intersected the study site. Within the study area, this community supports a generally low diversity and numbers of native annual herbaceous species. Most of the creosote scrub within the study site lacked a consistent herbaceous layer; however, where it occurred, the herbaceous layer most commonly contained such annuals as pebble pincushion (*Cheanactus carphoclinia*), spiny-herb (*Chorizanthe rigida*), chia (*Salvia columbariae*), and occasionally desert trumpet (*Eriogonum inflatum*).

Mojave Wash Scrub (Holland Code 34250)

Mojave wash scrub occurs in desert washes generally and normally contains many of the perennial plant species found in the surrounding scrub habitat with the addition of species that are specific to desert wash parameters; sandy bottoms of wide canyons, incised arroyos of upper bajadas, and sandy or rocky braided washes of lower bajadas below approximately 5,000 feet in elevation. Within the study site, Mojave wash scrub contained many of the same dominant shrubs as found in creosote bush scrub with the additions of smoke tree (*Psorothamnus spinosa*) and catclaw acacia (*Acacia greggii*) and to a much lesser extent with palo verde (*Cercidium floridum*). Mojave wash scrub was also observed to contain annuals and biennials not observed in the surrounding upland scrub, such as desert milkweed (*Asclepias erosa*), ajamete (*Asclepias subulata*), and Mojave lupine (*Lupinus sparsiflorus*).

Disturbed Habitat (Holland Code 13000)

Disturbed habitat is any land on which the native vegetation has been significantly altered by agriculture, construction, or other land-clearing activities, and the species composition. Within the survey site, disturbed habitat occurred generally along both sides of the railroad tracks and access roads and within all other previously disturbed areas, including the areas immediately surrounding the Colorado River Aqueduct. The amount of disturbed habitat varied from several feet to more than 50 feet from the centerline of the survey area. Vegetation typically consisted of weedy, introduced annuals such as wild mustard (*Brassica* sp.), redstem filaree and Mediterranean schismus.

Figure 3: Mojave Creosote Bush Scrub

A relatively average and undisturbed portion of Mojave creosote bush scrub.

Figure 4: Disturbed Mojave Creosote Bush Scrub

Example of disturbed Mojave creosote bush scrub located at the southern end of the survey site adjacent to the Colorado River Aqueduct. This area consists of spaced shrubs and sparse herbaceous layer.

Figure 5: Mojave Wash Scrub

An example of a Mojave wash scrub dominated with creosote bush scrub species..

Figure 6: Mojave Wash Scrub with additional species

Mojave scrub wash dominated with smoke tree (*Dalea spinosa*), white bursage, and mormon tea, with Mojave creosote scrub in the background

Special-status Plant Species

A total of 21 special-status[5] plant species have the potential to occur in the project area based on the proximity of the project to previously recorded occurrences in the region, on-site vegetation and habitat quality, topography, elevation, soils, surrounding land uses, habitat preferences, and geographic ranges of special-status plant species known to occur in the region.

One of these plant species, Trelease's beavertail pricklypear (*Opuntia basilaris* var. *treleasei*), is federally and state listed as endangered. The remaining have no designated status or protection under federal or state endangered species legislation but are recognized as rare or endangered, or potentially at risk of becoming so, by the California Native Plant Society (CNPS). CNPS List 1B species are rare throughout their range, with the majority of them endemic to California. Most of the plants of List 1B have declined significantly over the last century. List 2 species are considered to be rare and endangered in California but are more common elsewhere. List 3 species are those for which CNPS lacks the necessary information to assign them to one of the other lists or to reject them. List 4 species are of limited distribution or infrequent throughout a broader area in California and their overall vulnerability or susceptibility to threat is considered relatively low at this time. While these plants are not considered "rare" from a statewide perspective, they are uncommon enough that their status should be monitored regularly. In addition, CNPS added a 'threat rank' to their listings. This is an extension added onto the CNPS List and designates the level of endangerment by a 1 to 3 ranking, with 1 being the most endangered and 3 being the least endangered. The threat ranks are defined as follows:

- 0.1-Seriously threatened in California (high degree/immediacy of threat)
- 0.2-Fairly threatened in California (moderate degree/immediacy of threat)
- 0.3-Not very threatened in California (low degree/immediacy of threats or no current threats known).

