Dudek, "Draft Middle Canyon Spring Survey and Status Report"
(August 2007; 2007C)

D R A F T

Survey and Status Report for the Middle Canyon Spring




A U G U S T 2 0 0 7

PREPARED FOR:

The Newhall Land and Farming Company
23823 Valencia Blvd.
Valencia, CA 91355

PREPARED BY:

Dudek
25152 Springfield Ct., Suite 180
Valencia, CA 91355

D R A F T

MIDDLE CANYON SPRING SURVEY AND STATUS REPORT

Prepared for:

The Newhall Land and Farming Company
23823 Valencia Boulevard
Valencia, California 91355
Contact: Corey Harpole
661.255.4075

Prepared by:

DUDEK
25152 Springfield Court, Suite 180
Valencia, California 91355
Contacts: Sherri Miller and Michael Sweesy
661.705.3399

In association with:

GSI Water Solutions, Inc.
55 SW Yamhill Street, Suite 400
Portland, Oregon 97204

AUGUST 2007

Printed on 30% post-consumer recycled material.

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

INTENTIONALLY LEFT BLANK

1.0 INTRODUCTION

This survey and status report provides documentation of existing biotic conditions. Middle Canyon occurs within the Mission Village project site, within the Specific Plan area (Figures 1 and 2). Mission Village includes proposed commercial and multifamily residential land uses, as well as roads and open space. The majority of the existing watershed, with the exception of the spring area and open space, will be developed. Commerce Center Drive will be constructed across the northern end of the canyon adjacent to the north-northeast side of the spring area. GSI Water Solutions, Inc. (GSI) and Allan E. Seward Engineering Geology, Inc. (AESEG) identified the following significant impacts of development on the spring area (GSI and AESEG 2007):

- A potential long-term increase in groundwater discharge to the spring of approximately 9% because of the future importation of water supplies for outdoor irrigation uses in Middle Canyon (compared with its current undeveloped condition)
- Potential shorter-term changes in groundwater discharge to the spring arising from multi-year cycles of below-normal and above-normal rainfall (resulting in potential short-term changes in groundwater that could fluctuate between −4% and +29%)
- Alterations to the spring resulting from the alignment of Commerce Center Drive in the lower portion of Middle Canyon.

