Dear Mr. Niemiec:

In accordance with your request, we have prepared this geologic reconnaissance for the proposed pump station and reservoir to be located at 13661 Olde Highway 80 in Lakeside, California. The accompanying report describes the site soil and geologic conditions and discusses potential geotechnical constraints. The site is underlain by surficial soil composed of topsoil and alluvium on the northern portion of the property and topsoil over granitic rock on the southern portion. The site is considered suitable for the possible construction of a reservoir and pump station based on our reconnaissance level study. Additional field investigation work should be performed for a design level study in preparation of construction drawings.

Should you have questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Kelli A. James  
RCE 79438

Shawn Foy Weedon  
GE 2714

John Hoobs  
CEG 1524

KAJ:SFW:JH:dmc

(e-mail)  Addressee
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APPENDIX B
- SEISMIC REFRACTION SURVEY

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SOIL AND GEOLOGIC RECONNAISSANCE

1. PURPOSE AND SCOPE

This report presents the results of a soil and geologic reconnaissance for the proposed pump station and reservoir located at 13661 Olde Highway 80 in Lakeside, California (see Vicinity Map, Figure 1). The purpose of this study is to provide preliminary soil and geologic information for the subject project and identify known geologic hazards that may adversely impact the proposed project.

The scope of our work included reviewing readily available published and unpublished geologic literature pertinent to the site and performing a field reconnaissance to evaluate surface geologic conditions and possible equipment access and logistics. We also advanced three hand-auger borings up to about 5 feet deep to observe and sample the surficial deposits on the subject property and to check for the presence of groundwater or seepage. The logs and other details of the field investigation are presented in Appendix A. We tested selected soil samples obtained from the borings for moisture content which are presented on Figures A-1 – A-3. Southwest Geophysics performed a seismic refraction survey to assess the approximate depth and apparent rippability of underlying surficial soil and rock materials consisting of 11 seismic refraction traverses. The seismic refraction survey report is presented in Appendix B.

2. SITE AND PROJECT DESCRIPTION

The property consists of approximately 4.4 acres of mostly vacant land that is bordered by Olde Highway 80 to the north, Interstate 8 to the south, existing housing developments to the east, and a trailer park to the west. Houses and outbuildings are currently located north of the property and at the central area of the site. The property is relatively flat with elevations ranging from about 600 feet to 635 feet above mean sea level (MSL) according to Google earth. Surface drainage flows to the north to an active channel. Much of the site is covered by existing trees, shrubs, brush, along with reeds in the low-lying areas. Several rock outcroppings exist near the center of the site. A wooden bridge is located at the north end of the site that provides access to the existing houses. We understand the northern third of the site lies within the 100-year floodplain. The Geologic Map, Figure 2, depicts the geologic conditions of the site.

3. SOIL AND GEOLOGIC CONDITIONS

During our field reconnaissance, we observed surficial soil deposits consisting of topsoil and alluvium on the northern portion of the site and formational granitic rock material at various stages of weathering on the southern portion. In addition, rock outcrops are exposed at the surface in several areas of the property. The estimated occurrence and distribution of the surficial and formational rock units are discussed herein and are depicted on the Geologic Map, Figure 2. We used published
geologic maps to help evaluate the approximate location of the geologic units. A future geotechnical study should be performed to evaluate the approximate thickness and verify location of the existing geologic conditions.

3.1 Topsoil (Unmapped)

We expect topsoil to generally blanket the southern portion of the property in the area mapped as granitic rock. The topsoil likely consists of loose, unconsolidated, silty to clayey sand. In general, we do not expect the topsoil exceeds a thickness of 2 to 3 feet. We did not map the topsoil on the Geologic Map (Figure 2) due to the relatively thin nature of the deposit. Topsoil is considered compressible and unsuitable in its present condition and would require remedial grading where improvements are planned.

3.2 Alluvium (Qal)

Alluvium is mapped across the northern portion of the study area. We also encountered alluvium in the 3 shallow hand-auger borings. The alluvium consists of loose, dry to wet, dark brown, silty, fine to medium sand. Alluvial soil is considered compressible and would require remedial grading in areas where structures are planned. The alluvium located below the groundwater may be considered liquefiable; however, an additional study would be required to evaluate the liquefaction potential.

