THE CITY OF SAN DIEGO

REPORT TO THE PLANNING COMMISSION

DATE ISSUED: December 4, 2013 REPORT NO. PC-13-133

ATTENTION: Planning Commission
Agenda of December 12, 2013

SUBJECT: Vernal Pool Information Workshop

SUMMARY:

WORKSHOP BY CITY STAFF AND WILDIFE AGENCIES (U.S. FISH AND WILDIFE SERVICE AND CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE) TO PRESENT INFORMATION ON VERNAL POOLS LOCATED WITHIN THE CITY OF SAN DIEGO AND ASSOCIATED ENDANGERED AND THREATENED VERNAL POOL SPECIES. FOCUS WILL BE ON THE STATUS, CURRENT THREATS, AND ABILILITY TO RESORE THESE IMPORTANT VERNAL POOL RESOURCES. THIS IS AN INFORMATION WORKSHOP AND NO ACTION IS REQUIRED ON THE PART OF THE PLANNING COMMISSION.

BACKGROUND/OVERVIEW OF VERNAL POOLS

Vernal pools are ephemeral wetlands that occur from southern Oregon through California into northern Baja California, Mexico (USFWS 1998). They require a unique combination of climatic, topographic, geologic, and evolutionary factors for their formation and persistence. They form in regions with Mediterranean climates where shallow depressions fill with water during fall and winter rains, and then dry up when the water evaporates in the spring (Collie and Lathrop 1976; Holland 1976, 1988; Thorne 1984).

An impervious subsurface layer consisting of claypan, hardpan, or volcanic stratum prevents downward percolation of water within the pools (Holland 1976, 1988). The figure below shows a schematic cross-section of a vernal pool. Seasonal inundation makes vernal pools too wet for adjacent upland plant species adapted to drier soil conditions, while rapid drying during late spring makes pool basins unsuitable for typical marsh or aquatic species that require a more persistent source of water. Groups of vernal pools are sometimes referred to as vernal pool complexes, which may include two to several hundred individual vernal pools (Keeler-Wolf et al. 1998). The vernal pool complexes were given identification numbers by Bauder (1986). The numbers were updated by the City of San Diego's Vernal Pool Inventory (2004), and again updated by SANDAG Service Bureau (2012). Local upland vegetation communities associated

with vernal pools include needlegrass grassland, annual grassland, coastal sage scrub, maritime succulent scrub, and chaparral (USFWS 1998).

Historically, San Diego vernal pool habitat probably covered as much as 6% of the county, approximately 520 square kilometers (200 square miles). Current estimates indicate a loss of vernal pool habitat in San Diego County around 95 to 97% because of intensive cultivation and urbanization (Bauder and McMillan 1998).

Vernal pools within a complex are generally hydrologically connected, such that water flows over the surface from one vernal pool to another and/or water flows and collects below ground such that the soil becomes saturated with water, thus filling the vernal pool through the perched water table that lies beneath. For overland flow to occur, the precipitation rate must exceed the infiltration rate or the soil column becomes completely saturated. Typically, significant watershed contributions only occur when the upland soils are fully recharged to the point where a perched groundwater table develops; this usually only occurs when seasonal precipitation is greater than average. Given rainfall patterns and amounts typical for Southern California, the direct precipitation into the pools is by far the most important source of water to the vernal pools (Hanes et al. 1990).

The upland areas that support the vernal pool watershed also support pollinator populations and habitat for adult amphibians. Pollinators often require upland habitat for nesting, breeding, and sustenance, and amphibians often use upland habitat for burrows and foraging of food sources. Upland habitat areas provide an important role in maintaining the vernal pool habitat health and persistence.

They are 54 vernal pool complexes identified within the City of San Diego's jurisdiction, encompassing approximately 2,485 vernal pools and nearly 40 acres of basin area (See Attachment 1). The majority of these pools (2,151 pools) are within the City's existing Multi-Habitat Planning Area (MHPA), existing conserved lands, or planned for conservation through existing permits. The pools are primarily located on San Diego's mesa tops in Del Mar Mesa, Carmel Mountain, Kearny Mesa, Mira Mesa, and Otay Mesa.

DISCUSSION

The vernal pools in San Diego include six federally listed endangered species: San Diego fairy shrimp, Riverside fairy shrimp, Otay Mesa mint, San Diego Mesa mint, San Diego button celery, and California Orcutt grass. Spreading navarretia, also found within San Diego vernal pools, is a federally threatened species. Otay Mesa mint, San Diego Mesa mint, San Diego button-celery, and California Orcutt grass are also listed as an endangered species by the State of California. Critical habitat has been identified by the U.S. Fish and Wildlife Service for San Diego fairy shrimp, Riverside fairy shrimp, and spreading navarretia.

San Diego fairy shrimp and Riverside fairy shrimp are small aquatic crustaceans. San Diego fairy shrimp are restricted to vernal pools and other nonvegetated ephemeral pools from 2 to 12 inches in depth. Riverside fairy shrimp are known to occur in pools that are greater than 12 inches in depth. The life cycle of both these species are dependent on the changing

hydrologic conditions of the vernal pool. These species cannot persist in perennial water bodies because the rewetting of the dried cysts is one component of a set of environmental stimuli that trigger hatching (Eriksen and Belk 1999).

San Diego fairy shrimp are usually observed January through March when seasonal rainfall fills vernal pools and initiates cyst hatching. Individuals hatch and mature within 7 to 14 days of rainfall filling a pool, depending on water temperature (Simovich and Hathaway 1996). This hatching period may be extended in years with early or late rainfall. Riverside fairy shrimp are usually observed January through March, although the hatching period may be extended in years with early or late rainfall. Individuals hatch, mature, and reproduce within 7 to 8 weeks of rainfall filling a pool, depending on water temperature (Simovich and Hathaway 1996).

