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GEOCON PROJECT NO. S1140-05-01

MARCH 2016

GEOCON
CONSULTANTS, INC.
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. S1140-05-01
March 31, 2016

VIA ELECTRONIC EMAIL

Hawthorn Development
c/o Lenity Architecture, LLC
3150 Kettle Court SE
Salem, Oregon 97301

Attn: Kristi Neznanski

Subject: GEOTECHNICAL INVESTIGATION
PLACER RETIREMENT RESIDENCE
3865 OLD AUBURN ROAD
ROSEVILLE, CALIFORNIA

Dear Ms. Neznanski:

In accordance with your authorization of our proposal (Geocon Proposal No. LS-15-301, dated January 15, 2016), we have prepared this geotechnical investigation report for the subject project located at 3865 Old Auburn Road in Roseville, Placer County, California.

The accompanying report presents our findings, conclusions, and recommendations regarding the geotechnical aspects of designing and constructing the project as presently proposed. In our opinion, no adverse geotechnical conditions were encountered that would preclude development at the site provided the recommendations contained in this report are incorporated into the design and construction of the project.

Please contact us if you have any questions regarding this report or if we may be of further service.

Sincerely,

GEOCON CONSULTANTS, INC.

Jeremy J. Zorne, PE, GE
Senior Engineer

REGISTERED PROFESSIONAL ENGINEER
JEREMY J. ZORNE
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GEOTECHNICAL INVESTIGATION

1.0 PURPOSE AND SCOPE

This report presents the results of our geotechnical investigation for the proposed Placer Retirement Residence project located at 3865 Old Auburn Road in Roseville, California. The approximate site location is depicted on the Vicinity Map, Figure 1.

The purpose of our investigation was to evaluate subsurface soil and geologic conditions at the site and provide conclusions and recommendations relative to the geotechnical aspects of designing and constructing the project as presently proposed.

To prepare this report, we performed the following scope of services:

- Performed a limited geologic literature review to aid in evaluating the geologic conditions present at the site. A list of referenced material is included in Section 9.0 of this report.
- Reviewed available design plans and layouts to select exploratory boring locations.
- Performed a site reconnaissance to review project limits, determine drill rig access and mark out exploratory boring locations for subsequent utility clearance.
- Notified subscribing utility companies via Underground Service Alert (USA) a minimum of 48 hours (as required by law) prior to performing exploratory excavations at the site.
- Performed thirteen exploratory borings (B1 through B13) using a track-mounted drill rig equipped with hollow-stem auger drilling capabilities to depths ranging from approximately 6½ to 21½ feet.
- Obtained representative soil samples from the borings.
- Logged the borings in accordance with the Unified Soil Classification System (USCS).
- Performed laboratory tests on selected soil samples to evaluate pertinent geotechnical parameters.
- Upon completion, backfilled the borings with the soil cuttings.
- Prepared this report summarizing our findings, conclusions and recommendations regarding the geotechnical aspects of developing the site as presently proposed.

Details of our field exploration program including boring logs are presented in Appendix A. Approximate locations of the borings are shown on the Site Plan, Figure 2. Details of our laboratory testing program and test results are summarized and presented in Appendix B.

2.0 SITE AND PROJECT DESCRIPTION

The approximate 12-acre site, located on the northwest corner of Old Auburn Road and Sierra College Boulevard, is currently partially developed with a single-family residence and fenced horse pastures. We understand that the existing residence includes a swimming pool and septic leach field; however, the location of the septic leach field is unknown. The site gently slopes upward from

the streets with an approximate elevation difference of 25 feet between the north and south. Based on our review of historical satellite photography, the central portion of the site was formerly developed with a structure and outbuilding(s) prior to 2003. The structure has since been removed. The eastern portion of the site appears to have been graded/terraced in the past, resulting in up to 7 feet of undocumented fill. A seasonal creek flows along the southeast site boundary.