3.3 Granitic Rock (Kgr)

Early Cretaceous-age granitic rock of the Southern California Batholith underlies the southern portion of the site composed of undifferentiated tonalite and granodiorite. Granitic rock may contain adversely oriented fractures and/or joints which could potentially affect planned cut slope excavations. Fractures and/or joints may also contribute to the propagation of groundwater or seepage. Generally, fill soil derived from decomposed granitic rock exhibits adequate bearing and slope stability characteristics. The soil derived from excavations within the decomposed granitic rock would likely possess a “very low” to “low” expansion potential (expansion index of 50 or less), silty, medium to coarse sands. Excavations within the less-weathered granitic rock will be difficult and may generate boulders and oversize materials (rocks greater than 12 inches in length); however, large boulders and strong rock could occur within the highly weathered portion of the rock. The granitic rock is considered suitable to support the planned reservoir.

4. GROUNDWATER

We did not encounter groundwater or subsurface seepage in the hand-auger borings performed for this study to a depth of 5 feet. However, water is actively flowing in the drainage located on the northern portion of the property. We expect groundwater would be encountered within the alluvium on the
northern portion of the property possibly from 6 to 10 feet deep. It is not uncommon for groundwater or seepage conditions to develop where none previously existed. Groundwater and seepage are dependent on seasonal precipitation, irrigation, land use, among other factors, and vary as a result. Proper surface drainage of irrigation and rainwater will be critical to future performance of the project.

5. GEOLOGIC HAZARDS

5.1 Faulting and Seismicity

Based on our reconnaissance, a review of published geologic maps, the previously referenced geotechnical report, and experience with the soil and geologic conditions in the general area, no known active, potentially active, or inactive faults are located at the site.

According to the computer program *EZ-FRISK* (Version 7.62), seven known active faults are located within a search radius of 50 miles from the property. We used the 2008 USGS fault database that provides several models and combinations of fault data to evaluate the fault information. Based on this database, the nearest known active faults are the Newport-Inglewood and Rose Canyon Faults, located approximately 18 miles west of the site and are the dominant source of potential ground motion. Earthquakes that might occur on the Newport-Inglewood or other faults within the southern California and northern Baja California area are potential generators of significant ground motion at the site. The estimated deterministic maximum earthquake magnitude and peak ground acceleration for the Newport-Inglewood Fault are 7.5 and 0.36g, respectively. Table 5.1.1 lists the estimated maximum earthquake magnitude and peak ground acceleration for the Newport-Inglewood Fault and other faults in relationship to the site location. We used acceleration attenuation relationships developed by Boore-Atkinson (2008) NGA USGS2008, Campbell-Bozorgnia (2008) NGA USGS, and Chiou-Youngs (2008) NGA acceleration-attenuation relationships in our analysis.

<table>
<thead>
<tr>
<th>Fault Name</th>
<th>Distance from Site (miles)</th>
<th>Maximum Earthquake Magnitude (Mw)</th>
<th>Peak Ground Acceleration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Boore-Atkinson 2008 (g)</td>
</tr>
<tr>
<td>Newport-Inglewood</td>
<td>18</td>
<td>7.5</td>
<td>0.36</td>
</tr>
<tr>
<td>Rose Canyon</td>
<td>18</td>
<td>6.9</td>
<td>0.30</td>
</tr>
<tr>
<td>Elsinore</td>
<td>25</td>
<td>7.9</td>
<td>0.34</td>
</tr>
<tr>
<td>Earthquake Valley</td>
<td>29</td>
<td>6.8</td>
<td>0.21</td>
</tr>
<tr>
<td>Coronado Bank</td>
<td>30</td>
<td>7.4</td>
<td>0.26</td>
</tr>
<tr>
<td>Palos Verdes Connected</td>
<td>30</td>
<td>7.7</td>
<td>0.29</td>
</tr>
<tr>
<td>San Jacinto</td>
<td>46</td>
<td>7.9</td>
<td>0.23</td>
</tr>
</tbody>
</table>
It is our opinion the site could be subjected to moderate to severe ground shaking in the event of an earthquake along any of the faults listed on Table 5.1.1 or other faults in the southern California/northern Baja California region. We do not consider the site to possess a greater risk than that of the surrounding developments.

