Project No. S9929-05-01
September 29, 2014

VIA ELECTRONIC MAIL

Mr. Jason Greminger
Consultants Collaborative, Inc.
160 Industrial Street, Suite 200
San Marcos, California 92078

Subject: PRELIMINARY REVIEW OF HYDROGEOLOGICAL CONDITIONS
SAN MARCOS HIGHLANDS SPECIFIC PLAN AREA
SAN DIEGO COUNTY, CALIFORNIA

Dear Mr. Greminger:

In accordance with your authorization, we have prepared this preliminary review of hydrogeological conditions for the San Marcos Highlands Specific Plan Area (the Site) in San Diego County, California. The San Marcos Highlands residential development project proposes to use groundwater and/or supplemental potable water, depending on availability, for irrigation of common area slopes, public/private parks and restoration areas, and right-of-way landscaping.

PURPOSE AND SCOPE

The purpose of our study was to provide hydrogeologic information requested by the City of San Marcos and the San Diego Local Agency Formation Commission (LAFCO), including:

- Existing conditions pertaining to groundwater use on the Site;
- Characterization/quantification of past groundwater use at the Site;
- Groundwater use in the surrounding area; and,
- Proposed groundwater use (quantity, rate, and duration) for the project.

We performed a review of readily available hydrogeological literature, groundwater data, and maps for the region. We also discussed well drilling conditions in the area with a water well driller who is active in the region. It is important to note that we were not able to obtain and review copies of *Well Completion Reports* for the area surrounding the Site. The City of San Marcos submitted a *Well Completion Report Release Agreement – Agency Study* (request form) to the California Department of Water Resources (DWR) to obtain well records for this study. However, DWR judged that this study did not constitute an "Agency Study" and declined to release well records.

FINDINGS

The following sections present the findings of our review of the information sources previously described including a discussion of the site boundaries and topography, regional geology, and groundwater conditions.

Site Description

The Site is located at the northern terminus of Las Posas Road in San Marcos, California. Palomar College and State Route 78 are located approximately 1.5 miles south of the Site. The approximate location of the Site is shown on Figure 1, Vicinity Map. It consists of approximately 293 acres of undeveloped land that borders the northern edge of the City of San Marcos (see Figure 2, Aerial Photograph).

Topography of the Site consists of moderately hilly terrain, with high points at the southeast and northwest corners, and a seasonal drainage (Agua Hedionda Creek) that flows across the Site from northeast to southwest between high elevation areas. Site topography is depicted on Figure 3, Topographic Map. Site elevations range from a low of approximately 610 feet above mean sea level (MSL), where the creek flows offsite near the southwest corner, to 1,302 feet and approximately 1,020 feet above MSL at the southeast and northwest corners, respectively. A branch of the San Diego Aqueduct (underground pipe) runs beneath the western portion of the Site.

Geologic Setting

The Site is underlain by Mesozoic-age metasedimentary and metavolcanic rocks, described as volcanic breccia and metamorphosed andesitic flows, tuffs, and breccias (Kennedy and Tan, 2007), and referenced herein as metamorphic rocks. The geologic setting of the Site and surrounding area are depicted on Figure 4, Geologic Map.

Groundwater

The Site is in the San Diego Basin, as defined by the State Water Resources Control Board (SWRCB). The San Diego Basin is subdivided into Hydrologic Units, which are further subdivided into Hydrologic Areas and Subareas. The Site is located in the Buena Subarea of the Agua Hedionda Hydrologic Area, in the Carlsbad Hydrologic Unit (California Regional Water Quality Control Board – San Diego Region [RWQCB-SD] Hydrologic Unit No. 904.31). Beneficial uses of groundwater in the Buena Hydrologic Subarea are identified as municipal, agricultural, and industrial (RWQCB-SD, 2011). Industrial process supply, freshwater replenishment, and groundwater replenishment are not listed as beneficial uses of groundwater in the Buena Hydrologic Subarea.