We understand that the proposed project consists of constructing a three-story, 145-suite senior living facility, seven single-story duplex cottages, two detached garages, and associated improvements. The buildings will likely be of wood-framed construction with estimated point loads up to 80 kips and wall loads of 3.5 kips/foot. The buildings will be supported on conventional shallow foundation systems with interior concrete slabs-on-grade. Other improvements will likely include underground utility infrastructure, concrete flatwork, and paved parking/driveway areas. Pavement will consist of both asphalt concrete and rigid Portland cement concrete. Although a proposed grading plan for the project was not available for our review, given the topography of the site, we anticipate site grading will consist of cuts and fills on the order of 10 feet or less.

The site location is shown on the Vicinity Map, Figure 1. Site configuration, current site conditions and proposed improvements are shown on the Site Plan, Figure 2. Existing site topography and the approximate location and thickness of the fill encountered are shown on Topographic Map, Figure 3. The location of the former structures in the central portion of the site is shown on Historical Site Photo (2002), Figure 4.

3.0 SOIL AND GEOLOGIC CONDITIONS

We identified soil and geologic conditions by observing exploratory excavations and reviewing referenced geologic literature (Section 9.0). The soil descriptions provided in this report include the USCS symbol where applicable.

3.1 Regional and Local Geology

The site is located in the eastern portion of the Great Valley geomorphic province of California or what is more commonly referred to as the Central Valley. The Sacramento Valley comprises the northern portion of the Central Valley and is bounded by the Sierra Nevada and southern Cascade Range to the east and the Coast Ranges and Klamath Mountains to the west. The Sacramento Valley is filled with a thick sequence of Jurassic to recent age sedimentary deposits both continental and marine in origin. Based on the *Preliminary Geologic Map of the Sacramento 30' x 60' Quadrangle, California,* California Geological Survey (CGS), 2011, the site is underlain by early-Pleistocene Turlock Lake Formation. The Turlock Lake Formation is an alluvial fan deposit mainly comprising granitic, older alluvium derived from the Sierra Nevada.

3.2 Fill

We encountered approximately 3½ to 7 feet of existing fill in Borings B1, B3, B4, B6 and B7 within the eastern portion of the site. The fill generally consisted of sandy, lean clay (CL) with variable amounts of gravel. Based on laboratory test data, the relative compaction of existing fill averages approximately 82 percent of maximum dry density. Existing fill is not suitable for direct support of structural improvements or additional fill and will require complete removal and re-compaction prior to development. The approximate thickness and location of the existing fill encountered is shown on the Topographic Map, Figure 3.

3.3 Alluvium (Turlock Lake Formation)

Below the fill, where present, and at the ground surface elsewhere, we encountered alluvium (Turlock Lake Formation) extending beyond the total depth explored of approximately 21½ feet. The alluvium generally consisted of very stiff to hard, sandy, lean clay (CL). Based on laboratory test results (Appendix B), site soil is moderately expansive.

Soil conditions described herein are generalized. The boring logs included in Appendix A provide more detailed information such as soil type, color, moisture, consistency, and USCS classification of the soils encountered at specific locations and elevations.

4.0 GROUNDWATER

In the higher elevation portions of the site, groundwater was not encountered to depths up to 21½ feet. In the lower elevation portion of the site (Boring B5), adjacent to the seasonal stream in the southeastern portion of the site, groundwater was encountered at a depth of approximately 7 feet on February 9, 2016.

It should be noted that fluctuations in the level of groundwater may occur due to variations in rainfall, temperature, and other factors. Depth to groundwater can also vary significantly due to localized pumping, irrigation practices, and seasonal fluctuations. Therefore, it is possible that groundwater may be higher or lower than the levels stated above.

5.0 GEOLOGIC HAZARDS

5.1 Regional Active Faults

Based on our research, analyses, and observations, the site is not located on any known “active” earthquake fault trace. In addition, the site is not contained within an Alquist-Priolo Earthquake Fault Zone. Therefore, we consider the potential for ground rupture due to onsite active faulting to be low.