We used the computer program EZ-FRISK to perform a probabilistic seismic hazard analysis. The computer program EZ-FRISK operates under the assumption that the occurrence rate of earthquakes on each mapped Quaternary fault is proportional to the faults slip rate. The program accounts for earthquake magnitude as a function of fault rupture length, and site acceleration estimates are made using the earthquake magnitude and distance from the site to the rupture zone. The program also accounts for uncertainty in each of following: (1) earthquake magnitude, (2) rupture length for a given magnitude, (3) location of the rupture zone, (4) maximum possible magnitude of a given earthquake, and (5) acceleration at the site from a given earthquake along each fault. By calculating the expected accelerations from considered earthquake sources, the program calculates the total average annual expected number of occurrences of site acceleration greater than a specified value. We utilized acceleration-attenuation relationships suggested by Boore-Atkinson (2008) NGA USGS 2008, Campbell-Bozorgnia (2008) NGA USGS 2008, and Chiou-Youngs (2008) in the analysis. Table 5.1.2 presents the site-specific probabilistic seismic hazard parameters including acceleration-attenuation relationships and the probability of exceedance.

<table>
<thead>
<tr>
<th>Probability of Exceedance</th>
<th>Boore-Atkinson 2008 (g)</th>
<th>Campbell-Bozorgnia 2008 (g)</th>
<th>Chiou-Youngs 2008 (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2% in a 50 Year Period</td>
<td>0.44</td>
<td>0.36</td>
<td>0.41</td>
</tr>
<tr>
<td>5% in a 50 Year Period</td>
<td>0.34</td>
<td>0.28</td>
<td>0.31</td>
</tr>
<tr>
<td>10% in a 50 Year Period</td>
<td>0.27</td>
<td>0.22</td>
<td>0.23</td>
</tr>
</tbody>
</table>

The California Geologic Survey (CGS) has a program that calculates the ground motion for a 10 percent of probability of exceedence in 50 years based on an average of several attenuation relationships. Table 5.1.3 presents the calculated results from the Probabilistic Seismic Hazards Mapping Ground Motion Page from the CGS website.
TABLE 5.1.3
PROBABILISTIC SITE PARAMETERS FOR SELECTED FAULTS
CALIFORNIA GEOLOGIC SURVEY

<table>
<thead>
<tr>
<th>Calculated Acceleration (g)</th>
<th>Calculated Acceleration (g)</th>
<th>Calculated Acceleration (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm Rock</td>
<td>Soft Rock</td>
<td>Alluvium</td>
</tr>
<tr>
<td>0.22</td>
<td>0.25</td>
<td>0.29</td>
</tr>
</tbody>
</table>

While listing peak accelerations is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including the frequency and duration of motion and the soil conditions underlying the site. Seismic design of the structures should be evaluated in accordance with the 2010 California Building Code (CBC) guidelines or guidelines currently adopted by the City of San Diego.

5.2 Liquefaction

Liquefaction typically occurs when a site is located in a zone with seismic activity, onsite soil is cohesionless or silt/clay with low plasticity, groundwater is encountered within 50 feet of the surface, and soil relative densities are less than about 70 percent. If the four of the previous criteria are met, a seismic event could result in a rapid pore-water pressure increase from the earthquake-generated ground accelerations. Seismically induced settlement may occur whether the potential for liquefaction exists or not. The potential for liquefaction and seismically induced settlement may exist within the alluvium at the northern portion of the site. We did not perform a liquefaction analysis and an additional investigation should be performed if structures are planned within the alluvium area shown on the geologic map. Recommendations for mitigating liquefaction can be provided in the future geotechnical investigation, if necessary.

5.3 Effects of Liquefaction

Adverse impacts associated with liquefaction include lateral spreading, ground rupture and/or sand boils, and settlement of the liquefiable layers.

Lateral spreading occurs when liquefiable soils are in the immediate vicinity of a free face such as a slope. Factors controlling lateral displacement include earthquake magnitude, distance from the earthquake epicenter, thickness of liquefiable soil layer, grain-size characteristics, fines contents of the soil, and SPT blow counts. The potential of lateral spreading in the liquefiable soil below the groundwater table should be evaluated in future studies.
Surface manifestation due to liquefaction may consist of surface rupture and/or sand boils, and surface settlement. Sand boils occur where liquefiable soil is extruded upward through the soil deposit to the ground surface. Providing an increase in overburden pressure and a compacted fill mat can mitigate surface manifestation. The potential for surface manifestation should be evaluated in future studies if structures are planned within the alluvial area.