DWR maintains data regarding groundwater basins in the State. The Site is not part of a defined groundwater basin but rather is considered an upland area. The nearest groundwater basin (as defined by DWR) is the San Marcos Valley Groundwater Basin (DWR Groundwater Basin No. 9-32), located approximately 1 to 2½ miles south and southwest from the Site (DWR, 2004).

The primary groundwater-bearing units in the San Marcos Valley Groundwater Basin are alluvium and residuum (deeply weathered bedrock). Fractured crystalline bedrock is of lesser importance for groundwater supply in the area due to highly varied and generally limited rates of production.

The San Diego County Water Authority (SDCWA) states, regarding groundwater supply in areas outside of the principal alluvial aquifers (basins) and farther inland, that groundwater occurs in fractured crystalline bedrock and semi-consolidated sedimentary deposits where yield and storage are limited and the aquifers are best suited for lower-yielding domestic water supply wells (SDCWA 2014).

The Site is not located within a designated groundwater management area (DWR, 2014). The closest designated groundwater management area is the San Pasqual Valley Groundwater Basin, located approximately 12 miles southeast of the Site.

Groundwater Availability

The site geology is mapped as metamorphic rock, so groundwater at the Site would be obtained from fractured crystalline bedrock. As noted previously, the capacity or yield of wells in fractured bedrock areas is generally relatively low.

DWR (2004) reported that alluvium in the San Marcos Valley Groundwater Basin extends up to depths of 175 feet and that wells completed in the alluvium yield as much as 60 gallons per minute (gpm), but they did not report any yield information for wells completed in residuum or fractured bedrock.

Based on professional experience and our discussions with a San Diego area water well driller, the anticipated yield for wells drilled in the fractured metamorphic bedrock is generally relatively low, typically varying from less than 10 gpm up to approximately 30 gpm as a best-case well in the area, with a necessary well depth on the order of 700 to 1,000 feet. Higher-yielding wells are occasionally constructed in fractured metamorphic bedrock in the region, but they are exceptions to the norm.

Groundwater Quality

DWR (1967) reported that groundwater extracted from the fractured and jointed crystalline rocks (to include metamorphic rocks) in the San Diego region generally had a total dissolved solids (TDS) concentration between 150 and 700 parts per million, a calcium to sodium bicarbonate character, and a chemical quality suitable for domestic and irrigation uses.

Current/Past Site Groundwater Use

Currently there is no groundwater use at the Site. We understand that there is an approximate 8- to 10-foot-diameter hand-dug well of unknown depth on the northern section of the Site near the drainage (see Figure 2). Standing water was present in the well at a depth of approximately 8 feet below ground surface during the summer of 2013. We did not determine the age or the historic use of that well during this study.

Surrounding Area Groundwater Use

We were unable to obtain copies of confidential *Water Well Drillers Reports* or *Well Completion Reports* from DWR for properties surrounding the Site, so specific groundwater use data for the surrounding area was not available during this study. Based on the 2012 DWR Well master database, the San Marcos Basin (1 to 2½ miles south and southwest of the Site) had between 10 and 20 wells per square mile. We anticipate that the spatial density of wells in the upland area outside the basin is likely lower.

Drinking water is provided to the City of San Marcos by the Vallecitos Water District (City of San Marcos, 2014), which imports all of its water from the Metropolitan Water District of Southern California (Vallecitos Water District, 2014). The site vicinity is also serviced by the Vista Irrigation District, who obtains local water from the Lake Henshaw watershed and imported water from MWD and SDCWA (LAFCO, 2014; Vista Irrigation District, 2014).

Based on review of aerial photographs, general land use patterns, and water agency service maps for the site vicinity, we anticipate that the large residential and apparent agricultural properties located north and west of the Site receive water service from Vista Irrigation District and may also have wells. The higher-density residential subdivision located south of the Site within the City of San Marcos receives water service from the Vallecitos Water District.