The cysts from successful reproduction are either dropped to the pool bottom or remain in the brood sac until the female dies and sinks. The cysts are capable of withstanding temperature extremes and prolonged drying. Only a portion of the cysts may hatch when the pools refill in the same or subsequent rainy seasons. Therefore, cyst "banks" develop in pool soils that are composed of the cysts from several years of breeding. This partial hatching of cysts allows the San Diego and Riverside fairy shrimp to persist in its extremely variable environment, since pools commonly fill and dry before hatched individuals can reproduce. If all cysts hatched during an insufficient filling, the species could be extirpated from a pool (Philippi et al. 2001; Simovich 2005; Simovich and Hathaway 1996). The ability of San Diego fairy shrimp to develop and maintain cyst banks is vital to the long-term survival of the species (Ripley et al. 2004; Simovich 2005). In the City of San Diego, San Diego fairy shrimp are found in vernal pools located in Del Mar Mesa, Kearny Mesa, Mira Mesa, Chollas Heights, Mission Trails Regional Park, Marron Valley, Otay Mesa and MCAS Miramar (See attachment 2). Distribution of Riverside fairy shrimp within the City of San Diego is more restricted and occurs in Otay Mesa and MCAS Miramar (See attachment 3).

Otay Mesa mint and San Diego mesa mint are annual herbs in the mint family (Lamiaceae). Otay Mesa mint has at least six flowers or more per node on the stem, and a glabrous to minutely hairy calyx, while San Diego Mesa mint typically has two flowers per node. Otay Mesa mint is found only in southern San Diego County in vernal pools near the Otay Mesa region (see attachment 4). San Diego Mesa mint occurs primarily in Mira Mesa, MCAS Miramar, and Kearny Mesa (see attachment 5).

The link between the onset of germination, temporal conditions associated with vernal pool inundation, temperature, and moisture are critical to the germination, maturation, flowering, and fruiting of Otay Mesa mint and San Diego Mesa mint. The interaction of these factors provides the plants favorable conditions in the spring rather than in the summer, autumn, or winter. The plantst commences flowering in May and continues through June or July; by early to mid-summer, the pools become dry. Natural differences in the precipitation and the saturation/drying time of vernal pools from year to year may influence the distribution and abundance of these species. These environmental factors make it difficult to obtain an accurate measure of the population. Additionally, a portion of the population is represented by seeds remaining in the seed bank, which is not accounted for each year.

San Diego button-celery is a perennial, gray-green herb that has a storage tap-root. San Diego button-celery is a vernal pool obligate and relies on ephemerally wet conditions to reproduce, blooming from April through June. San Diego button-celery seems more tolerant of a wider range of vernal pool habitat than most obligate vernal pool species. It is specifically adapted to surviving in vernally wet conditions due to the presence of air channels in the roots that facilitate necessary gas exchange in submerged plants (Keeley 1998).

Important differences between San Diego button-celery and the other sensitive vernal pool plant species in southern California is that San Diego button-celery is a perennial species and has been known to occur in the intermound areas, outside of vernal pool basins. San Diego Mesa mint, Otay Mesa mint, California Orcutt grass, and spreading navarretia are all annual species and are highly dependent on the health and quality of the existing seed bank for current and future ecological stability. While a healthy seed bank is important for San Diego button-celery as well, the fact that the plants are perennial means that the seed bank can be almost nonexistent and the San Diego button-celery will continue to persist for a number of years, with fluctuating wet and dry years. San Diego button-celery is found in vernal pools in the City of San Diego County at Otay Mesa, Kearny Mesa, Del Mar Mesa, and MCAS Miramar (See attachment 6).

California Orcutt grass is an annual grass in the grass family (Poaceae) that is bright gray-green in color and secretes sticky droplets. California Orcutt grass typically flowers from April through July and then sets seed. This species is adapted to conditions in the wettest, longest lasting portion of vernal pools. It is less abundant at the shallow periphery of vernal pools that are subject to more rapid changes in moisture (Reeder 1993; Munz 1974). The first significant fall and winter rains begin the process of vernal pool inundation; with no rain, no significant germination of this species will occur. California Orcutt grass seeds germinate while pools are inundated, and the plant appears prostrate during this period. Orcutt grass typically requires at least 15 to 30 days of inundation before germination will occur, so in low rainfall years, there may not be enough ponding to promote adequate germination and the species may remain dormant in the seed bank until an adequate rainfall season (Griggs 1976, 1981). As the season progresses, temperature increases and rainfall declines result in increased evaporation. This stimulates the plant's stems to become more erect, at which time the plant begins to flower. Flowering generally occurs April through June, and by early to mid-summer the pools become dry. Within the City of San Diego, this species is located in Otay Mesa and MCAS Miramar (See attachment 7).

Spreading navarretia is an annual herb in the phlox family (Polemoniaceae). The life cycle of spreading navarretia is dependent on the function of the vernal pool ecosystem. This annual species germinates from seeds left in the seed bank. For many vernal pool plant species, soil moisture affects the timing of plant germination (Myers 1975). Although not proven, it is likely that spreading navarretia uses these same cues for germination. The timing of germination is important so that the plant germinates under favorable conditions in the spring rather than the summer, autumn, or winter.

Spreading navarretia abundance also varies from year to year depending on precipitation and the soil saturation/drying time of the vernal pool. This annual variation makes it impossible to obtain an accurate count of the number of individuals in the population because the proportion of

standing plants to remaining seeds in the seed bank that makes up the population cannot be measured. Within San Diego County, this species is found primarily within Otay Mesa (See attachment 8).

Threats to vernal pools and associated species can be divided into three major categories: 1) direct destruction of vernal pools from construction, vehicle traffic, grazing, dumping, and deep plowing; 2) indirect threats that degrade or destroy vernal pools (e.g., altered hydrology, draining, competition by introduced species, habitat fragmentation); and 3) potential long-term, cumulative impacts such as the effects of isolation on genetic diversity and locally adapted genotypes, air and water pollution, drastic climate variations, and changes in nutrient availability (Bauder 1986). Vernal pool species may also be affected by factors associated with climate change.