Impacts to CNPS List 1 and 2 species are generally considered significant under CEQA. Impacts to List 3 species are not generally considered as this is primarily an advisory list. Impacts to List 4 species are generally not presumed significant, due to the wider distribution of these species, but may be considered significant should conditions warrant it (e.g. a species' habitat is being converted at a rapid pace due to local development pressure).

Methods

The survey area consisted of 100 feet on both sides of the Arizona and California Railroad Company's (ARZC) railroad tracks.

In preparation for the field surveys the California Natural Diversity Database (CNDDB) (CDFG, 2011) and the CNPS online database (CNPS, 2011) were queried to develop a list of special-status and rare plant species that have been previously recorded in the Project region. Data were

[5] Special-status plants are those listed as rare, threatened, or endangered by the State or federal government or by organizations with recognized expertise, such as the California Native Plant Society.

queried for San Bernardino County and for the following USGS 7.5 minute topographic quadrangles that contained the Project survey area: Cadiz Lake NW, Cadiz Lake NE, Chubbuck, Milligan, Danby Lake, and Africa Mountains. Field surveys were then focused on the resulting 21 plant species identified through the database search results (Appendix A). Of those species, 8 had a moderate potential to occur within the survey area; the remaining 11 species were considered as having low potential to occur based mainly on lack of suitable habitat parameters, such as substrate or elevation specificity.

Field surveys were conducted within the study area on April 19, 20, and 21, 2011, by a four person botanical survey team that included Darren Burton and Jon West of Environmental Science Associates, and Jeremiah George, Ph.D. and Youssef Attalla, Ph.D., of Environmental Intelligence, LLC. The survey dates were chosen to encompass the maximum chance of observing the blooming periods of the annual species (note: perennial species, such as cactuses, can be located and positively identified outside of their respective blooming periods). Due to the low growing nature and scarcity of the herbaceous vegetation and generally widely spaced character and flat topography of creosote bush scrub, visual coverage of the study area was very comprehensive and effectively complete.

The length of the study site was first assessed by driving access roads that occurred along the length of the Project to identify habitats with a moderate potential to support target species based on habitat conditions and suitability. Selected segments that were observed to contain moderate habitat suitability, which was generally based on shrub diversity and presence of annuals, were surveyed on foot. Disturbed areas with low plant growth were methodically scanned from a vehicle driven at very slow speeds and randomly assessed by foot where plant growth and some marginal habitat was present. Plant communities were characterized according to Holland (1986) along the entire length of the survey site and all plant species observed were identified to the appropriate level needed to determine rarity.

Survey Results

No special-status plant species were observed within the study area. The rare plant survey was timed during the typical blooming period of the target species to allow for certainty of taxonomic identification Most of the plant species encountered were in bloom and easily identifiable by their flowers or infructescences; some species were past or near the end of their blooming periods. Nonetheless, all species were positively identified by either vegetative parts, fruit, or identifiable reproductive structures (i.e., flower parts).

Table 2 (in Appendix A) lists all plant species observed within the study area. A few herbaceous annuals were widespread throughout the study area, including red-stem filaree (*Erodium cicutarium*), and desert pincushion (*Chaenactis stevioides*). Various other annuals were scattered sparsely throughout the site and found in concentrated areas, such as bright green buckwheat (*Eriogonum viridescens*), desert calico (*Loeseliastrum matthewsii*), and chia (*Salvia columbariae*). The greatest species diversity was concentrated in the western portion of the study area, with the eastern portion dominated by <name of plant community here> almost exclusively by just a few species such as **<or just say creosote if it's creosote scrub>_____**. In general, the

annual plant cover of the survey site was considered moderate to low and species diversity was typically low throughout.

Most plants were recognizable to species or subspecies level; those that were not immediately recognized or comparable to published photograph from a field guide were identified using the Desert Jepson Manual (Baldwin et al, 2002). Those species that resembled special-status taxa were able to be excluded due to known distributions or one or more recognizable distinguishing morphological characteristics that distinguished it from a target species. For example, *Opuntia basilaris* var. *basilaris* was observed at the eastern end of the site and was determined not be *O. b.* var. *brachyclada*, a taxon listed by the CNPS as rare, threatened or endangered in California and elsewhere, based on range and morphological differences in spine architecture. Also, two *Cryptantha* species of limited distribution have been documented as occurring in eastern San Bernardino County and within Mojave creosote bush scrub; however, the two *Cryptantha* species that were observed (in bloom) were identified as commonly occurring species and not special-status due to leaf and nutlet morphology. *Eschscholzia minutiflora* was found on in limited spots within the survey site. However, the special-status subspecies, *E. m.* ssp. *twisselmanii*, is not known to occur anywhere near the survey vicinity; it is currently only found in very limited regions of Kern County.