The SDCWA indicates that several agencies within their service area have documented potential groundwater development projects that could provide an additional 22,000 acre-feet of groundwater production in fiscal year 2015 (SDCWA, 2014). However, their published list of existing, planned, and conceptual groundwater development projects does not identify any projects by agencies in the site vicinity (e.g., Vallecitos Water District, City of San Marcos, and Vista Irrigation District).

Proposed Groundwater Use

The project proposes to use groundwater and/or supplemental potable water, depending on availability, for irrigation of common area slopes, public/private parks and restoration areas, and right-of-way landscaping. We understand that the project's estimated water usage for these purposes is as follows:

- 31,660,000 gallons per year (60.2 gallons per minute) for the first four years when landscaping is becoming established; then,
- 11,600,000 gallons per year (22.1 gallons per minute) after the initial four-year period.

Due to anticipated limitations of the fractured bedrock aquifer in the area, the capacity of a well at the Site is unlikely to exceed 30 gpm. The area of influence for a given water supply well is highly variable based on numerous factors including the type of aquifer and its specific characteristics, pumping rate and duration, and intake area (i.e., screen length) of the well. The California Department of Health Services (DHS) Drinking Water Source Assessment and Protection Program outlines several methods of varying complexity for estimating/delineating a wellhead protection area around a groundwater source (DHS 1999). With regard to performing a preliminary assessment for a groundwater source in a fractured rock aquifer, DHS states the following:

> *In fractured rock aquifers, the complexity of the flow system does not lend itself to a simple delineation method that accurately reflects the appropriate size, shape and direction of zones. Given the [very limited] resources and time available to conduct the [Drinking Water Source] assessments, DHS recommends the minimum delineation method in fractured rock to be the calculated fixed radius method, increasing the calculated radius of each zone by 50%. The default effective porosity of 0.2 would be used in the equation. Increasing the size of the zones in fractured rock reflects the increased vulnerability of these sources compared to those in porous media aquifers.*

While groundwater use on this project would not be for drinking water supply, the methodology for estimating the radius of influence of a future well is useful for developing an order-of-magnitude radius-of-influence estimate for this preliminary assessment. DHS (1999) provides the following equation for the calculated fixed radius for fractured rock aquifers:

$$R_T = 1.5 \times \sqrt{\frac{QT}{\pi \eta H}}$$

Where,

R_T = Radius (in feet) of zone for Time of Travel T
T = Time of Travel (years)
Q = Pumping capacity of well (in ft^3/year) (ft^3/year = gpm x 70,267)
π = 3.1416
η = Aquifer effective porosity (default = 0.2)
H = Well screened interval (in feet)

Using a pumping rate of 30 gpm for 4 years, with a well screen interval of 100 feet, and effective porosity of 0.2, results in a radius R_T of 550 feet.

CONCLUSIONS AND RECOMMENDATIONS

The Site is underlain by Mesozoic-age metasedimentary and metavolcanic rocks. As such, development of a groundwater source on the Site will rely on a well(s) constructed in fractured metamorphic bedrock. The anticipated yield for wells drilled in the fractured metamorphic bedrock is generally relatively low, typically varying from less than 10 gpm up to approximately 30 gpm as a best-case well in the area, with a potential necessary well depth on the order of 700 to 1,000 feet.

Groundwater extracted from the fractured and jointed metamorphic bedrock beneath the Site is anticipated to have a TDS concentration between 150 and 700 parts per million, a calcium to sodium bicarbonate character, and a chemical quality suitable for domestic and irrigation uses.

Currently there is no groundwater use at the Site. In the surrounding area, the properties located north and west of the Site may rely, at least in-part, on individual wells, while the residential subdivision south of the Site receives water from the Vallecitos Water District.

Based on preliminary information as discussed herein, we recommend applying an approximate 550-foot buffer to adjacent groundwater-using properties from proposed well locations at the Site. Under such conditions, the groundwater use scenario currently proposed for the project is unlikely to impact surrounding groundwater users.