In order to estimate the distance of known active faults to the site, we used the computer program *EQFAULT*, (Version 3, Blake, 2000). Principal references used within *EQFAULT* are Jennings (1975), Anderson (1984) and Wesnousky (1986). Results for active faults within 60 miles of the site are summarized in Table 5.1.

TABLE 5.1
REGIONAL ACTIVE FAULTS

Fault Name	Approximate Distance From Site (miles)	Maximum Moment Magnitude (M_W)
Foothills Fault System	6.3	6.5
Great Valley 3	42.0	6.8
Great Valley 4	43.7	6.6
Great Valley 5	46.7	6.5
Great Valley 6	55.6	6.7
Hunting Creek - Berryessa	55.7	6.9
Concord - Green Valley	55.7	6.9

5.2 Ground Shaking

We used the USGS computer program *2008 Interactive Deaggregations* to estimate the peak ground acceleration (PGA) and modal (most probable) magnitude associated with the 2,475-year return period. The USGS estimated PGA is 0.23 g and the modal magnitude is 6.6.

While listing PGA is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including frequency and duration of motion and soil conditions underlying the site.

5.3 Liquefaction

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary loss of shear strength due to pore pressure buildup under the cyclic shear stresses associated with intense earthquakes. Based on the subsurface conditions encountered at the site and relatively low seismicity in the area, liquefaction is not considered a hazard for the project.

5.4 Expansive Soil

We performed laboratory Expansion Index (EI) testing on a near-surface soil sample to evaluate soil expansion potential; test results are presented in Appendix B. EI test results indicated an EI of 65. Table 5.4 presents soil expansion classifications based on American Society for Testing and Materials (ASTM) and 2013 California Building Code (CBC) standards.

TABLE 5.4
SOIL EXPANSION CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	Soil Expansion Classification (ASTM D4829)	Soil Expansion Classification (2013 CBC)
0 – 20	Very Low	Non-Expansive
21 – 50	Low	Expansive
51 – 90	Medium	
91 – 130	High	
Greater Than 130	Very High	

Specific recommendations with respect to expansive soils are provided in this report.

5.5 Landslides and Slope Stability

The existing slopes (inclinations of approximately 4H:1V) appear to be performing well without evidence of global instability, although localized erosion and surficial sloughing is present at some locations. If proposed slopes are cut and/or constructed and grading is performed in accordance with the recommendations in this report, we consider the potential for future global instability to be low for slopes at the site.

5.6 Soil Corrosion Potential Screening

We performed soil corrosion potential screening by conducting laboratory testing on two representative near-surface soil samples. The laboratory test results and published screening levels are presented in Appendix B.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 General

6.1.1 No soil or geologic conditions were encountered during our investigation that would preclude development of the site as planned, provided the recommendations contained in this report are incorporated into the design and construction of the project.

6.1.2 The primary geotechnical constraints identified in our investigation are:

- **Expansive Soil:** Moderately expansive clay soils blanket the site. These conditions will require deepened footings, deepened curbs in pavement areas, a layer of aggregate below concrete flatwork, and careful attention to proper moisture conditioning and compaction.
- **Undocumented Fill:** Existing undocumented fill was encountered in several of our borings in the eastern portion of the site. The approximate location and thickness of the fill encountered are shown on Topographic Map, Figure 3. Within proposed building areas, existing fill will require complete removal and re-compaction prior to placing additional fill or constructing improvements. We estimate over-excavation depths will range from less than one foot to 7 feet, depending on location.
- **Existing Structures, Features and Utilities:** Complete removal of existing improvements (buildings, foundations, septic systems, utilities, etc.) is required as part of site development.

6.1.3 Conclusions and recommendations provided in this report are based on our review of referenced literature, analysis of data obtained from our field exploration program, laboratory testing program, and our understanding of proposed development at this time.

6.1.4 We should review the project plans as they develop further, provide engineering consultation as needed during final design, and perform geotechnical observation and testing services during construction.