INTENTIONALLY LEFT BLANK

IMAGE SOURCE: USGS 24K Quad

FIGURE 1

DUDEK

Middle Canyon Spring Survey and Status Report

Regional Map

Z:\Projects\j373801\Newhall Ranch\arcmap\Mission Village\Middle Canyon Spring

INTENTIONALLY LEFT BLANK

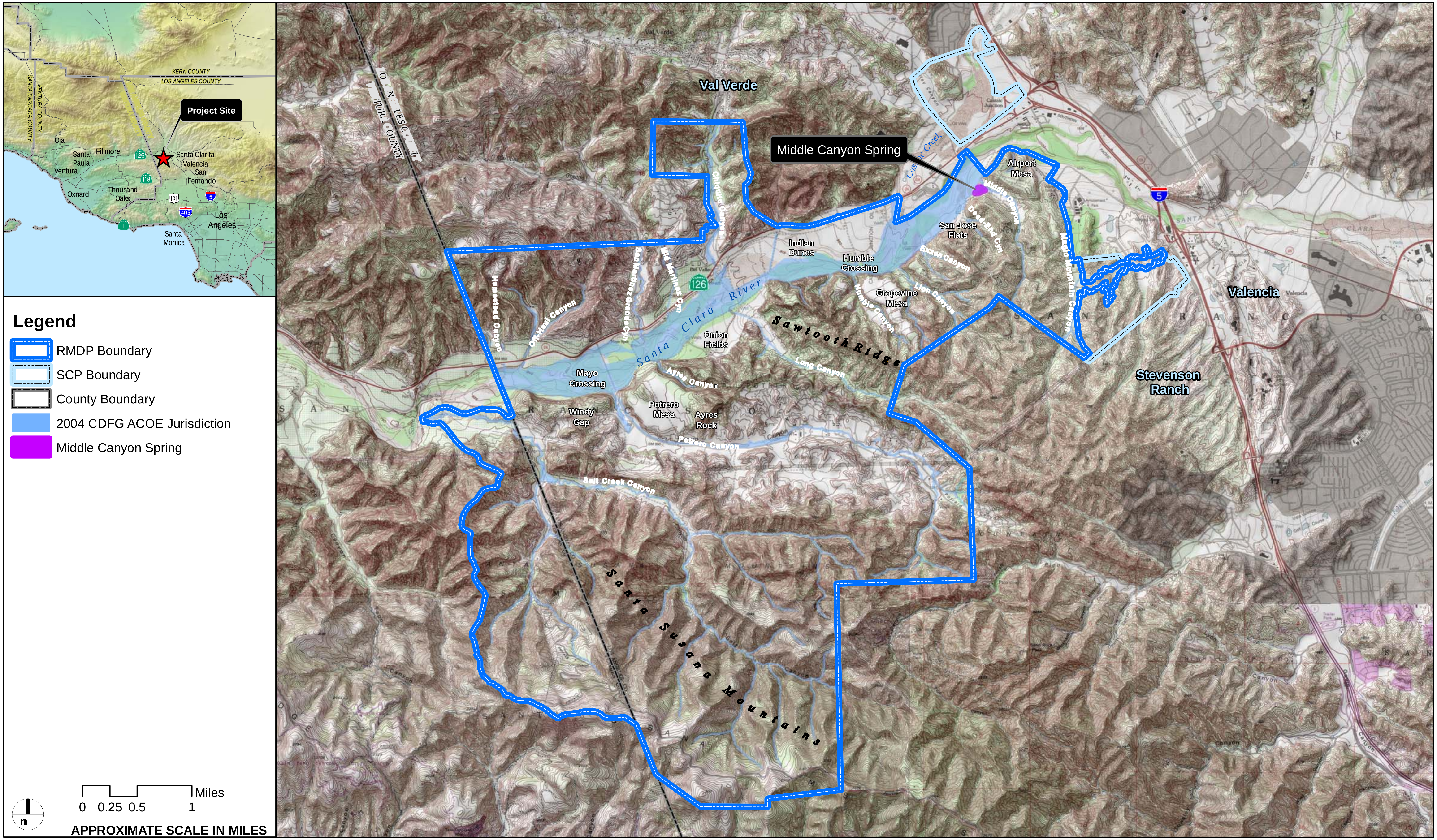


IMAGE SOURCE: USGS 24K Quad

FIGURE 2

DUDEK

Middle Canyon Spring Survey and Status Report

Vicinity Map

Z:\Projects\j373801\Newhall Ranch\arcmap\Mission Village\Middle Canyon Spring

INTENTIONALLY LEFT BLANK

2.0 METHODS

Dudek conducted a review of available historical and current aerial photographs and U.S. Geological Survey (USGS) 7.5-minute topographic maps of Middle Canyon Spring (USGS 1930, 1988) as well as the *Middle Canyon Spring Hydrogeologic Assessment and Impact Evaluation Report* (GSI and AESEG 2007). The historical black-and-white aerial photograph was taken in 1930. The current color aerial photograph was taken in 2006. The GSI and AESEG report (2007) analyzed the potential water sources and quality of groundwater supplying the spring, as well as the potential hydrologic effects of development on the spring.

Dudek biological and habitat restoration staff completed site visits of the spring area on June 7 and 12, 2007, for the purpose of documenting biotic conditions at the spring and preparing this survey and status report. Dudek staff conducted a preliminary inventory of plant species and vegetation components, and mapped the major site features using a Global Positioning System (GPS) unit with submeter accuracy. The floral inventory was not comprehensive and, as discussed later in this survey and status report, further inventory is necessary.

INTENTIONALLY LEFT BLANK

3.0 EXISTING CONDITIONS

3.1 Geomorphology and Existing Conditions at the Spring

Early aerial photographs indicate the presence of Middle Canyon Spring at its current location prior to 1930, before agricultural and irrigation activities began in this area. Currently, the canyon is undeveloped, with the exception of agricultural and oil extraction operations, and has historically been used for grazing livestock and growing alfalfa. Irrigated areas in the canyon receive water from a deep Saugus well located about 0.25 mile east-southeast of the spring (GSI and AESEG 2007). Groundwater occurs within the alluvial deposits of the main canyon and side canyons, within the upper Saugus Formation, as perched groundwater, and within the deeper Saugus Formation as the regional groundwater system (GSI and AESEG 2007).

Flows at Middle Canyon Spring currently saturate a core area (approximately 400 by 400 feet) of the spring complex. The size of the core area coincides with the presence of a slump (landslide), as discussed below. Two outflow channels in the northern portion of the spring area drain onto an intermediate terrace, where water then flows into the Santa Clara River floodplain. Soil conditions within the core area differ from those within the riverbed floodplain as described further below.

The core spring area is defined as that area currently inundated by spring flow: flowing or standing water, or fully saturated soil. Within the core spring area, water appears to flow from numerous points at the toe of the slope below the existing ranch road. The water proceeds to flow across hummocky topography, intermittently coalescing into more distinct flow channels only to disperse again into sheet flow over lower benched areas. The vegetation exhibits a clear pattern in response to these flow patterns: bull tule (*Scirpus robustus*) appears to be associated with more consolidated flow, while more broadleaved, herbaceous vegetation appears where sheet flow is present.