Conservation of vernal pool species is dependent on maintaining pool hydrology and the surrounding watershed, as well as protecting adjacent upland habitats including pollinators (for dermal pool plant species). Extant populations need to be preserved and managed to reduce stressors from on site and adjacent activities, and regular monitoring is essential to gauging population trends and stressor effects. For some vernal pool species, re-establishment of populations within extant unoccupied or restored pools may be warranted.

Vernal pool restoration can reestablish the physical and biotic characteristics of vernal pool habitat such that critical functions are restored. The restored habitat should resemble reference habitat in regard to the following attributes: soil properties, water quality, topography, hydrology, nutrient cycling, species diversity and species interactions. Based on positive data from ongoing monitoring programs, it appears that restoration can provide self-sustaining vernal pool ecosystems with clear and significant benefits to San Diego and Riverside fairy shrimp, Otay Mesa mint, San Diego Mesa mint, San Diego button celery, California Orcutt grass, and spreading navarretia especially when cyst and seed translocation occurs from existing (conserved) occupied pools (RECON 2005; Black 2000a, 2000b; EDAW 2005 and 2010, AECOM 2006, 2010b,2010c, and 2011). These successful restoration efforts have been achieved by a combination of conducting topographic reconstruction, applying aggressive programs for weed and thatch control, reestablishing cyst banks through inoculation, and improving upland habitat for watershed protection and water quality improvements.

Benefits of restoration to the listed vernal pool species include increasing the amount of available vernal pool habitat and increasing the quality of existing vernal pool habitat. These benefits, when supplemented by long-term monitoring and management, can reduce threats to the listed vernal pool species and maintain and improve the habitat quality and regional distribution of the pools and species they support. Since 1997, several projects have documented success in the translocation of San Diego fairy shrimp and in the establishment of populations of listed plant species including San Diego button-celery and San Diego Mesa mint. These include California Terraces on Otay Mesa (RECON 2005), San Diego Spectrum at Kearny Mesa (Glen Lukos Associates 2005), and other vernal pool restoration projects on Otay Mesa, and MCAS Miramar.

CONCLUSION

Vernal pools and the associated endangered and threatened species are a highly specialized ecosystem with a limited distribution remaining throughout San Diego County. Threats such as development, invasive species, altered hydrology, and habitat fragmentation can cause further decline of the pools and surrounding habitat. Conservation and restoration play an important role in the protection and long-term viability of unique resources.

Respectfully submitted,

Jeanne Krosch
Senior Planner
Planning and Neighborhood
Restoration Department

Cathy Winterrowd
Deputy Director
Planning and Neighborhood
Restoration Department