6.2 Seismic Design Criteria

6.2.1 We understand that seismic design of the structures will be performed in accordance with the provisions of the 2013 California Building Code (CBC) which is based on the American Society of Civil Engineers (ASCE) publication: *Minimum Design Loads for Buildings and Other Structures* (ASCE 7-10). We used the United States Geological Survey (USGS) web application *US Seismic Design Maps* (http://geohazards.usgs.gov/designmaps/us/application.php) to evaluate site-specific seismic design parameters in accordance with the 2013 CBC/ASCE 7-10. Results are summarized in Table 6.2.1. The values presented are for the risk-targeted maximum considered earthquake (MCE_R).

TABLE 6.2.1
2013 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2013 CBC / ASCE 7-10 Reference
Site Class	D	Section 1613.3.2/ Table 20.3-1
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	0.490g	Figure 1613.3.1(1) / Figure 22-1
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.247g	Figure 1613.3.1(2) / Figure 22-2
Site Coefficient, F_A	1.408	Table 1613.3.3(1) / Table 11.4-1
Site Coefficient, F_V	1.907	Table 1613.3.3(2) / Table 11.4-2
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	0.690g	Eq. 16-37 / Eq. 11.4-1
Site Class Modified MCE_R Spectral Response Acceleration (1 sec), S_{M1}	0.470g	Eq. 16-38 / Eq. 11.4-2
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.460g	Eq. 16-39 / Eq. 11.4-3
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.314g	Eq. 16-40 / Eq. 11.4-4

6.2.2 Table 6.2.2 presents additional seismic design parameters for projects with Seismic Design Categories of D through F in accordance with ASCE 7-10 for the mapped maximum considered geometric mean (MCE_G).

TABLE 6.2.2
2013 CBC SITE ACCELERATION DESIGN PARAMETERS

Parameter	Value	ASCE 7-10 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.159g	Figure 22-7
Site Coefficient, F_{PGA}	1.482	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.236g	Section 11.8.3 (Eq. 11.8-1)

6.2.3 Conformance to the criteria presented in Tables 6.2.1 and 6.2.2 for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a maximum level earthquake occurs. The primary goal of seismic design is to protect life and not to avoid structural damage, since such design may be economically prohibitive.

6.3 Excavation Characteristics

6.3.1 In our opinion, grading and excavations at the site may be accomplished with moderate effort using heavy-duty grading/excavation equipment.

6.3.2 Temporary excavation slopes must meet Cal-OSHA requirements as appropriate. We anticipate that the majority of excavations in undisturbed alluvial soils will be classified as Cal-OSHA "Type B" soil. Excavations within existing fill, sandy soils, or areas with active seepage will be classified as Cal-OSHA "Type C." Excavation sloping, benching, the use of trench shields, and the placement of trench spoils should conform to the latest applicable Cal-OSHA standards. The contractor should have a Cal-OSHA-approved "competent person" onsite during excavation to evaluate trench conditions and to make appropriate recommendations where necessary. It is the contractor's responsibility to provide sufficient and safe excavation support as well as protecting nearby utilities, structures, and other improvements which may be damaged by earth movements.

6.3.3 The excavation support recommendations provided by Cal-OSHA are generally geared towards protecting human life and not necessarily towards preventing damage to nearby structures or surface improvements. The contractor should be responsible for using the proper active shoring systems or sloping to prevent damage to any structure or improvements near underground excavations.

6.4 Permanent Cut and Fill Slopes

6.4.1 Permanent cut and fill slopes should be constructed no steeper than 2H:1V. To mitigate potential erosion, slopes should be vegetated as soon as possible and surface drainage should be directed away from the tops of slopes.

6.4.2 Fill slopes should be overbuilt a minimum of 2 feet and cut back to finished grade or track-walked with a D6 dozer (or similar equipment) such that the fill soils are uniformly compacted to at least 90 percent of the laboratory maximum dry density at or above optimum moisture content to the face of the finished slope.