In our professional opinion, these three species do not occur at the Project site and no additional or late season floristic surveys are warranted.

Assessment of Potential Impacts on Special-status Plants and Natural Communities

No special-status plant species were found within the study area during the survey. Given the results of this 2011 survey and the history of past habitat degradation throughout the study area, the potential for special-status species to occur is low. Therefore, it is the professional opinion of ESA that Project-related construction and usage of associated access roads associated with the proposed Cadiz Valley Water Conservation, Recovery, and Storage Project will have no impacts on special-status plants and mitigation to special-status plant species will not be required.

Recommendations

No special-status plants were found within the study area. It is our professional opinion that the surveys conducted in April 2011 were adequate to allow determination of a low likelihood of special-status plants being impacted by the proposed Project. No further surveys are recommended and no mitigation for impacts to special-status plants will be required under CEQA.

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APPENDIX A: TABLE 1

Listed/Protected Plant Species with Potential to Occur within the Rare Plant Study Area

Scientific Name	Common Name	Listing Status	Potential to Occur Onsite
Androstephium breviflorum	Small-flowered androstephium	List 2.2	**Moderate.** Creosote bush scrub and desert dunes between 840 and 4,960 feet; found west of Iron Mountains in 1995; suitable habitat throughout Project area.
Arctomecon merriamii	White bear poppy	List 2.2	**Low.** Rocky soils in creosote bush scrub between 1,520 and 4,910 feet; not found in 1995 or 1999; site is outside range and elevations are too low.
Astragalus insularis var. *harwoodii*	Harwood's milk-vetch	List 2.2	**Moderate.** Sandy or gravelly desert dunes, desert scrub below 930 feet; 300+ plants between Danby Lake and Cadiz Road in 2010; suitable habitats and elevations along ARZC ROW and western wellfields.
Astragalus lentiginosus var. *borreganus*	Borrego milk-vetch	List 4.3	**Moderate.** Sandy soils in creosote bush scrub between 90 and 840 feet; observed in 1995 east of Iron Mountain pumping plant and Cadiz Lake in sand field areas; suitable habitats and elevations in western wellfields and sandy areas along ARZC ROW particularly near Danby Lake.
Castela emoryi	Crucifixion thorn	List 2.3	**Low.** Deciduous shrub along gravelly washes, slopes, and plains in creosote bush scrub between 280 and 1,890 feet; not found in 1995 or 1999; as a large shrub occurring in washes, this plant would have been found if present within the ARZC ROW.
Colubrina californica	Las animas colubrina	List 2.3	**Low.** Evergreen shrub in creosote bush scrub between 30 and 3,100 feet; not found in 1995 or 1999; as a large shrub occurring in washes, this plant would have been found if present within the ARZC ROW.
Coryphantha alversonii	Alverson's foxtail cactus	List 4.3	**Moderate.** Rocky to cobbly soils in creosote bush scrub between 230 and 4,730 feet; found west of Iron Mountain in 1995; suitable habitats in Section 17 and where Ship and Old Woman Mountains approach ARZC ROW.
Cryptantha costata	Ribbed cryptantha	List 4.3	**Moderate.** Sandy soils in creosote bush scrub between 180 and 1,550 feet; found in 1995 at Cadiz Lake and in areas of stabilized dunes, but not along Cadiz Road; suitable habitats east of Danby Lake.
Cryptantha holoptera	Winged cryptantha	List 4.3	**Moderate.** Sandy to rocky soils in creosote bush scrub between 310 and 3,720 feet; not found in 1995 or 1999; suitable habitats throughout.
Cynanchum utahense	Utah vine milkweed	List 4.2	**Moderate.** Dry sandy, gravelly soil in creosote bush scrub between 465 and 4,400 feet; not found in 1995 or 1999; suitable habitats throughout.