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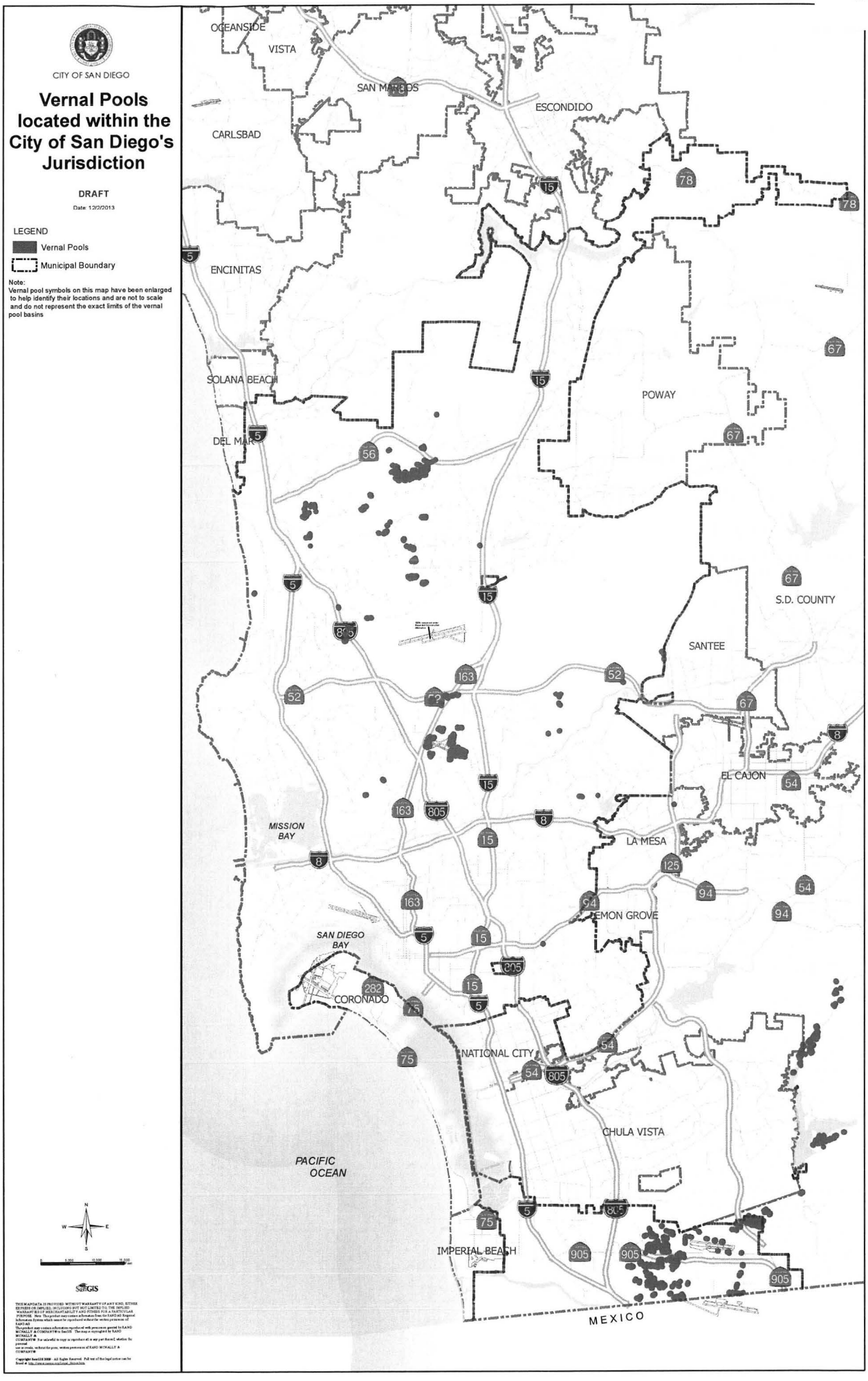
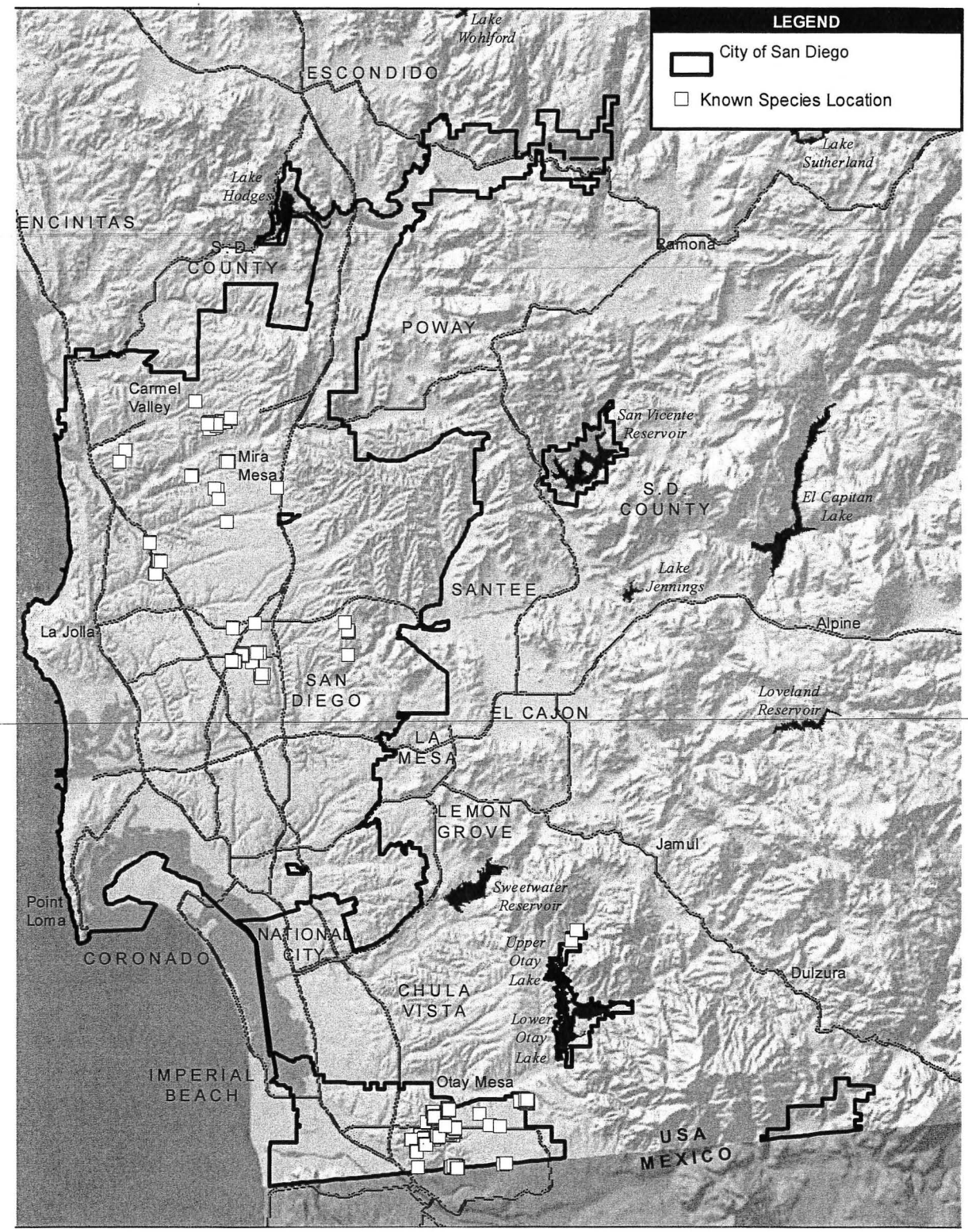
Attachments:

1. City of San Diego, Vernal Pool Location Map
2. Distribution of San Diego Fairy Shrimp
3. Distribution of Riverside Fairy Shrimp
4. Distribution of Otay Mesa Mint
5. Distribution of San Diego Mesa Mint
6. Distribution of San Diego Button-Celery
7. Distribution of California Orcutt Grass
8. Distribution of Spreading Navarretia


CITY OF SAN DIEGO
Vernal Pools located within the City of San Diego's Jurisdiction
DRAFT
Date: 12/2/2013
LEGEND
Vernal Pools
Municipal Boundary
Note:
Vernal pool symbols on this map have been enlarged to help identify their locations and are not to scale and do not represent the exact limits of the vernal pool basins
OCEANSIDE
VISTA
SAN MARCOS
ESCONDIDO
CARLSBAD
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
EL CAJON
LA MESA
LEMON GROVE
NATIONAL CITY
CHULA VISTA
IMPERIAL BEACH
CORONADO
MISSION BAY
SAN DIEGO BAY
PACIFIC OCEAN
MEXICO