6.5 Materials for Fill

6.5.1 Excavated soils generated from cut operations at the site are suitable for use as fill in structural areas provided they do not contain deleterious matter, organic material, or cementations larger than 6 inches in maximum dimension.

6.5.2 Import fill material should be primarily granular with a "low" expansion potential (Expansion Index less than 50), a Plasticity Index less than 15, be free of organic material and construction debris, not contain rock larger than 6 inches in greatest dimension, and contain sufficient fines to act as a binder to reduce caving potential when excavated.

6.5.3 Environmental characteristics and corrosion potential of import soil materials should also be considered. Proposed import materials should be sampled, tested, and approved by Geocon prior to its transportation to the site.

6.6 Groundwater, Seepage, Soil Moisture Conditions

6.6.1 Groundwater was not encountered in the higher elevation portions of the site to depths up to 21½ feet during our investigation. Groundwater was encountered in Boring B5, advanced in a lower elevation portion of the site near the seasonal drainage at an approximate depth of 7 feet, however, based on site topography, we anticipate that this area will be in a fill area during site grading. Zones of shallow perched water and wet soil may develop during and after wet weather periods. In areas near the seasonal drainage, zones of shallow perched water and wet soil could be present year round. The contractor should be prepared to accommodate potential seepage in project excavations, especially during the wet season. Due to the relatively low permeability of site soils, shallow perched water and wet soil conditions may continue after site grading and construction of improvements.

6.6.2 If grading commences during the seasonal wet period (typically winter and spring), surface soils will likely be wet and unstable. Earthwork contractors should be aware of moisture sensitivity of fine-grained soils and potential compaction/workability difficulties. Often, a period of at least one month of warm and dry weather is necessary to allow the site to dry sufficiently so that heavy grading equipment can operate effectively and required compaction can be achieved.

6.6.3 Similarly, fill derived from excavations with seepage will likely need to be aerated/dried to achieve suitable moisture content for compaction. In addition, soil excavated/exposed adjacent to drainages during any time of the year will likely have high moisture content (well above optimum) and will likely require significant drying effort to attain suitable compaction when placed as engineered fill. We should evaluate conditions in the field at the time of construction and evaluate the type, level and extent of mitigation alternatives.

6.6.4 Conversely, during the seasonal dry period (typically summer and fall), dry fine-grained soils near the ground surface form hard “clods” that may require significant additional grading effort (discing, mixing, scarification, or other means) to attain uniform moisture conditioning.

6.7 Grading

6.7.1 All earthwork operations should be observed and all fills tested for recommended compaction and moisture content by a representative of Geocon.

6.7.2 References to relative compaction and optimum moisture content in this report are based on the latest ASTM D1557 Test Procedure. Structural building pad areas should be considered as areas extending a minimum of 5 feet horizontally beyond the outside dimensions of buildings, including footings and overhangs carrying structural loads.

6.7.3 Prior to commencing grading, a pre-construction conference with representatives of the client, grading contractor, and Geocon should be held at the site. Site preparation, soil handling, and/or the grading plans should be discussed at the pre-construction conference.

6.7.4 Site preparation should begin with removal of existing surface/subsurface structures, foundations, underground utilities, and debris. Any existing wells and septic systems not planned for use should be abandoned in accordance with local oversight agency requirements. Existing pipelines and overlying trench backfill should be completely removed to expose undisturbed soil. The existing swimming pool shell should be completely removed and the resulting excavation sloped back to permit entry to earthwork backfill and compaction equipment. Alternately, provided the pool is outside areas of planned structural improvements, portions of the pool shell may remain, provided it will not conflict with planned improvements. We can provide updated recommendations prior to construction once development plans are finalized. Excavations or depressions resulting from site clearing operations, or other existing excavations or depressions, should be restored with engineered fill in accordance with the recommendations of this report.

6.7.5 Within areas to be developed, any existing trees and associated root systems should be removed. Roots larger than 1 inch in diameter should be completely removed. Smaller roots may be left in-place as conditions warrant and at the discretion of our field representative.