Seismically induced settlement could occur within the liquefied soil layer and/or layers after seismic shaking stops due to rearrangement of the sand particles. Additional field exploration should be performed in future geotechnical investigations.

The mitigation of potential hazards due to liquefaction can be accomplished in several ways, including the densification or removal of the potentially liquefiable soil or the use of foundation systems that still provide acceptable structural support should liquefaction occur. Soil densification is generally used to increase the density and provide liquefaction mitigation of sensitive soil to relatively shallow depths over large areas. Deep foundation systems may be used to transmit structural loads to bearing depths below the liquefiable zones and may consist of driven piles or drilled piles. Deep foundations are designed to mitigate damage to the structures supported on the piles, however they do not generally reduce the potential for damage to underground utilities and peripheral site improvements.

### 5.4 Landslides

Examination of aerial photographs in our files and review of available geotechnical reports for the site vicinity indicate that landslides are not present at the property or at a location that could impact the site.

### 5.5 Dam Inundation

The site is not located down-gradient of any existing water-retaining structure and is not within a potential inundation area for an earthquake-induced dam failure; therefore, the potential for dam inundation is considered low. However, Lake Jennings is located about 1 mile north of the property.

### 5.6 Seiches and Tsunamis

Seiches are caused by the movement of an inland body of water due to the movement from seismic forces. The potential of seiches to occur is considered to be very low due to the absence of a nearby inland body of water. The site is not adjacent to an inland body of water; therefore, the risk of a seiche is considered low.
A tsunami is a series of long-period waves generated in the ocean by a sudden displacement of large volumes of water. Causes of tsunamis include underwater earthquakes, volcanic eruptions, or offshore slope failures. The first order driving force for locally generated tsunamis offshore southern California is expected to be tectonic deformation from large earthquakes. The site is located approximately 18 miles from the Pacific Ocean at an elevation of approximately 600 feet above Mean Sea Level. Therefore, the risk of tsunamis affecting the site is negligible.

5.7 Seismic Refraction Survey

Southwest Geophysics Incorporated performed 11 seismic refraction survey lines to evaluate the approximate shear wave velocities of the subsurface materials. The velocities can provide rough approximations for the thickness of surficial soil and depth to granitic rock. The locations of the seismic traverses are presented on the Geologic Map, Figure 2, and their survey report is presented in Appendix B.

According to the Caterpillar Performance Handbook (1999 edition), igneous rocks, such as granite, are generally considered rippable by a Caterpillar D9R bulldozer with a single ripper shank to a velocity of about 5,800 ft/s (feet per second) and marginally rippable to a velocity of 8,000 ft/s providing the rock is sufficiently jointed and fractured. However, these rippable velocities are not necessarily economical.

The seismic refraction survey presents an evaluation of rock rippability using shear wave velocities. Table 5.7.1 presents the estimated rippability classifications and associated geologic units based on our experience with grading granitic rock and the information in the seismic survey report.

<table>
<thead>
<tr>
<th>Seismic P-Wave Velocity (feet/second)</th>
<th>Estimated Rippability</th>
<th>Estimated Geologic Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 2,000</td>
<td>Easy</td>
<td>Surficial Soil</td>
</tr>
<tr>
<td>2,000 – 4,000</td>
<td>Moderate</td>
<td>Highly Weathered Decomposed Granitic Rock</td>
</tr>
<tr>
<td>4,000 – 5,500</td>
<td>Difficult – Possible Blasting</td>
<td>Moderately Weathered Rock</td>
</tr>
<tr>
<td>5,500 – 7,000</td>
<td>Very Difficult – Probable Blasting</td>
<td>Slightly Weathered Rock</td>
</tr>
<tr>
<td>&gt;7,000</td>
<td>Blasting Generally Required</td>
<td>Fresh Rock</td>
</tr>
</tbody>
</table>

Table 5.7.1 presents rippability values more conservative than the Caterpillar Performance Handbook. The rippability values should be considered estimates and the contractor should perform
independent rippability studies to evaluate the excavations into the on-site materials before submitting bid estimates.