Scientific Name	Common Name	Listing Status	Potential to Occur Onsite
Echinocereus engelmannii var. howeii	Howe's hedgehog cactus	List 1B.1	**Low.** In creosote bush scrub between 1,333 and 2,400 feet; not found in 1995 or 1999; elevations too low to be suitable.
Linanthus maculatus	Little San Bernardino Mountains linanthus	List 1B.2	**Low.** Sandy soils in creosote bush scrub between 604 to 6,030; not observed in 1995 or 1999; found in the vicinity of Joshua Tree, the Project area is well outside the known range of the species.
Matelea parvifolia	Spear-leaf matelea	List 2.3	**Low.** Dry rocky soils in creosote bush scrub between 1,360 and 3,390 feet; not found in 1995 or 1999; elevations too low to be suitable
Monardella robisonii	Robison's monardella	List 1B.3	**Low.** Pinyon-juniper woodland between 1,890 and 4,650; not found in 1995 or 1999; site is outside range and elevations are too low; suitable habitat not present within survey area.
Nemacaulis denudate var. *gracilis*	Slender cottonheads	List 2.2	**Moderate.** Sandy slopes above drainage at 1,560 feet; found in Arica Mountains in 2010; suitable habitats and elevations along ARZC ROW and western wellfields.
Opuntia basilaris var. *brachyclada*	Short-joint beavertail cactus	List 1B.2	**Low.** Creosote bush scrub between 1,320 and 5,580 feet; not found in 1995 or 1999; site is outside range and elevations are too low.
Penstemon albomarginatus	White-margined beardtongue	List 1B.1	**Low.** Sandy soils, stabilized dunes, roadside washes in creosote bush scrub between 1,980 and 3,300 feet; elevations too low to be suitable.
Penstemon stephensii	Stephen's beardtongue	List 1B.3	**Low.** Carbonate or rocky soils in creosote bush scrub between 3,500 and 5,720 feet; not found in 1995 or 1999; elevations too low to be suitable.
Physalis lobata	Lobed ground-cherry	List 2.3	**Low.** Decomposed granite in creosote bush scrub between 1,550 and 2,480 feet; not found in 1995 or 1999; elevations too low to be suitable; suitable substrates not observed within survey area.
Salvia greatae	Orocopia sage	List 1B.3	**Low.** Broad alluvial bajadas and fans beside washes in creosote bush scrub between 120 and 2,500 feet; found in Marble Mountains in 1978; potentially suitable habitats in Section 17 and where Ship and Old Woman Mountains approach ARZC ROW.
Sphaeralcea rusbyi var. *eremicola*	Rusby's desert-mallow	List 1B.2	**Low.** Creosote bush scrub between 3,020 and 4,650; not observed in 1995 or 1999; elevations too low to be suitable.

APPENDIX A: TABLE 2

Plant Species Observed within the Rare Plant Study Area

Scientific Name	Common Name
Nonflowering Plants	
Ephedraceae	**Joint-fir Family**
Ephedra nevadensis	Nevada joint-fir
Flowering Plants	
Eudicots	
Amaranthaceae	**Amaranth Family**
Atriplex canescens	four-winged saltbush
Atriplex hymenelytra	desert holly
Atriplex polycarpa	allscale
*Salsola tragus**	Russian thistle
Suaeda moquinii	Torrey's sea-blight
Tidestromia oblongifolia	honeysweet
Asclepiadaceae	**Milkweed Family**
Asclepias erosa	desert milkweed
Asclepias subulata	ajamete
Sarcostemma hirtellum	hairy milkweed
Asteraceae	**Sunflower Family**
Ambrosia dumosa	burrobush
Baileya multiradiata	woolly marigold
Bebbia juncea	sweetbush
Calycoseris wrightii	white tackstem
Chaenactis stevioides	desert pincushion
Chrysothamnus paniculatus	wash rabbitbrush
Dicoria canescens	dicoria
Encelia farinosa	brittlebush
Encelia fructescens	rayless encelia
Eriophyllum wallacei	Wallace's woolly daisy
Ericameria cooperi	Cooper's goldenbush
Geraea canescens	desert sunflower
Hymenoclea salsola	cheesebush
Malacothrix glabrata	desert dandelion
Monoptilon bellioides	gray desert star