6.7.6 Within areas to be developed, surface vegetation consisting of grasses and other similar vegetation should be removed by stripping to a sufficient depth to remove organic-rich topsoil. Based on our observations observed during our field exploration, we estimate required stripping depths will range from approximately 2 to 4 inches. The actual stripping depth should be determined based on site conditions prior to grading. Material generated during stripping is not suitable for use within 5 feet of building pads or within pavement areas but may be placed in landscaped or non-structural areas or exported from the site.

6.7.7 Alternatively, surface vegetation may be mowed such that 1 to 2 inches of stubble remains. After removing mowed vegetation, the ground surface should be thoroughly scarified (mixed) in two perpendicular directions to a depth of 12 inches to blend remaining grass and roots into the surface soil. The resulting soil should be thoroughly mixed such that vegetation segments longer than 1 inch are not visually discernable and the overall organic content is 3% or less.

6.7.8 The most effective site preparation alternatives will depend on site conditions prior to grading. We should evaluate site conditions and provide supplemental recommendations immediately prior to grading, if necessary.

6.7.9 In general, where fill is placed on slopes steeper than 5H:1V, we recommend that horizontal benches angled slightly into the slope be cut into competent formational material on the slopes prior to placing fill. Benches should roughly parallel slope contours. These benches should extend at least 2 feet into competent material. In addition, a keyway should be cut into the slope at the base of the fill. In general, keyways should be at least 10 feet wide and extend at least 2 feet into competent material. Bench and keyway criteria may need revision during construction based on the actual conditions encountered and grading operations. A typical keying and benching detail is presented as Figure 5.

6.7.10 To reduce potential for differential settlement of planned structures, the cut portion of cut-fill transition building pads, if any, should be undercut to at least the depth of the fill, not to exceed 3 feet, and replaced with properly compacted fill soils. The undercut should extend at least 5 feet beyond the structure perimeter. We should review the grading plan, when available, to evaluate the presence of cut-fill transition pads.

6.7.11 In proposed development areas, all existing undocumented fill should be over-excavated to competent native soil and replaced as engineered fill. We estimate over-excavation depths will range from less than one foot to 7 feet. This depth will vary based on conditions exposed during grading and may be adjusted by Geocon during grading.

6.7.12 Areas left at grade, areas to receive fill, and the bottoms of over-excavated areas should be scarified at least 12 inches, uniformly moisture-conditioned at least 2% above optimum moisture content and compacted to at least 90% relative compaction. Scarification and re-compaction operations should be performed in the presence of our representative.

6.7.13 If grading begins during summer or fall or during periods of extended dry weather, near-surface clay soil may contain desiccation cracks extending deeper than the recommended over-excavation and scarification depth. Should this condition exist, the site should be continuously watered for a sufficient time to close desiccation cracks.

6.7.14 Engineered fill should be compacted in horizontal lifts not exceeding 8 inches (loose thickness) and brought to final design elevations. Each lift should be moisture-conditioned at least 2% above optimum moisture content, and compacted to at least 90% relative compaction.

6.7.15 The top 6 inches of final vehicular pavement subgrade, whether completed at-grade, by excavation, or by filling, should be uniformly moisture-conditioned at least 2% above optimum moisture content and compacted to at least 95% relative compaction. Final pavement subgrade should be finished to a smooth, unyielding surface. We further recommend proof-rolling the subgrade with a loaded water truck (or similar equipment with high contact pressure) to verify the stability of the subgrade prior to placing aggregate base (AB). The subgrade minimum moisture content should be verified by testing within 24 hours prior to the placement of AB.

6.7.16 Pipe bedding, shading, and trench backfill should conform to the requirements of the appropriate utility authority. Material excavated from trenches should be adequate for use as general backfill above shading provided it does not contain deleterious matter, vegetation, or cementations larger than 6 inches in maximum dimension. Trench backfill should be placed in loose lifts not exceeding 8 inches, moisture-conditioned at least 2% above optimum and compacted to at least 90% relative compaction. Compaction should be performed by mechanical means only; jetting of trench backfill is not recommended.