A comparison of the 1930 USGS 7.5-minute topographic map, the 2006 aerial photograph, and the 1988 USGS 7.5-minute topographic map for the Middle Canyon Spring area suggests historical hydrologic and geomorphologic changes in the spring discharge area, the adjacent bank of the Santa Clara River, and spring-supported riparian vegetation. The discharge area for the spring has been extensively modified by Santa Clara River flooding several times during the last century. Southern California, including the Santa Clara River, experienced major flooding during 1938 and 1969 (USGS 1991). It appears that river flooding removed large areas of spring-supported riparian vegetation prior to 1930 and that, more recently (2005), riparian vegetation was removed by flooding south-southwest of the spring. Comparison of the 1930 USGS topographic map with present-day conditions suggests that a large river alluvium terrace immediately southwest of the spring has been extensively eroded by flood flows. This has resulted in a more southerly discharge for the spring, which appeared to flow farther to the north in the 1930 photograph. Additionally, the 1930 photograph and the 1988 USGS topographic map show two ponds, one pre-1930 and the other more recent, both to the southwest of the spring. The topography containing the older pond has since been severely altered by river flooding. It has not been determined whether spring flows once contributed to these ponds.

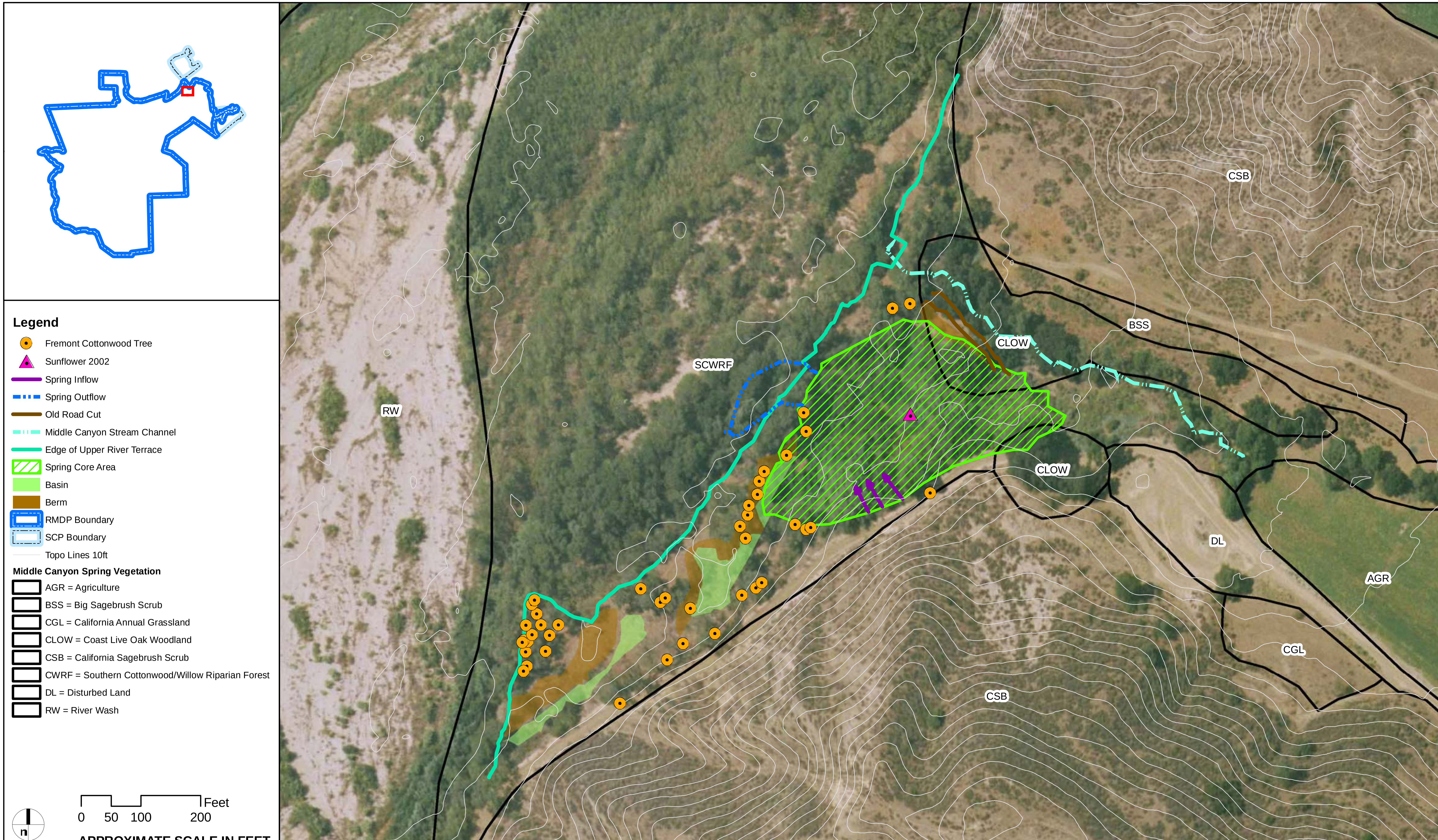
The 1930 USGS topographic map indicates that the slope of the riverbank to the southwest of the spring may have been once protected with riprap. This analysis of historical and recent topography and aerial images suggests that the size and configuration of the downgradient extent of spring-supported vegetation, and the near bank and terraces of the Santa Clara River, have been historically altered by flooding. The vigor of spring flow, however, has been sufficient to reestablish large areas of riparian vegetation after flood events.