REFERENCES

1. California Department of Health Services, 1999, *Drinking Water Source Assessment and Protection (DWSAP) Program,* Division of Drinking Water and Environmental Management, revised January 2000, 209 p.
2. California Department of Water Resources, 1967, *Groundwater Occurrence and Quality: San Diego Region,* Bulletin 106-2, 235 p.
3. DWR, 2003, *California's Groundwater, Bulletin 118 – Update 2003,* October, 246 p.
4. DWR, 2004, *San Marcos Area Groundwater Basin*, in *California's Groundwater, Bulletin 118 – Update 2003,* http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/9-32.pdf, updated February 27.
5. DWR, 2014, *Groundwater Information Center Map Interface,* http://gis.water.ca.gov/app/groundwater/, accessed in September 2014.
6. Kennedy, M. P. and Tan, S. S., 2007, compilers: *Geologic Map of the Oceanside 30' x 60' Quadrangle, California*, California Geological Survey, Regional Geologic Map Series, 1:100,000 Scale, Map No. 2.
7. California Regional Water Quality Control Board, San Diego Region, 2011, *Water Quality Control Plan For the San Diego Basin,* Adopted September 8, 1994, with amendments effective on or before April 4, 2011.
8. San Diego County Water Authority website: http://www.sdcwa.org/groundwater, accessed in September 2014.
9. San Diego Local Agency Formation Commission website: http://www.sdlafco.org/index.html, accessed in September 2014.
10. City of San Marcos website: http://www.ci.san-marcos.ca.us/, accessed in September 2014.
11. Vallecitos Water District website: http://www.vwd.org/, accessed in September 2014.
12. Vista Irrigation District website: http://www.vid-h2o.org, accessed in September 2014.

LIMITATIONS

The conclusions contained in this evaluation are based upon the assumption that the soil and rock conditions on the Site are consistent with conditions identified in literature we obtained and reviewed for this project. If any variations are encountered during later activities, they may alter our conclusion, and we should be notified so that supplemental recommendations can be given.

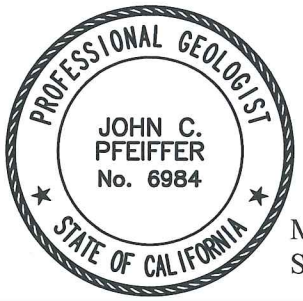
The conclusions contained in this report have not been verified through subsurface exploration or site reconnaissance. Changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. Additionally, changes in resource economics, extraction technologies, utilization patterns, or applicable standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated partially or wholly by changes outside our control.

Our professional services were performed, our findings obtained, and our conclusions prepared in accordance with generally accepted geological principles and practices used in this area at this time. No warranty is given, either express or implied.

Please contact us if you have any questions concerning the contents of this preliminary review or if you need additional information.