6.8 Foundations

6.8.1 The proposed structures can be supported by conventional reinforced concrete shallow foundations within building pads prepared in accordance with the recommendations of this report.

6.8.2 To reduce potential for moisture variations beneath buildings, foundations should consist of continuous perimeter strip footings with isolated interior spread footings. Perimeter strip footings should be continuous around the entire perimeter of the structure without breaks or discontinuities.

6.8.3 Perimeter strip footings should be at least 12 inches wide and interior spread footings should be at least 18 inches square. All footings should be embedded at least 18 inches below lowest adjacent pad grade. Underground utilities running parallel to footings should not be constructed in the zone of influence of footings. The zone of influence may be taken to be the area beneath the footing and within a 1:1 plane extending out and down from the bottom of the footing.

6.8.4 Continuous footings should be reinforced with at least four No. 4 reinforcement bars, two each placed near the top and bottom of the footing. The reinforcement recommended above is for soil characteristics only and is not intended to replace reinforcement required for structural considerations. The project structural engineer should evaluate the need for additional reinforcement.

6.8.5 Foundations proportioned as recommended above may be designed for an allowable bearing capacity of 3,000 pounds per square foot (psf) for combined dead plus live loads. This value may be increased by one-third to evaluate all loads, including wind or seismic forces.

6.8.6 The allowable passive pressure used to resist lateral movement of the footings may be assumed to be equal to a fluid weighing 300 pounds per cubic foot (pcf). The allowable coefficient of friction to resist sliding is 0.30 for concrete against soil. Combined passive resistance and friction may be utilized for design provided that the frictional resistance is reduced by 50%.

6.8.7 Shallow foundations designed in accordance with the recommendations above should experience total settlement of less than one inch and differential settlement of ½ inch or less over a distance of 50 feet. The majority of settlement will be immediate and occur as the building is constructed.

6.8.8 A Geocon representative should observe foundation excavations prior to placing reinforcing steel or concrete to observe that the exposed soil conditions are consistent with those anticipated. If unanticipated soil conditions are encountered, foundation modifications may be required.

6.9 Slabs-on-Grade

6.9.1 Interior concrete slab-on-grade floors in conjunction with conventional foundation systems recommended in this report are suitable for the proposed residential structures. Slab thickness and reinforcement should be determined by the structural engineer based on the anticipated loading. However, at a minimum, slabs should be at least 4 inches thick and reinforced with No. 3 reinforcing bars placed 18 inches on center, each way. Structural requirements may require additional reinforcement or thicker concrete slabs.

6.9.2 If the near-surface soils of building pads become dry prior to constructing concrete slabs-on-grade, building pads should be re-moistened by soaking or sprinkling such that the upper 12 inches of soil is at or above optimum moisture content at least 24 hours before concrete placement.

6.10 Slab-on-Grade Moisture Protection Considerations

6.10.1 Migration of moisture through concrete slabs or moisture otherwise released from slabs is not a geotechnical issue. However, for the convenience of the owner, we are providing the following general suggestions for consideration by the owner, architect, structural engineer, and contractor. The suggested procedures may reduce the potential for moisture-related floor covering failures on concrete slabs-on-grade, but moisture problems may still occur even if the procedures are followed. If more detailed recommendations are desired, we recommend consulting a specialist in this field.

6.10.2 A minimum 10-mil-thick vapor barrier meeting ASTM E1745-97 Class C requirements may be placed directly below the slab, without a sand cushion provided the concrete water/cement ratio is 0.45 or less (see Paragraph 6.10.4). To reduce the potential for punctures, a higher quality vapor barrier (15 mil, Class A or B) may be used. The vapor barrier, if used, should extend to the edges of the slab, and should be sealed at all seams and penetrations.