The seismic refraction survey study indicated highly variable conditions laterally and with depth. This is likely due to hard rock corestones at or near the surface within a more rippable decomposed granitic rock. In addition, there are limitations when a lower velocity unit is below a higher velocity corestone. Therefore, field trenching and/or drilling should be performed in areas of the surveys to check reported velocities. Based on figures presented in the seismic refraction survey, we estimate that the upper 5 to 20 feet below existing grade is generally composed of alluvium in the northern portion of the site and the upper 1 to 10 feet generally composed of topsoil and possible undocumented fill in the southern portion. Table 5.7.2 presents the estimated thicknesses of the geologic conditions based on the seismic refraction survey.

<table>
<thead>
<tr>
<th>Seismic Line</th>
<th>Surficial Soil – Qal and Topsoil (feet)</th>
<th>Depth to Fresh Granitic Rock (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL-1</td>
<td>2-6</td>
<td>28-42</td>
</tr>
<tr>
<td>SL-2</td>
<td>2-10</td>
<td>10-30</td>
</tr>
<tr>
<td>SL-3</td>
<td>2-6</td>
<td>20-40</td>
</tr>
<tr>
<td>SL-4</td>
<td>1-6</td>
<td>20-30</td>
</tr>
<tr>
<td>SL-5</td>
<td>6-9</td>
<td>20-35</td>
</tr>
<tr>
<td>SL-6</td>
<td>8-11</td>
<td>20-25</td>
</tr>
<tr>
<td>SL-7</td>
<td>1-8</td>
<td>10-45</td>
</tr>
<tr>
<td>SL-8</td>
<td>0-6</td>
<td>20-55</td>
</tr>
<tr>
<td>SL-9</td>
<td>2-14</td>
<td>20-40</td>
</tr>
<tr>
<td>SL-10</td>
<td>1-20</td>
<td>20-43</td>
</tr>
<tr>
<td>SL-11</td>
<td>2-10</td>
<td>10-15</td>
</tr>
</tbody>
</table>

6. FUTURE GEOTECHNICAL STUDIES

Based on our review of published geologic maps and our geologic reconnaissance of the site, a geotechnical investigation of the property will be necessary to further evaluate the subsurface conditions and to provide recommendations for design of the proposed project. The geotechnical investigation should include performing excavation, sampling, and logging of subsurface excavations and laboratory testing to aid in geologic mapping, and the preparation of foundation and retaining wall design criteria, seismic design and recommendations for remedial grading.
7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Based on our review of published geological maps and our field investigation, the study area is underlain by approximately 5 to 20 feet of alluvium on the northern portion of the site and 1 to 10 feet of topsoil on the southern portion.

7.2 A geotechnical investigation would be required to more clearly define the limits of rock material and the depth of rippable zones. This information can be used to provide specific design parameters for the bidding and construction process for the proposed project, if desired. Geocon Incorporated should be contacted if design parameters for the reservoir will be required.

7.3 We did not observe groundwater or seepage in our exploratory hand-auger boring excavations in the upper 5 feet. However, water is flowing in the drainage channel to the north and groundwater may be encountered at depths of 6 to 10 feet in the northern portion of the site. Water may be a design and construction issue depending on the depth of the planned improvements.

7.4 With the exception of possible seismic shaking, we did not observe significant geologic hazards and do not know hazards to exist on the site that would adversely affect the proposed project.
LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon Incorporated should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon Incorporated.