Sincerely,

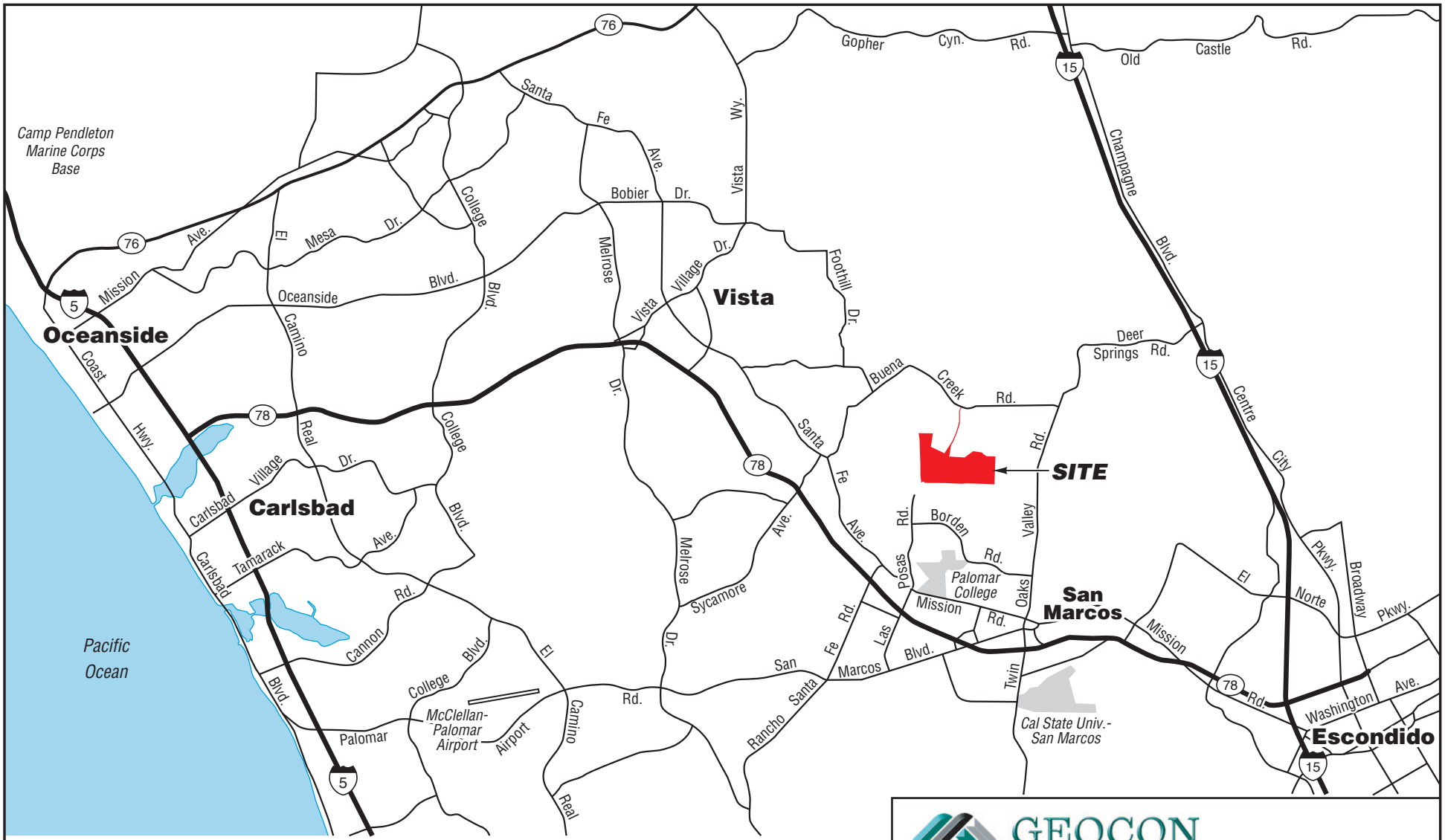
GEOCON CONSULTANTS, INC.



John C. Pfeiffer, PG, CEG
Senior Geologist

Matthew Lesh, PG
Senior Project Geologist

Attachments: Figure 1, Vicinity Map
Figure 2, Aerial Photograph
Figure 3, Topographic Map
Figure 4, Geologic Map