Source: ESRI; USGS 2004; SANDAG 2011

5.5 2.75 0 5.5 Miles

Scale: 1:348,480; 1 inch = 5.5 miles

Distribution of San Diego Fairy Shrimp

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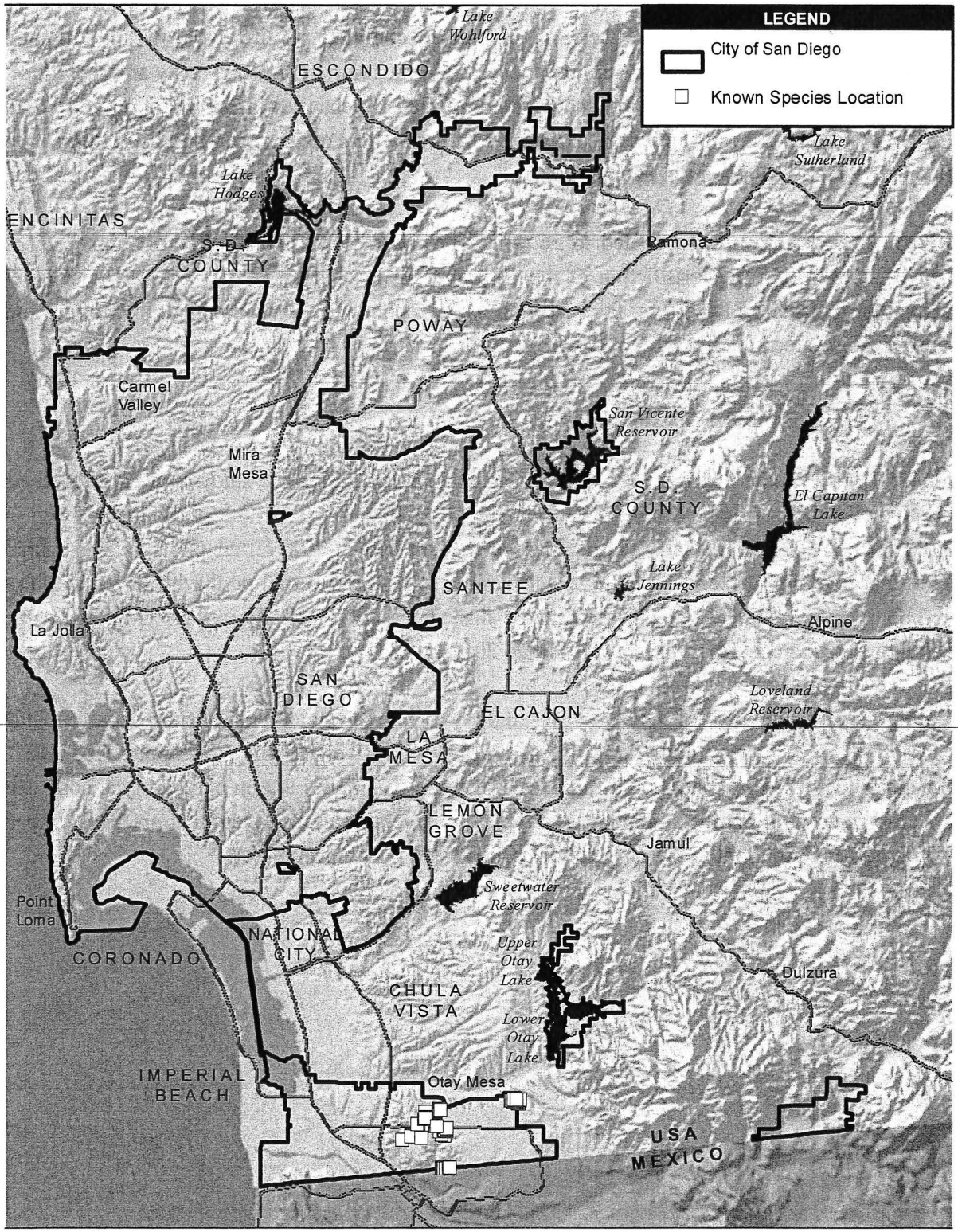

Source: ESRI; USGS 2004; SANDAG 2011

5.5 2.75 0 5.5 Miles

Scale: 1:348,480; 1 inch = 5.5 miles

Distribution of Riverside Fairy Shrimp

Focal Species Status Update for Vernal Pool Habitat Conservation Plan

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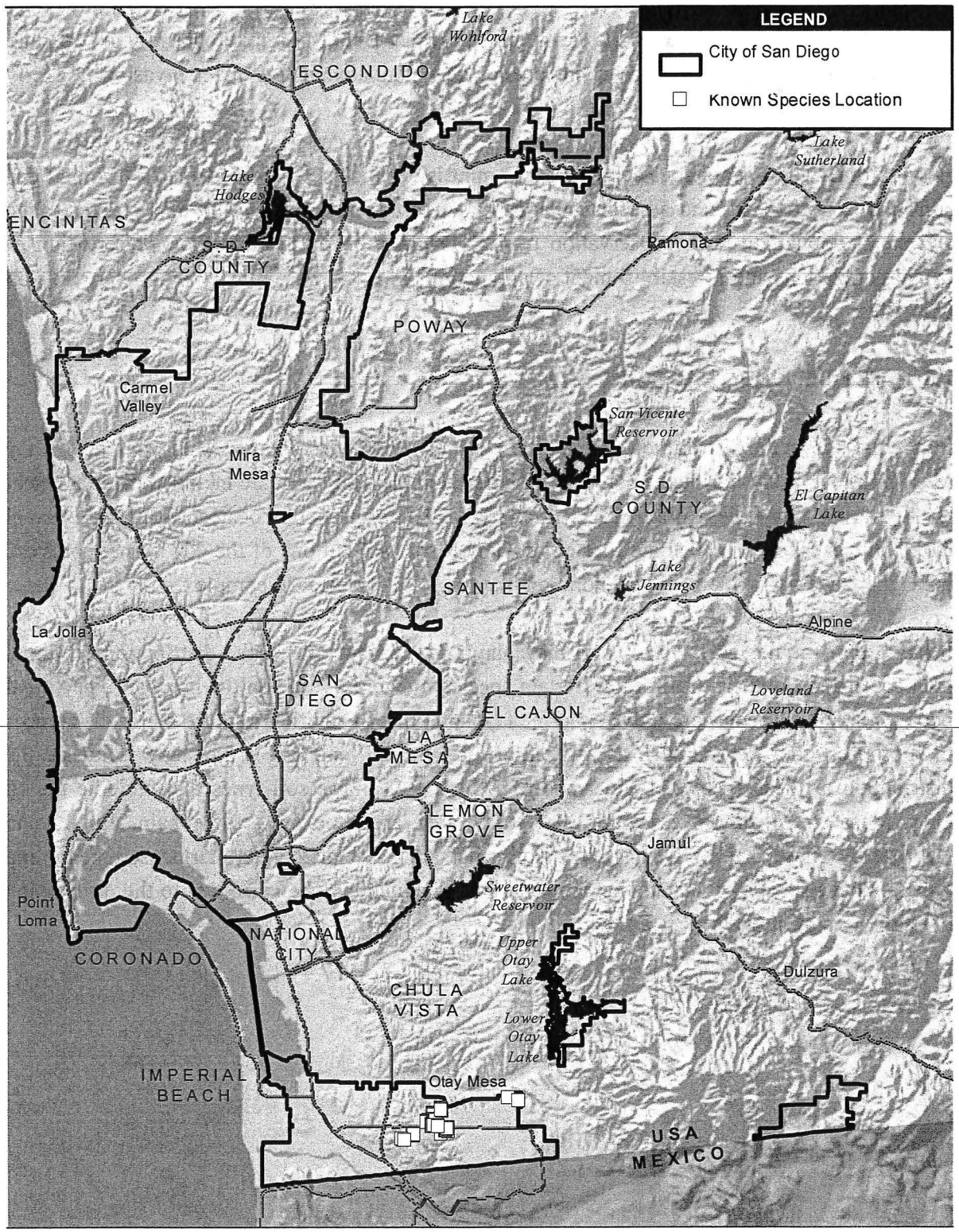