The spring is located on what appears to be an upper terrace of the Santa Clara River. The upper river terrace is either fluvial in origin or an expression of underlying geologic strata that are exposed at the surface. This terrace extends westward from the spring at a gentle slope and eventually tapers to an end where river flow has eroded the terrace. An intermediate elevation terrace or geologic structure is present between the spring terrace and the Santa Clara River. This intermediate terrace slopes at a direction similar to the upper terrace and is marked at the western terminus by river erosion. Riparian vegetation within this near stretch of the Santa Clara River floodplain is likely enhanced by water outflows from both Middle Canyon Spring and Middle Canyon Creek. It is possible that a surface hydraulic connection exists between Middle Canyon Spring and Middle Canyon Creek at peak flow events.

Past manipulation of the topography near the spring and of the spring outflow area was apparent during the site visit (Figure 3). An unpaved road is cut into the steep hillside above the entire southerly margin of the spring area, passing in close proximity above the surface inflow of the spring. This road is currently used for agricultural operations, and may be the location of a local trail according to plans for the Mission Village project area. The road bank is unconsolidated fill, and jute matting has been installed for erosion control. Two earthen berm and depressed basin complexes are situated along, and extend westward from, the northwest and southwest margins of the spring area. These abandoned features appear to direct and impound spring water outflow, for historical purposes that are no longer known. Evidence of an old road cut and berm was also observed along the northeast margin of the spring area. A rocky mound of unknown origin is present within the center of the core spring area; it appears to be composed of cobblestones, gravel, and soil. It rises approximately 1 meter (3.28 feet) in height, and is approximately 3 by 5 meters (9.84 to 16.4 feet) in area. This mound is partially vegetated.

Present characteristics of the spring area probably are influenced to a large extent by the position of the berms and outflow channels. Without these berms and channels, the spring would likely have a more diffuse sheeting outflow and could extend the margins toward the edge of the upper Santa Clara River terrace. Although the presence of many large Fremont cottonwood *(Populus fremontii*) trees to the west-southwest of the current spring area suggests this is likely, due to the historical disturbances and channeling of the spring area, there may be other reasons that this area shows evidence of greater past water availability (Figure 3).

INTENTIONALLY LEFT BLANK



Legend

- Fremont Cottonwood Tree
- Sunflower 2002
- Spring Inflow
- Spring Outflow
- Old Road Cut
- Middle Canyon Stream Channel
- Edge of Upper River Terrace
- Spring Core Area
- Basin
- Berm
- RMDP Boundary
- SCP Boundary
- Topo Lines 10ft

Middle Canyon Spring Vegetation

- AGR = Agriculture
- BSS = Big Sagebrush Scrub
- CGL = California Annual Grassland
- CLOW = Coast Live Oak Woodland
- CSB = California Sagebrush Scrub
- CWRF = Southern Cottonwood/Willow Riparian Forest
- DL = Disturbed Land
- RW = River Wash

0 50 100 200 Feet

APPROXIMATE SCALE IN FEET

AERIAL SOURCE: DigitalGlobe, 2007

FIGURE 3

Middle Canyon Spring Survey and Status Report

Existing Conditions

DUDEK

Z:\Projects\j373801\Newhall Ranch\arcmap\Mission Village\Middle Canyon Spring

INTENTIONALLY LEFT BLANK

3.2 Geologic and Groundwater Influences on the Spring

A conceptual model of the geologic and groundwater factors that govern the flow of groundwater into the spring was developed by GSI and AESEG (2007). The discharge of groundwater into the spring occurs from three visible seeps along the southern margin of the core spring area and from upwelling of groundwater through the sediments that lie between these seeps and the open water that is present further north within the core spring area. The three visible seeps lie at an elevation of about 1,014 feet above mean sea level (AMSL) and are just below the existing unpaved access road. The ground surface slopes to the north from this point and lies at an elevation of about 1,005 feet AMSL in the nearest open water area. Further north, ground surface elevations are as low as 982 feet AMSL within the core spring area.

Groundwater enters the spring from the Saugus Formation, which contains coarse-grained beds of poorly cemented and permeable sandstone and pebbly to cobbly sandstone that daylight at the core spring area. Observations from drilling, geologic logging, and inspections of road cuts and hill slopes indicate that, to the south of the spring, at least one of these beds extends along the southwestern side of Middle Canyon and is juxtaposed with saturated alluvial deposits just to the southeast of the spring, This allows alluvial groundwater to move into the Saugus Formation along the sides of the canyon, and the coarse-grained nature of the permeable Saugus bed(s) promotes groundwater movement laterally along the bedding strike and downgradient toward the spring.