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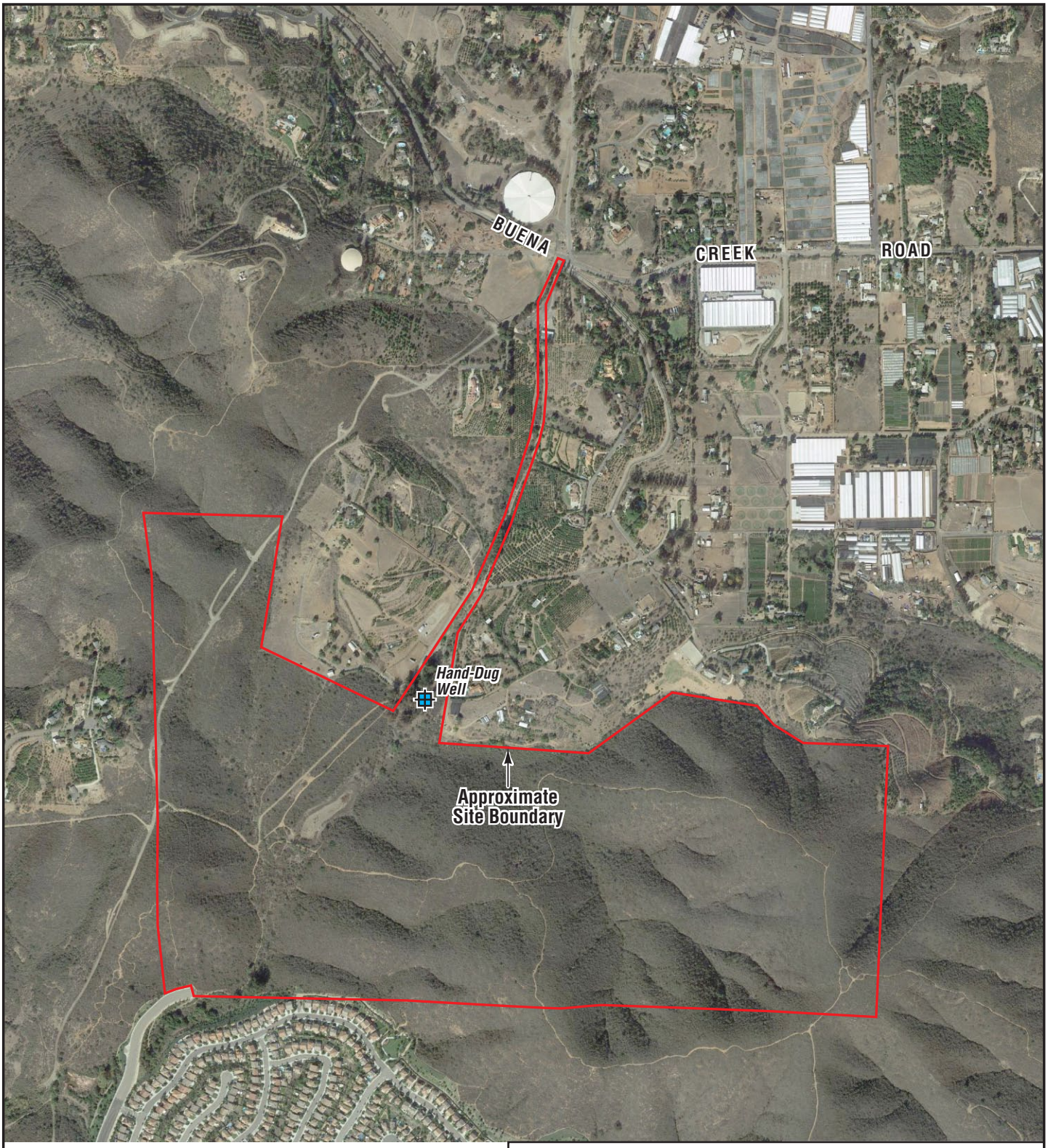
San Marcos Highlands