Source: ESRI; USGS 2004; SANDAG 2011

5.5 2.75 0 5.5 Miles

Scale: 1:348,480; 1 inch = 5.5 miles

Distribution of Otay Mesa Mint

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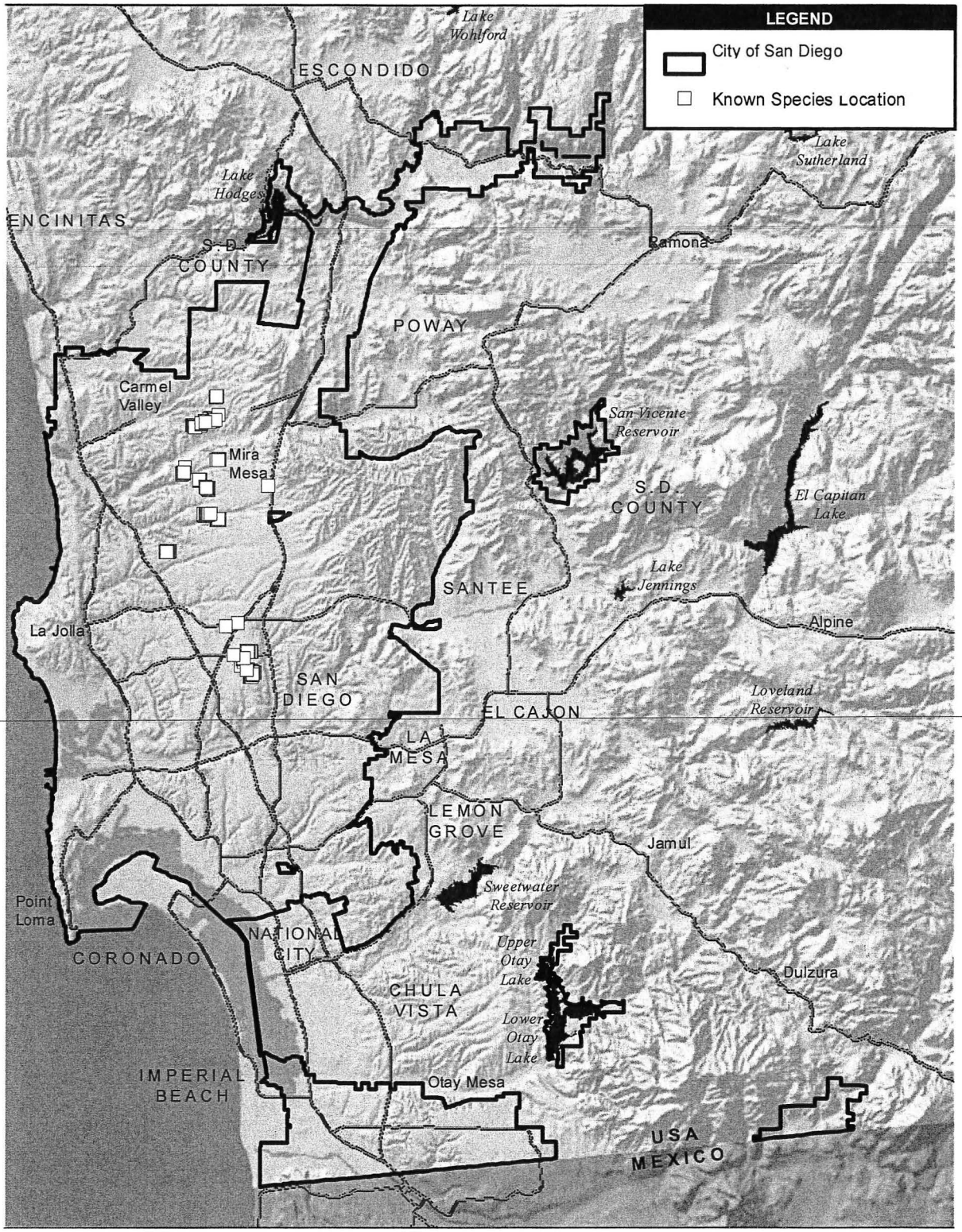