The presence of the spring, and its location just west of the mouth of Middle Canyon, are attributable to the following five factors:

1. **The presence of permeable beds at the top of the Saugus Formation in the lower end of Middle Canyon.** As discussed above, these localized permeable beds connect the shallow alluvial groundwater system in lower Middle Canyon to the spring, and thereby act as the primary conduit directing groundwater flow to the spring.
2. **The presence of fine-grained beds in the Saugus Formation, directly beneath (downsection of) the uppermost permeable Saugus beds.** These fine-grained beds limit the amount of downward groundwater migration, thereby allowing the permeable Saugus beds to be the primary source of water to the spring.
3. **The presence of a faulted synclinal structure.** The Saddle Lineament, which traverses the lower end of Middle Canyon, blocks downward migration of groundwater along Saugus Formation bedding planes. The Saddle Lineament converges with the upper permeable Saugus source bed at the spring area.

4. **The presence of fine-grained older alluvium at the mouth of Middle Canyon.** This material restricts alluvial groundwater movement from Middle Canyon to the Santa Clara River alluvium. This material also extends a short distance west of the mouth of Middle Canyon and underlies the spring area at depth, where it limits lateral migration of groundwater from the Saugus source bed directly into the granular alluvium lying in the Santa Clara River corridor.
5. **The presence of a shallow slump within the spring area.** This feature is composed of disturbed/weathered granular material derived from the adjacent Saugus Formation to the south. This material is semi-permeable and allows much through-flow of groundwater entering the slump from the Saugus source bed to the south. The slump forms an elevated area of irregular hummocky topography and may have variable internal permeability, both of which affect the surficial expression of groundwater in the spring area. The slump overlies the low-permeability older alluvium, which limits downward infiltration of groundwater migrating through the slump. The lateral distribution of the slump material appears to coincide closely with the extent of the spring area. The spring outlets appear at the margin of the slump, and concentrated flows occur in two discrete channels cut into the fine-grained older alluvium.

Groundwater chemistry data collected by GSI and AESEG (2007) provide additional indications regarding the source(s) of water discharging at the spring. On the basis of the water chemistry, the water discharging at the spring appears to be a mixture of alluvial groundwater and other groundwater—likely from the shallow Saugus Formation. The most likely sources of shallow Saugus Formation groundwater at the spring are the perched groundwater observed in several shallow Saugus Formation borings, and/or irrigation water from Saugus well No. 156 that comes in direct contact with exposed shallow Saugus Formation beds. There is no indication from water level or geologic data that water discharging at the spring is originating from the deeper Saugus Formation or from outside of the Middle Canyon watershed.

Some uncertainties exist in the current understanding of the spring system, including the following:

- The relationship between shallow groundwater levels and the magnitude of spring discharge, both on a short-term (seasonal) basis and a long-term (multi-year/decadal) basis
- The precise locations where the uppermost permeable Saugus Formation beds intersect saturated alluvial deposits up-canyon from the spring
- The amount of seasonal variability, if any, in the spring's water quality

- The quantity of water discharging from the spring, and seasonal and long-term variations in spring flow
- The extent of anthropogenic disturbance along the margins of the spring and possible channelization of the spring outlets.

Nonetheless, the field work (drilling, geologic mapping, and water level and water quality measurements) and subsequent data analysis activities conducted to date have provided a significant advancement in the understanding of the spring system. This information has allowed for the development of a conceptual model of the spring hydrogeology and development of a hydrologic monitoring program as part of this survey and status report.

3.3 Vegetation Community

The Middle Canyon Spring occurs within southern cottonwood–willow riparian forest. The vegetation was mapped by Dudek in summer 2006, in accordance with the "List of California Terrestrial Natural Communities Recognized by the California Natural Diversity Database" (CDFG 2003), as described in the *Biological Resources Technical Report for the Newhall Ranch Specific Plan Area* (Dudek & Associates 2006). Plant species encountered in or adjacent to the spring by Dudek during the June 2007 site visits are presented in Appendix A.

The southern cottonwood–willow riparian forest associated with the spring encompasses various vegetation components and strata, perhaps reflecting historical shifts in the periphery of the spring, and is generally characterized as follows:

Herbaceous Strata

- Wetland vegetation of the core spring area includes a perimeter thicket of desert wild grape (*Vitis girdiana*) and an abundance of bull tule. Some patches of cattails (*Typha* sp.) and California blackberry (*Rubus ursinus*) are present, interspersed with young arroyo willow (*Salix lasiolepis*), 8 to 16 feet in height. Flowing surface water is present or soil is fully saturated. Substrate is sand and granitic gravel.
- Areas of Italian thistle (*Carduus pycnocephalus*) (currently dead and dried) dominate large portions of the berms and basins situated to the west of the spring.

Shrub Strata

- An area of poverty weed (*Iva axillaris*) with Great Basin sagebrush (*Artemisia tridentata*) is located between the eastern margin of the spring and the bank of Middle Canyon Creek. This area has dense groundcover and moist soil. Another patch of this vegetation type is located on the eastern bank of Middle Canyon Creek, opposite the spring.