San Diego County, California

VICINITY MAP

S9929-05-01	September 2014	Figure 1



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Scale in Feet

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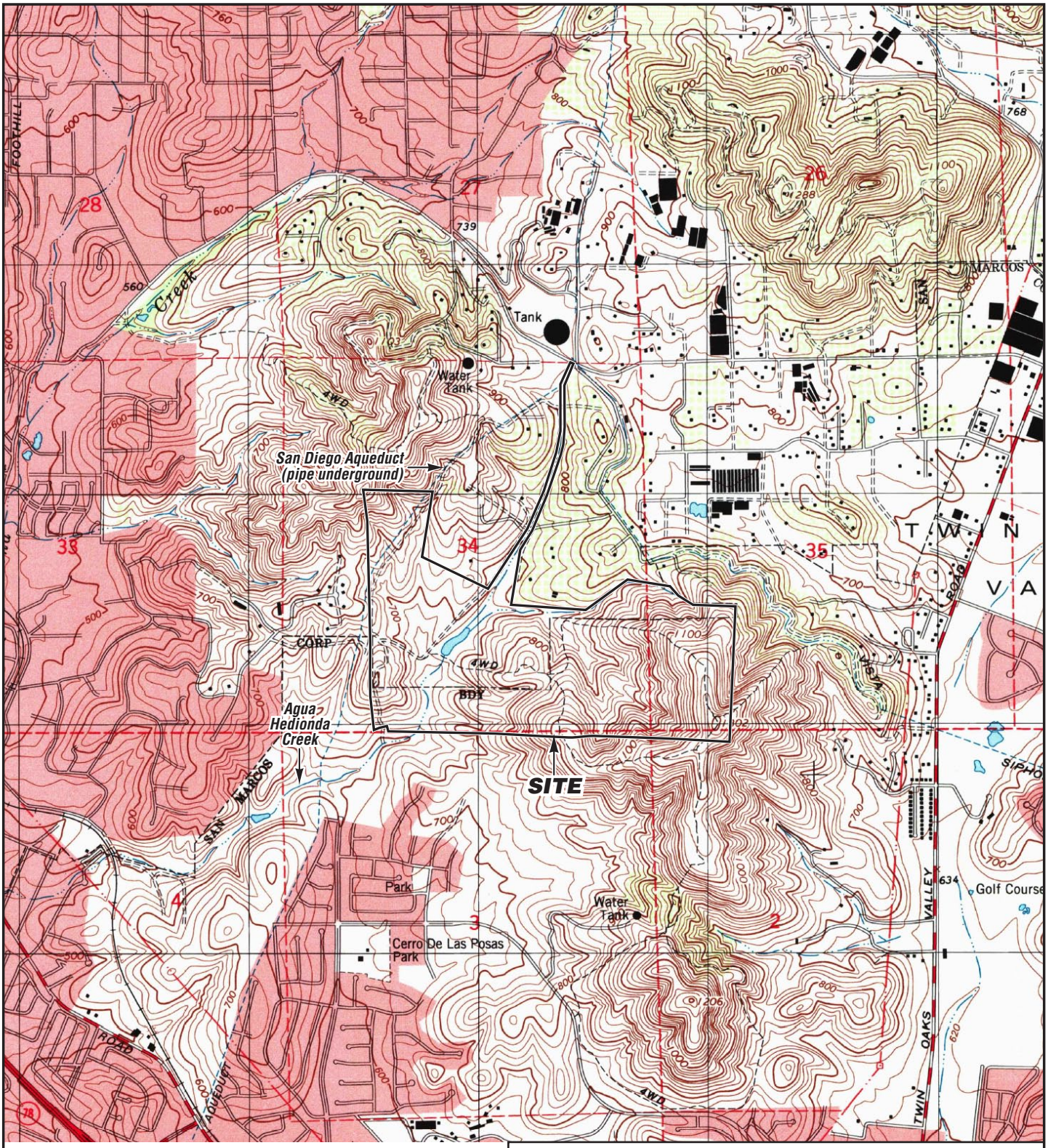
AERIAL PHOTOGRAPH