Source: ESRI; USGS 2004; SANDAG 2011

5.5 2.75 0 5.5 Miles

Scale: 1:348,480; 1 inch = 5.5 miles

Distribution of San Diego Mesa Mint

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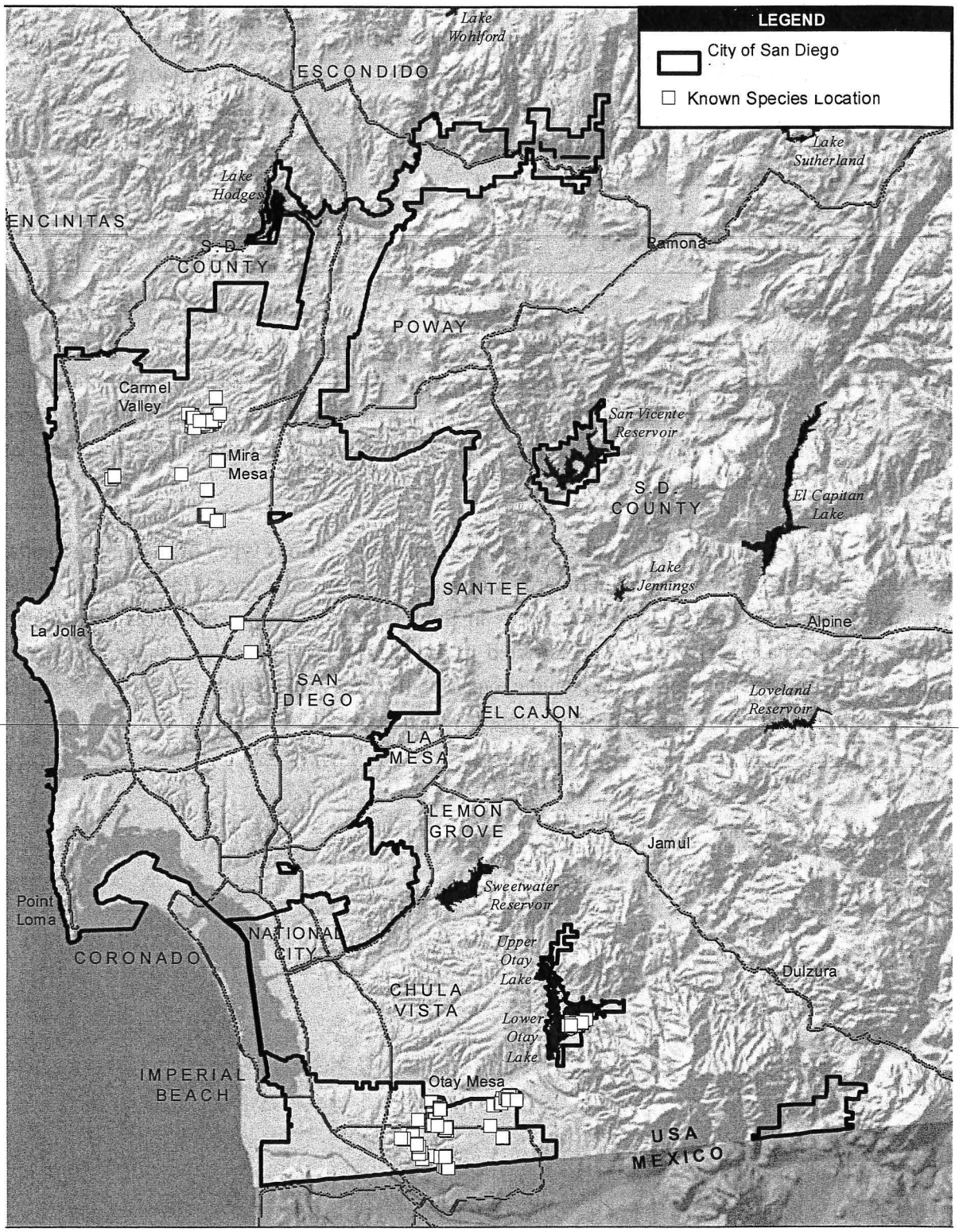

Source: ESRI; USGS 2004; SANDAG 2011

5.5 2.75 0 5.5 Miles

Scale: 1:348,480; 1 inch = 5.5 miles

Distribution of San Diego Button-Celery

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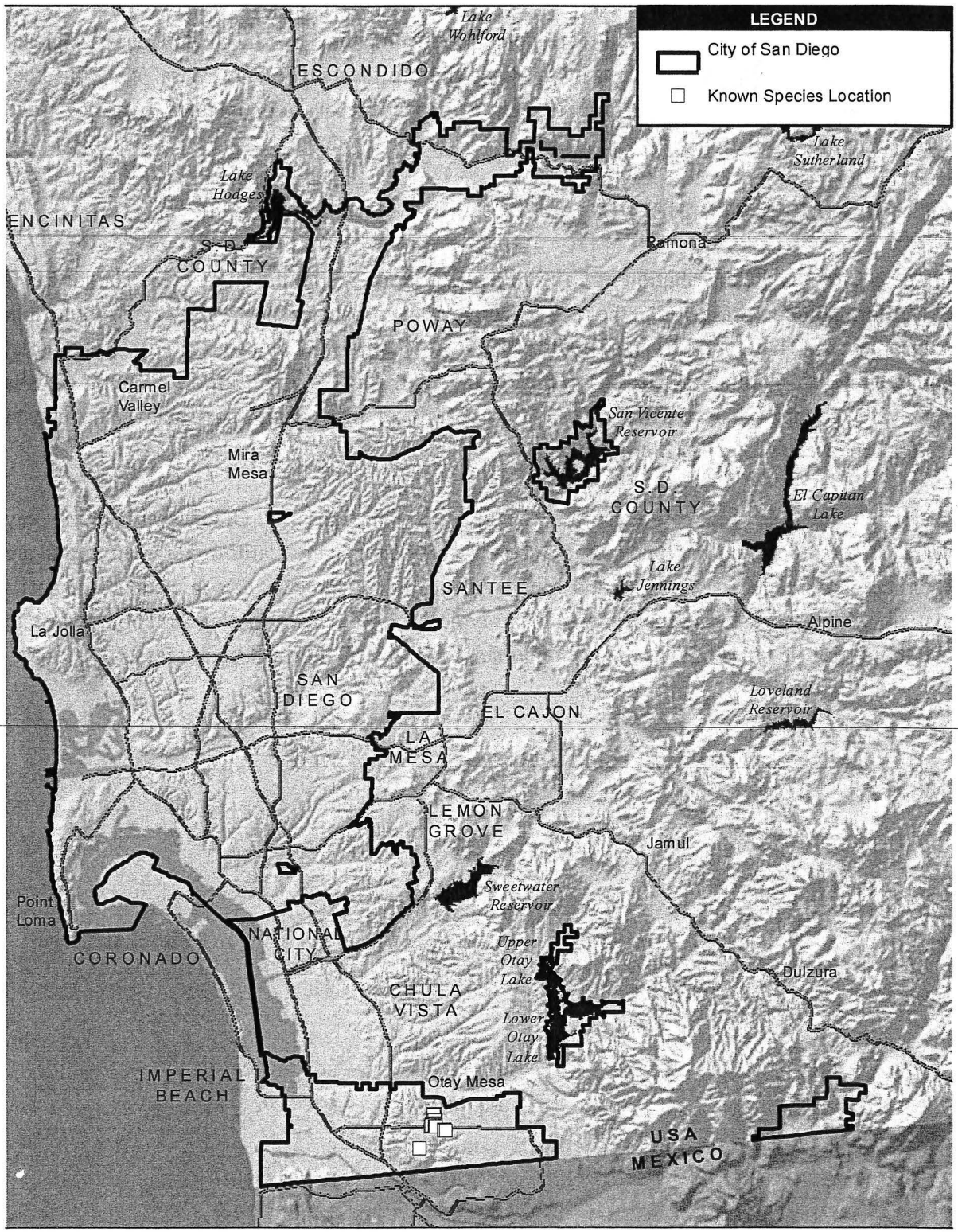