- An area composed of rushes (*Juncus* sp.) with Great Basin sagebrush is located northeast of the spring. This area is situated atop and along an old road berm between the spring and the coast live oak woodland along Middle Canyon Creek.

Canopy Strata

- Southern cottonwood–willow riparian forest surrounds the core spring area. Mature Fremont cottonwoods are present with heights of 30 to 45 feet and diameters up to 3 feet. Mature arroyo willow trees with heights of 20 feet are present. The dry understory is composed primarily of non-native grasses, such as ripgut brome (*Bromus diandrus*) and Poa sp. A heavy accumulation of organic duff is present. A row of Fremont cottonwoods stands atop a low berm that forms the northwestern border of the current spring wetland. Some Fremont cottonwoods farther from the spring appear to exhibit signs of water-deficit stress, suggesting sole reliance on soil moisture from annual rainfall instead of the spring wetland.

3.4 Undescribed Sunflower

The undescribed sunflower was first observed in summer 2002 (Dudek & Associates 2002). At that time, there were approximately 10 individuals, clustered in three to five clumps. The undescribed sunflower was determined by some botanists to be the Los Angeles sunflower (*Helianthus nuttallii* ssp. *parishii*), but determined by other botanists not to be this species. The Los Angeles sunflower is classified as List 1A by the California Native Plant Society (CNPS); this species was last seen in 1937 and is thought to be extinct (CNPS 2007).

In summer 2002, sunflower vouchers were sent to Dr. John Strother at the Jepson Herbarium at the University of California, Berkeley, and to Dr. Loren Rieseberg and Dr. Charles Heiser at the University of Indiana, Bloomington. Dr. Strother found the vouchers to be consistent with the Los Angeles sunflower (Ertter 2002). Dr. Rieseberg and Dr. Heiser identified the voucher specimens as Nuttall's sunflower (*Helianthus nuttallii* ssp. *nuttallii*) (Rieseberg 2002).

In fall 2002, Valerie Soza from the Rancho Santa Ana Botanic Garden evaluated the chromosomes of sunflower leaf samples and found that the undescribed sunflower has a unique ploidy level, intermediate between the Los Angeles sunflower and Nuttall's sunflower (Soza 2003). Subsequently, Dr. Mark Porter and Ruth Timme from the Rancho Santa Ana Botanic Garden evaluated the undescribed sunflower pollen using electron microscopy and determined that it is likely that the undescribed sunflower is a hybrid between *Helianthus nuttallii* and *H. californicus* or an intermediate evolutionary step between the two species (Porter and Fraga 2004). Because of the unresolved taxonomic status of this sunflower, it is treated here as a special-status species.

In addition to its unresolved taxonomic status, very little information is known about the ecology of this sunflower. The sunflower grows along the margin of a slight rise within the spring complex, in water-saturated soil and gravel. This sunflower is rhizomatous and grows to a height of 10 to 16 feet, rising above surrounding vegetation, and remains in the sun throughout most of the day. Honeybees, cabbage white butterflies, and damselflies were observed visiting these flowers in 2002, but whether they are important pollinators is unknown (Dudek & Associates 2002).

3.5 Undescribed Snail

The undescribed snail at Middle Canyon Spring was found by U.S. Fish and Wildlife Service (USFWS) biologists in 2006, and specimens were sent to the Smithsonian Institution for identification, where it was determined that this snail is not a currently described species; taxonomic classification is pending. The undescribed snail belongs to the genus *Pyrgulopsis* (Hershler 2007). *Pyrgulopsis* belongs to Hydrobiidae, the “spring snail” family (Liu and Hershler 2007).

During the June 2007 site visits, Dudek biologists observed over 100 small (approximately 2 to 6 millimeters) aquatic snails with a dark brown to black conical shell. Immediately below the river terrace where the spring outflows discharge into the upper river floodplain, snails were observed in swiftly flowing, clear to low-turbidity, shallow water (0.5 to 6.0 centimeters deep), on a sandy to silty substrate embedded with some coarse materials. The location where the snails were observed is shaded by a tall canopy, has vegetated banks, and has some small, open mudflats. To date, a comprehensive survey for the snails and a description of their habitat has not been attempted. During the June 2007 site visits, Dudek also observed unidentified snails in Middle Canyon Creek (below and within the agricultural field). This portion of the creek where the undescribed snails were observed appeared to be maintained perennially by agricultural runoff. Subsequent to the 2007 observation, alterations in agricultural practices resulted in a reduction of irrigation in this area, and water has not been observed to flow in the lower portion of the creek. The undescribed snail has not been observed in Middle Canyon Creek with the absence of flowing water (Carpenter and Harpole 2008).