2. This report is issued with the understanding that it is the responsibility of the owner or his representative to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and that the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

3. The findings of this report are valid as of the present date. However, 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. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

4. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.
APPENDIX A

FIELD INVESTIGATION

We performed the field investigation on July 23, 2012, consisting of a visual site reconnaissance and the drilling of 3 hand-auger borings up to 5 feet deep. The approximate locations of the exploratory borings are shown on the Geologic Map, Figure 2.
<table>
<thead>
<tr>
<th>DEPTH IN FEET</th>
<th>SAMPLE NO.</th>
<th>LITHOLOGY</th>
<th>SOIL CLASS (USCS)</th>
<th>GROUNDWATER</th>
<th>PENETRATION RESISTANCE (BLOWS/FT.)</th>
<th>ELEV. (MSL.)</th>
<th>DATE COMPLETED</th>
<th>DRY DENSITY (P.C.F.)</th>
<th>MOISTURE CONTENT (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>SM</td>
<td>ALLUVIUM (Qal)</td>
<td></td>
<td></td>
<td></td>
<td>07-23-2012</td>
<td></td>
<td>6.8</td>
</tr>
<tr>
<td>2</td>
<td>HA1-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MATERIAL DESCRIPTION**

- ALLUVIUM (Qal)
  - Loose, dry to damp, dark brown, Silty, fine- to medium-grained SAND; micaceous
  - Becomes damp

**BORENG TERMINATED AT 5 FEET**

No groundwater encountered
**BORING HA 2**

**ELEV. (MSL.)**

**DATE COMPLETED 07-23-2012**

**EQUIPMENT 3" HAND AUGER**

**BY: A. GASTELUM**

<table>
<thead>
<tr>
<th>DEPTH IN FEET</th>
<th>SAMPLE NO.</th>
<th>LITHOLOGY</th>
<th>SOIL CLASS (USCS)</th>
<th>GROUNDWATER</th>
<th>PENETRATION RESISTANCE (BLOWS/FT.)</th>
<th>DRY DENSITY (P.C.F.)</th>
<th>MOISTURE CONTENT (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>SM ALLUVIUM (Qal)</td>
<td>Loose, dry, dark brown, Silty, fine- to medium-grained SAND; micaceous</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Becomes moist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>HA2-1</td>
<td></td>
<td></td>
<td></td>
<td>- Becomes wet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BORING TERMINATED AT 5 FEET</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No groundwater encountered</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.
<table>
<thead>
<tr>
<th>DEPTH IN FEET</th>
<th>SAMPLE NO.</th>
<th>LITHOLOGY</th>
<th>SOIL CLASS (USCS)</th>
<th>GROUNDWATER</th>
<th>MATERIAL DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>HA3-1</td>
<td>SM</td>
<td>ALLUVIUM (Qal)</td>
<td></td>
<td>Loose, dry, dark brown, Silty, fine- to medium-grained SAND; micaceous</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-Becomes moist</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-Becomes wet</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>HA3-1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

BORING TERMINATED AT 5 FEET
No groundwater encountered

ELEV. (MSL.) _____ DATE COMPLETED 07-23-2012
EQUIPMENT 3" HAND AUGER

<table>
<thead>
<tr>
<th>PENETRATION RESISTANCE (BLOWS/FT.)</th>
<th>DRY DENSITY (P.C.F.)</th>
<th>MOISTURE CONTENT (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GEOCON

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.
APPENDIX B

SEISMIC REFRACTION SURVEY

FOR

PROPOSED
PUMP STATION AND RESERVOIR
13661 OLDE HIGHWAY 80
LAKESIDE, CALIFORNIA

PROJECT NO. G1393-52-06
SEISMIC REFRACTION SURVEY
13661 OLDE HIGHWAY 80
SAN DIEGO COUNTY, CALIFORNIA

PREPARED FOR:
Geocon Consultants, Inc.
6960 Flanders Drive
San Diego, CA 92121

PREPARED BY:
Southwest Geophysics, Inc.
8057 Raytheon Road, Suite 9
San Diego, CA 92111

July 31, 2012
Project No. 112269
July 31, 2012  
Project No. 112269

Mr. Shawn Weedon  
Geocon Consultants, Inc.  
6960 Flanders Drive  
San Diego, CA 92121

Subject: Seismic Refraction Survey  
13661 Olde Highway 80  
San Diego County, California

Dear Mr. Weedon:

In accordance with your authorization, we have performed a seismic refraction survey pertaining to the property located at 13661 Olde Highway 80 in the Lakeside area of San Diego County, California. Specifically, our survey consisted of performing 11 seismic refraction lines in the study area. The purpose of the study was to develop a subsurface velocity profile of the study area and to evaluate the apparent rippability of the subsurface materials. This report presents our survey methodology, equipment used, analysis, and results from our study.