Source: ESRI; USGS 2004; SANDAG 2011

5.5 2.75 0 5.5 Miles

Scale: 1:348,480; 1 inch = 5.5 miles

Distribution of California Orcutt Grass

Focal Species Status Update for Vernal Pool Habitat Conservation Plan

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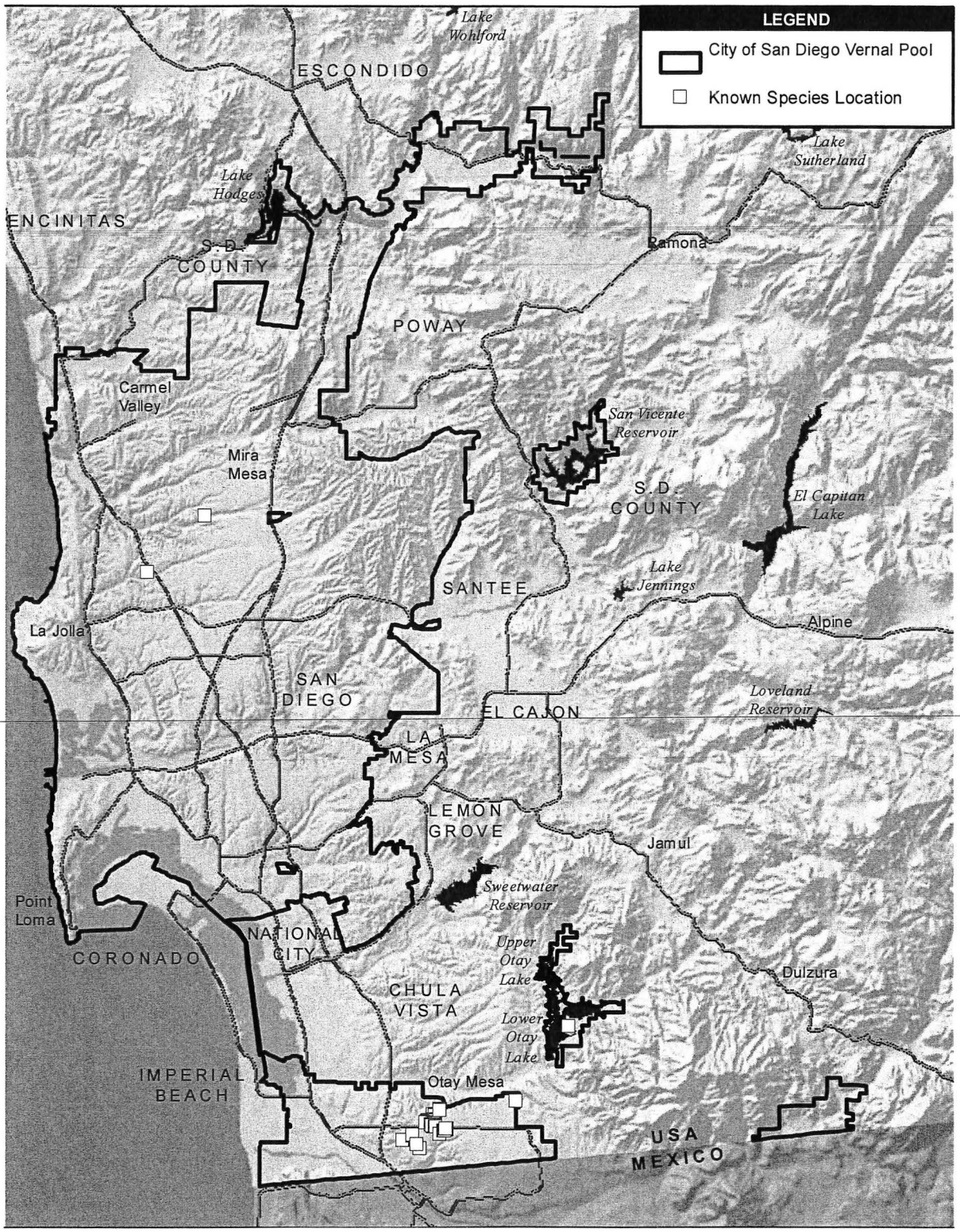

Source: ESRI; USGS 2004; SANDAG 2011

5.5 2.75 0 5.5 Miles

Scale: 1:348,480; 1 inch = 5.5 miles

Distribution of Spreading Navarretia

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