Hydrobiid snails (including *Pyrgulopsis*) are obligately aquatic, have limited vagility, and are incapable of dispersing across terrestrial barriers among hydrographically isolated habitats (Liu and Hershler 2007). Hydrobiids are gill-breathing and are dependent upon dissolved oxygen in the water in which they live. Frequently restricted to headsprings, hydrobiids exhibit a great degree of local endemism; this may reflect physiological specialization for these unique environments (Liu and Hershler 2007). Hydrobiids are prone to differentiation on a fine geographic scale, with most species being restricted to a single spring, spring complex, or local watershed (Liu and Hershler 2007).

Furnish and Monthey (1998) describe the basic life history of the Hydrobiid snails. Typically, members of this family are dioecious (i.e., constitute separate genders) and semelparous (i.e., breed only once in their lifetime and then die). Individuals have a lifespan of one year, with 90% or more of the population turning over annually. Eggs are laid in the spring and hatch in 2 to 4 weeks. Sexual maturity is reached by late summer, and some individuals overwinter as adults. Most hydrobiids are periphyton or perilithon grazers (Furnish and Monthey 1998).

Monthey (1998) provides further information on Hydrobiid snails. As individuals do not disperse widely, populations remain very localized in their distribution. Most hydrobiids are highly sensitive to oxygen deficits below saturation levels, elevated water temperatures, and sedimentation. Some hydrobiids avoid areas subject to eutrophication or periodic hypoxia. Major predators of hydrobiids include waterfowl, amphibians, turtles, and some fishes. Some hydrobiids occur only in shaded areas and may be photophobic (Cordeiro 2002).

Because 90% of the population turns over annually, any condition that impairs egg-laying or survivorship of eggs or young (e.g., excessive, smothering sedimentation) may result in extirpation (Furnish and Monthey 1998). Examples of identified threats to other hydrobiids in the Western United States include (Monthey 1998):

- Water quality impairment: Nutrient enrichment from excessive nitrogen and phosphorus levels resulting in eutrophication
- Water pollution from chemical spills; urban, agricultural, or industrial runoff; livestock use of springs; and reduced oxygen levels
- Elevated water temperatures
- Excessive sedimentation and eutrophication resulting from a variety of activities, including road grade construction, grazing, logging, and mining
- Disturbance to substrate: Mining or excavation of bottom substrates disturbs snail populations and increases sedimentation; smothering or burying preferred substrates may impair egg-laying or survivorship of eggs or young
- Changes in flow regime: Decreases in water flow or above-average fluctuations in water levels
- Reduced water-current velocities, which lower oxygen availability and allow accumulation of fine sediment

- Water diversions for irrigation or livestock watering that reduce spring flow and result in less suitable habitat
- Dams, which submerge springs, or channeling, which excessively modifies habitat and water flow.

INTENTIONALLY LEFT BLANK

4.0 REFERENCES

Carpenter, M., and C. Harpole. 2008. Personal communication from M. Carpenter and C. Harpole (Newhall Land) to S. Miller (Dudek), September 4, 2008.

CDFG (California Department of Fish and Game). 2003. "List of California Terrestrial Natural Communities Recognized by the California Natural Diversity Database." *California Natural Diversity Database.* Vegetation Classification and Mapping Program. September.

CNPS. 2007. *Inventory of Rare and Endangered Plants*. Online edition, Version 7-07a. http://www.cnps.org/inventory

Cordeiro, J. 2002. "California Status Factors: *Fluminicola* sp. 3 (Diminutive Pebblesnail)." *2004 Updated Ranks and Heritage Status for Survey and Manage Species.* Oregon State University, Oregon Natural Heritage Information Center. November 27. http://oregonstate.edu/ornhic/survey/fluminicola_sp_3_ca.pdf

Dudek & Associates, Inc. 2002. *2002 Sensitive Plant Survey Results for Newhall Ranch Specific Plan Area, Los Angeles County, California.* Prepared for the Newhall Land and Farming Company. November 20.

Dudek & Associates, Inc. 2006. *Biological Resources Technical Report for the Newhall Ranch Specific Plan Area, Los Angeles County, California*. Prepared for the Newhall Land and Farming Company. October.

Ertter, B. 2002. E-mail from B. Ertter (Jepson Herbaria) to K. Koch (Impact Sciences, Inc.), September 12.

Furnish, J.L., and R.W. Monthey. 1998. "Draft Management Recommendations for *Fluminicola* New Species 20, Lost Creek Pebblesnail, a ROD Mollusk Species Associated with Creek Habitats." *Aquatic Mollusk Survey Protocols*. December. http://www.blm.gov/or/plans/surveyandmanage/MR/AQMollusks/section6.htm

GSI and AESEG (GSI Water Solutions, Inc. and Allan E. Seward Engineering Geology, Inc.). 2007. *Middle Canyon Spring Hydrogeologic Assessment and Impact Evaluation Report.* Prepared for Newhall Land and Farming Company in association with Geosyntec Consultants. September.

Hershler, R. 2007. E-mail from R. Hershler (Smithsonian Institute) to M. Elvin (USFWS), February 5.