We appreciate the opportunity to be of service on this project. Should you have any questions related to this report, please contact the undersigned at your convenience.

Sincerely,

SOUTHWEST GEOPHYSICS, INC.

Principal Geologist/Geophysicist

Principal Geologist/Geophysicist

Distribution: Addressee (electronic)
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1. INTRODUCTION
In accordance with your authorization, we have performed a seismic refraction survey pertaining to the property located at 13661 Olde Highway 80 in the Lakeside area of San Diego County, California (Figure 1). Specifically, our survey consisted of performing 11 seismic refraction lines in the study area. The purpose of the study was to develop a subsurface velocity profile of the study area and to evaluate the apparent rippability of the subsurface materials. This report presents our survey methodology, equipment used, analysis, and results from our study.

2. SCOPE OF SERVICES
Our scope of services included:
- Performance of 11 seismic refraction lines in the project area.
- Compilation and analysis of the data collected.
- Preparation of this report presenting our results and conclusions.

3. SITE AND PROJECT DESCRIPTION
The study included the sparsely developed property located in between Interstate 8 (I-8) and Olde Highway 80, just west of El Dorado Parkway in the Lakeside area of San Diego County. Improvements at the site include a few single family homes. Chain link fencing surrounds much of the property. An east-west trending drainage cuts across the northern portion of the site. Vegetation includes annual grass, scattered brush and trees, as well as reeds in the low lying areas. Several large granitic boulders, which appear to be naturally placed, are present on the property. Figures 1 and 2 illustrate the study area as well as the general site conditions. Figures 3a and 3b also show the conditions in the profile areas.

Based on our discussions with you, it is our understanding that no site development plans are available for the project site. However, it is expected that future grading of the property will likely include cuts of less than 25 feet.
4. SURVEY METHODOLOGY

A seismic P-wave (compression wave) refraction survey was conducted at the site to evaluate the apparent rippability characteristics of the subsurface materials and to develop a subsurface velocity profile of the study areas. The seismic refraction method uses first-arrival times of refracted seismic waves to estimate the thicknesses and seismic velocities of sub-surface layers. Seismic P-waves generated at the surface, using a hammer and plate, are refracted at boundaries separating materials of contrasting velocities. These refracted seismic waves are then detected by a series of surface vertical component geophones, and recorded with a 24-channel Geometrics StrataView seismograph. The travel times of the seismic P-waves are used in conjunction with the shot-to-geophone distances to obtain thickness and velocity information on the subsurface materials.

Eleven seismic profiles (SL-1 through SL-11) were conducted for the project. The locations of the profiles, which were selected by your office, are depicted on Figure 2. Five shot points were conducted along lines SL-1 through SL-10 at the ends, midpoint, and intermediate points between the ends and midpoint. Three shots were conducted along SL-11 at the ends and midpoint. The lengths of the seismic refraction lines were 170 feet for SL-1 and SL-2, 180 feet for SL-7 through SL-10, 150 feet for SL-3, 125 feet for SL-4 through SL-6, and 65 feet for SL-11. It should be noted that, as a general rule, the effective depth of evaluation for a seismic refraction traverse is approximately one-third to one-fifth the length of the refraction line.

The refraction method requires that subsurface velocities increase with depth. A layer having a velocity lower than that of the layer above generally will not be detectable by the seismic refraction method and, therefore, could lead to errors in the depth calculations of subsequent layers. In addition, lateral variations in velocity, such as those caused by core stones, dikes, etc. can result in the misinterpretation of the subsurface conditions.

In general, seismic wave velocities can be correlated to material density and/or rock hardness. The relationship between rippability and seismic velocity is empirical and assumes a homogeneous mass. Localized areas of differing composition, texture, and/or structure may affect both the
measured data and the actual rippability of the mass. The rippability of a mass is also dependent on the excavation equipment used and the skill and experience of the equipment operator.

The rippability values presented in Table 1 are based on our experience with similar materials and assume that a Caterpillar D-9 dozer ripping with a single shank is used. We emphasize that the cutoffs in this classification scheme are approximate and that rock characteristics, such as fracture spacing and orientation, play a significant role in determining rock rippability. These characteristics may also vary with location and depth.