Scientific Name	Common Name
Palafoxia arida	desert Spanish-needles
Pectis papposa	chinch weed
Perityle emoryi	Emory's rock daisy
Porophyllum gracile	odora
Psathyrotes ramosissima	velvet rosettes
Stephanomeria exigua	milk aster
Stephanomeria pauciflora	desert milk aster
Bignoniaceae	**Bigonia Family**
Chilopsis linearis	desert willow
Boraginaceae	**Borage Family**
Amsinckia tessellata	fiddleneck
Cryptantha barbigera	fuzzy forget-me-not
Cryptantha nevadensis	Nevada forget-me-not
Pectocarya heterocarpa	combseed
Pholisma arenarium	dune food
Tiquilia plicata	plicate coldenia
Brassicaceae	**Mustard Family**
*Brassica tournefortii**	Saharan mustard
*Descurainia pinnata**	tansy
*Descurainia sophia**	flixweed
Guillenia lasiophylla	California mustard
Lepidium flavum	peppergrass
Lepidium lasiocarpum	sand peppergrass
*Sisymbrium irio**	London rocket
Cactaceae	**Cactus Family**
Opuntia basilaris	beavertail cactus
Opuntia echinocarpa	silver cholla
Capparaceae	**Caper Family**
Isomerus arborea	bladderpod
Cuscutaceae	**Dodder Family**
Cuscuta sp.	dodder
Euphorbiaceae	**Spurge Family**
Euphorbia setiloba	Yuma sandmat
Stillingia spinulosa	toothleaf
Fabaceae	**Pea/Bean Family**
Acacia greggii	catclaw acacia
Cercidium floridum	palo verde
Dalea mollissima	soft prairie clover
Lupinus sparsiflorus	Mojave lupine
Psorothamnus emoryi	indigo bush

Scientific Name	Common Name
Psorothamnus spinosus	smoke tree
Senna armata	desert senna
Geraneaceae	**Geranium Family**
*Erodium cicutarium**	red-stemmed filaree
Hydrophyllaceae	**Water-leaf Family**
Nama demissum	purple mat
Phacelia crenulata	notchleaf hacelia
Krameriaceae	**Krameria Family**
Krameria erecta	littleleaf rhatany
Lamiaceae	**Mint Family**
Hyptis emoryi	desert lavender
Salvia columbariae	chia
Loasaceae	**Stick-leaf Family**
Mentzelia albicaulis	little blazing star
Petalonyx thurberi	sandpaper plant
Malvaceae	**Mallow Family**
Eremalche rotundifolia	desert fivespot
Nyctaginaceae	**Four o'clock Family**
Mirabilis bigelovii	desert wishbone plant
Onagraceae	**Evening-primrose Family**
Camissonia boothii	red primrose
Camissonia brevipes	yellow cups
Camissonia claviformis	brown-eyed primrose
Oenothera deltoides	devil's lantern
Orobanchaceae	**Broom-rape Family**
Orobanche cooperi	desert broomrape
Papaveraceae	**Poppy Family**
Eschscholzia minutiflora	pygmy poppy
Plantaginaceae	**Plantain Family**
Plantago ovata	plantain
Polemoniaceae	**Phlox Family**
Gilia sp.	gilia
Langloisia setosissima	lilac sunbonnets
Loeseliastrum matthewsii	desert calico
Loeseliastrum schottii	Schott's calico
Polygonaceae	**Buckwheat Family**
Chorizanthe brevicornu	brittle spineflower
Chorizanthe rigida	rigid spineflower
Eriogonum inflatum	desert trumpet
Eriogonum thomasii	Thomas's buckwheat

Scientific Name	Common Name
Eriogonum viridescens	bright green buckwheat
Resedaceae	**Mignonette Family**
Oligomeris linifolia	narrowleaf oligomeris
Solanaceae	**Nightshade Family**
Datura wrightii	jimsonweed
Tamaricaceae	**Salt-cedar Family**
*Tamarix ramosissima**	tamarisk
Viscaceae	**Mistletoe Family**
Phorodendron californicum	mesquite mistletoe
Zygophyllaceae	**Caltrop Family**
Fagonia laevis	California fagonbush
Larrea tridentata	creosote bush
*Tribulus terrestris**	puncture vine
Monocots	
Agavaceae	**Agave Family**
Agave deserti	desert agave
Hesperocallis undulata	desert lily
Melanthiaceae	**Starfruit Family**
Zigadenus curvibracteatus	desert camas
Poaceae	**Grass Family**
Pleuraphis rigida	Big galleta
*Schismus barbatus**	Mediterranean schismus
Vulpia octoflora	sixweeks fescue

*=species not native to California