Liu, H.P., and R. Hershler. 2007. "Phylogenetic Relationships: Spring Snail." University of Denver, Department of Biological Sciences, Rocky Mountain Center for Conservation Genetics and Systematics. Accessed July 19. http://consgen.cr.usgs.gov/research/snail.asp

Monthey, R.W. 1998. "Draft Management Recommendations for Klamath Pebblesnail (*Fluminicola* n. sp. 1)." *Aquatic Mollusk Survey Protocols.* December. http://www.blm.gov/or/plans/surveyandmanage/MR/AQMollusks/section1.htm

Porter, J.M., and N. Fraga. 2004. *A Quantitative Analysis of Pollen Variation in Two Southern California Perennial* Helianthus *(Heliantheae: Asteraceae).* Rancho Santa Ana Botanic Garden.

Rieseberg, L. 2002. E-mail from L. Rieseberg (Indiana University) to K. Babcock (Impact Sciences, Inc.), October 8.

Soza, V. 2003. *Chromosome Counts for the Recently Discovered* Helianthus *Population on Newhall Ranch, Los Angeles County*. Rancho Santa Ana Botanic Garden. May 12.

U.S. Geological Survey. 1930. Newhall 7.5-minute topographic map.

U.S. Geological Survey. 1988.. Newhall 7.5-minute topographic map.

USGS (U.S. Geological Survey). 1991. *National Water Summary 1988–89—Hydrologic Events and Floods and Droughts.* USGS Water-Supply Paper 2375. Comp. R.W. Paulson, E.B. Chase, R.S. Roberts, and D.W. Moody. Denver, Colorado: U.S. Government Printing Office.

APPENDIX A

Vascular Plant Species Observed on Site

APPENDIX A
Vascular Plant Species Observed on Site

ANGIOSPERMAE (DICOTYLEDONES)

APIACEAE – CARROT FAMILY

* *Apium graveolens* – celery
* *Carduus pycnocephalus* – Italian thistle

ASTERACEAE – SUNFLOWER FAMILY

Ambrosia psilostachya – western ragweed
Artemisia tridentata – Great Basin sagebrush
Baccharis douglasii – Douglas baccharis
Baccharis salicifolia – mulefat
Iva axillaris – poverty weed
* *Silybum marianum* – milk thistle
* *Sonchus* sp. – sow-thistle

BORAGINACEAE – BORAGE FAMILY

Amsinckia menziesii var. *menziesii* – yellow fiddleneck
Heliotropium curassavicum – salt heliotrope

BRASSICACEAE – MUSTARD FAMILY

* *Brassica nigra* – black mustard
Rorippa nasturtium-aquaticum – water cress

CHENOPODIACEAE – GOOSEFOOT FAMILY

Atriplex triangularis – spearscale
Chenopodium sp. – goosefoot

CUCURBITACEAE – GOURD FAMILY

Cucurbita foetidissima – calabazilla

FABACEAE – LEGUME FAMILY

Lotus scoparius – deerweed

FAGACEAE – OAK FAMILY

Quercus agrifolia – coast live oak

LAMIACEAE – MINT FAMILY

* *Marrubium vulgare* – horehound

MALVACEAE – MALLOW FAMILY
Malva sp. – mallow

ROSACEAE – ROSE FAMILY
Adenostoma fasciculatum – chamise
Rubus ursinus – California blackberry

SALICACEAE – WILLOW FAMILY
Populus fremontii – Fremont cottonwood
Salix exigua – narrow-leaved willow
Salix lasiolepis – arroyo willow

SAURURACEAE – LIZARD'S-TAIL FAMILY
Anemopsis californica – yerba mansa

SCROPHULARIACEAE – FIGWORT FAMILY
Mimulus guttatus – common monkeyflower

SOLANACEAE – NIGHTSHADE FAMILY
Datura wrightii – jimsonweed

TAMARICACEAE – TAMARISK FAMILY
* *Tamarix ramosissima* – tamarisk

URTICACEAE – NETTLE FAMILY
Urtica dioica – giant creek nettle

VISCACEAE – MISTLETOE FAMILY
Viscum album – European mistletoe

VITACEAE – GRAPE FAMILY
Vitis girdiana – desert wild grape

ANGIOSPERMAE (MONOCOTYLEDONES)

CYPERACEAE – SEDGE FAMILY
Scirpus robustus – bull tule

JUNCACEAE – RUSH FAMILY
Juncus sp. – rush

POACEAE – GRASS FAMILY

* *Arundo donax* – giant reed
* *Bromus diandrus* – ripgut brome
* *Cynodon dactylon* – Bermuda grass
Distichlis spicata – saltgrass
Leymus triticoides – beardless wild rye
* *Piptatherum miliaceum* – smilo grass
* *Polypogon monspeliensis* – rabbit's-foot grass

* Signifies introduced (non-native) species.

INTENTIONALLY LEFT BLANK