S9929-05-01	September 2014	Figure 2



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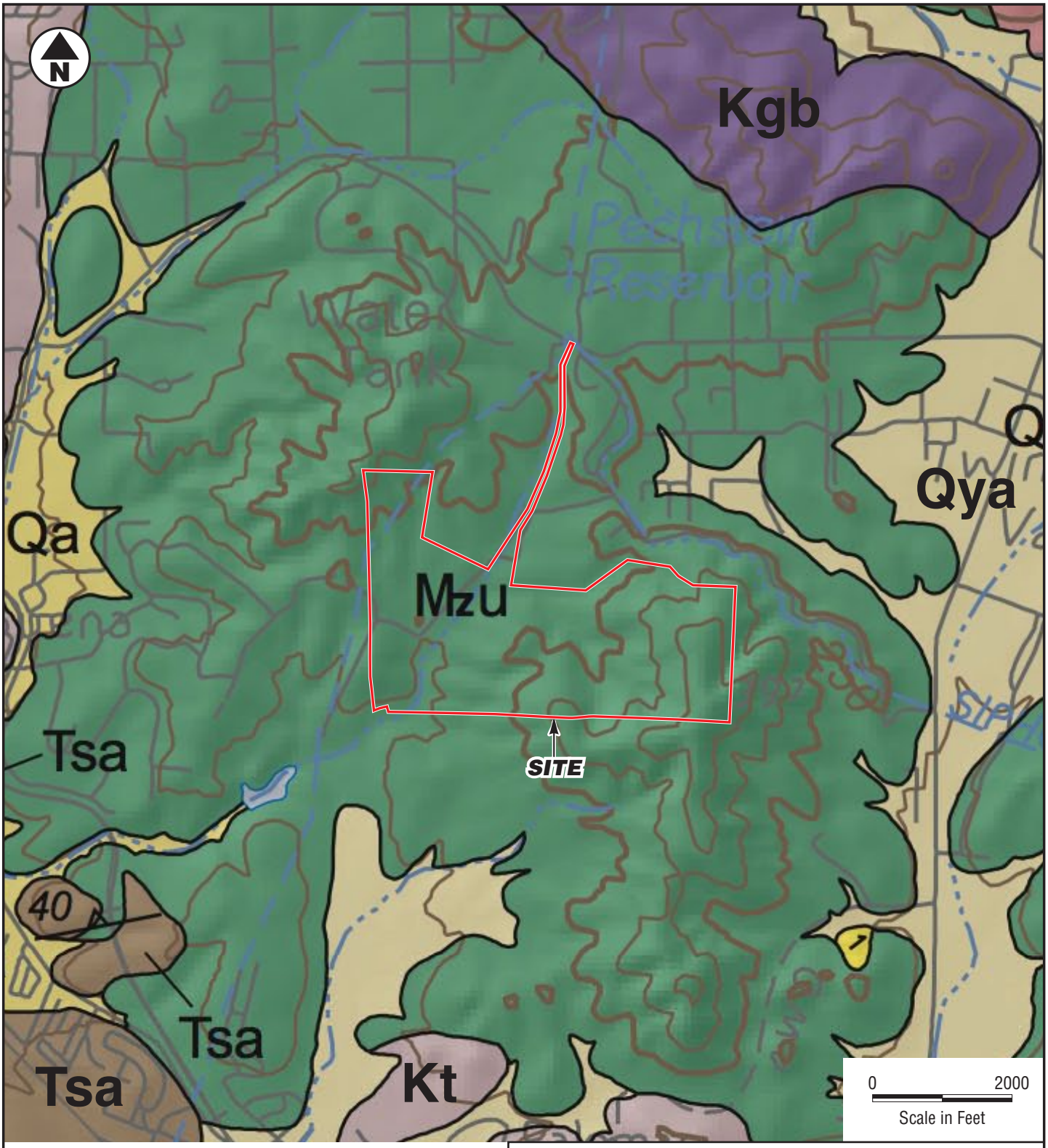
TOPOGRAPHIC MAP

S9929-05-01	September 2014	Figure 3



Qa	Alluvial flood plain deposits (late Holocene) Unconsolidated sandy, silty, and clay-bearing alluvium.
Qya	Young alluvial flood plain deposits (Holocene and late Pleistocene) Poorly consolidated, poorly sorted, permeable flood plain deposits.
Tsa	Santiago Formation (middle Eocene) Arkosik sandstone
Kt	Tonalite (mid-Cretaceous) Massive, coarse-grained, light-gray igneous rock
Kgb	Gabbro (mid-Cretaceous) Massive, coarse-grained, dark-gray and black igneous rock
Mzu	Metasedimentary & metavolcanic rocks (Mesozoic) Mostly volcaniclastic breccia and metaandesitic flows, tuffs and tuff-breccia.

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GEOLOGIC MAP

S9929-05-01	September 2014	Figure 4