For trenching operations, the rippability values should be scaled downward. For example, velocities as low as 3,500 feet/second may indicate difficult ripping during trenching operations. In addition, the presence of boulders, which can be troublesome in a narrow trench, should be anticipated.

Table 1 - Rippability Classification

<table>
<thead>
<tr>
<th>Seismic P-wave Velocity</th>
<th>Rippability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 2,000 feet/second</td>
<td>Easy</td>
</tr>
<tr>
<td>2,000 to 4,000 feet/second</td>
<td>Moderate</td>
</tr>
<tr>
<td>4,000 to 5,500 feet/second</td>
<td>Difficult, Possible Blasting</td>
</tr>
<tr>
<td>5,500 to 7,000 feet/second</td>
<td>Very Difficult, Probable Blasting</td>
</tr>
<tr>
<td>Greater than 7,000 feet/second</td>
<td>Blasting Generally Required</td>
</tr>
</tbody>
</table>

It should be noted that the rippability cutoffs presented in Table 1 are slightly more conservative than those published in the Caterpillar Performance Handbook (Caterpillar, 2004). Accordingly, the above classification scheme should be used with discretion, and contractors should not be relieved of making their own independent evaluation of the rippability of the on-site materials prior to submitting their bids.

Collected P-wave data were processed using SIPwin (Rimrock Geophysics, 2003) and SeisOpt® Pro™ (Optim, 2008). SIPwin was used to evaluate first arrival times and SeisOpt® Pro™ was used for interpretation. SeisOpt® Pro™ uses a nonlinear optimization technique called adap-
tive simulated annealing. The resulting velocity models provide a tomography image of the estimated geologic conditions. Both vertical and lateral velocity information is contained in the tomography models. Changes in layer velocity are revealed as gradients rather than discrete contacts, which typically are more representative of actual conditions.

5. RESULTS AND CONCLUSIONS

The results of the P-wave refraction survey are presented in Figures 4a through 4f. Based on our site observations and discussions with you, the layers/zones detected have been interpreted to be surficial soil overlying granitic rock with varying degrees of decomposition/weathering. As depicted in the tomographic images presented on Figures 4a through 4f, significant lateral variations (low and high velocity) in the weathered rock are present. In addition, pockets or zones of very high velocity material are present in the near surface.

During our site visit, we noted the presence of rock outcrops and core stones in the project area. The presence of these features indicates differential weathering of the onsite bedrock materials. Furthermore, substantial scatter was noted in the first-arrivals indicating the presence of inhomogeneities (i.e., boulders, intrusions, fracture zones, etc.) in the subsurface materials. Accordingly, variability in the layers depths and velocities should be expected across the project area.

Based on our results, very difficult conditions where blasting may be required to obtain proposed excavation depths will likely be encountered depending on the location, excavation depth, and desired rate of production. A contractor with excavation experience in similar difficult conditions should be consulted for expert advice on excavation methodology, equipment, production rate, and possibly oversized materials.

6. LIMITATIONS

The field evaluation and geophysical analyses presented in this report have been conducted in general accordance with current practice and the standard of care exercised by consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding
the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be present. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface surveying will be performed upon request.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Southwest Geophysics, Inc. should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document. This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.
7. SELECTED REFERENCES


Rimrock Geophysics, 2003, Seismic Refraction Interpretation Programs (SIPwin), V-2.76.

SITE PHOTOGRAPHS

13661 Olde Highway 80
San Diego County, California

Project No.: 112269 Date: 07/12

Figure 3a
SEISMIC PROFILES
SL-3 & SL-4

13661 Olde Highway 80
San Diego County, California

Project No.: 112269  Date: 07/12

Figure 4b
SEISMIC PROFILES
SL-9 & SL-10

13661 Olde Highway 80
San Diego County, California

Project No.: 112259  Date: 07/12

Figure 4e
LIST OF REFERENCES


3. Campbell, K. W., Y. Bozorgnia, *NGA Ground Motion Model for the Geometric Mean Horizontal Component of PGA, PGV, PGD and 5% Damped Linear Elastic Response Spectra for Periods Ranging from 0.01 to 10 s*, Preprint of version submitted for publication in the NGA Special Volume of Earthquake Spectra, Volume 24, Issue 1, pages 139-171, February 2008.