6.10.3 At least 4 inches of ½- or ¾-inch crushed rock, with no more than 5 percent passing the No. 200 sieve, may be placed below the vapor barrier to serve as a capillary break.

6.10.4 The concrete water/cement ratio should be as low as possible. The water/cement ratio should not exceed 0.45 for concrete placed directly on the vapor barrier. This is critically important to reduce the potential for differential curing and excessive shrinkage cracks. Midrange plasticizers could be used to facilitate concrete placement and workability.

6.10.5 Proper finishing, curing, and moisture vapor emission testing should be performed in accordance with the latest guidelines provided by the American Concrete Institute, Portland Cement Association, and ASTM.

6.11 Retaining Walls and Lateral Loads

6.11.1 Lateral earth pressures may be used in the design of retaining walls and buried structures. Lateral earth pressures may be assumed to be equal to an equivalent fluid pressure (EFP). Table 6.11 summarizes our recommended EFP values for design.

TABLE 6.11
RECOMMENDED LATERAL EARTH PRESSURES

Condition	Equivalent Fluid Density
Level Backfill – Active	45 pcf
2H:1V Sloping Backfill – Active	70 pcf
Level Backfill – At-Rest	60 pcf
Seismic Earth Pressure[1]	10 pcf

1. *Conventional triangular distribution. Should be combined with ACTIVE lateral earth pressure for seismic case analysis.*

6.11.2 Unrestrained walls should be designed using the active case. Unrestrained walls are those that are allowed to rotate more than 0.001H (where H is the height of the wall). Walls restrained from movement should be designed using the at-rest case. The above soil pressures assume drained conditions within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall.

6.11.3 Retaining wall foundations with a minimum depth of 18 inches may be designed using the allowable bearing capacity provided in 6.8.5 of this report. To resist lateral movement of retaining wall foundations, an allowable passive earth pressure equivalent to a fluid density of 300 pcf for footings or shear keys poured neat against properly compacted engineered fill soils or undisturbed natural soils. This allowable passive pressure is based on the assumption that a horizontal surface extends at least 5 feet or three times the depth of the footing or shear key, whichever is greater, beyond the face of the retaining wall foundation. If this surface is not protected by floor slabs or pavement, the upper 12 inches of material should not be included in the design for lateral resistance. An allowable friction coefficient of 0.30 may be used for resistance to sliding between soil and concrete. Combined passive resistance and friction may be utilized for design provided that the frictional resistance is reduced by 50%.

6.11.4 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and should be waterproofed as required by the project architect. Positive drainage for retaining walls should consist of a vertical layer of permeable material positioned between the retaining wall and the soil backfill. The permeable material may be composed of a composite drainage geosynthetic or a natural permeable material such as crushed gravel at least 12 inches thick and capped with at least 12 inches of native soil. A geosynthetic filter fabric should be placed between the gravel and the soil backfill. Provisions for removal of collected water should be provided for either system by installing a perforated drainage pipe along the bottom of the permeable material which leads to suitable drainage facilities.

6.11.5 The recommendations presented above are generally applicable to the design of rigid concrete or masonry retaining walls with a level backfill and having a maximum height of 10 feet. In the event that walls higher than 5 feet or other types of walls are planned, Geocon should be consulted for additional recommendations.

6.12 Concrete Sidewalks, Driveways and Flatwork

6.2.1 Due to the presence of moderately expansive near-surface soils, exterior concrete sidewalks and flatwork will likely experience seasonal movement. Therefore, some cracking and/or vertical offset should be anticipated. We are providing the following recommendations to reduce distress to concrete flatwork. Recommendations include moisture conditioning subgrade soils, providing deepened cut-off curbs adjacent to landscaped areas, and providing adequate construction and control joints. It should be noted that even with implementation of these measures, minor slab movement or cracking could still occur.

- Concrete flatwork, excluding concrete pavements subject to wheel loads, should be at least 4 inches thick and underlain by at least 6 inches of Class 2 AB or soil meeting the requirements of Paragraph 6.5.2 of this report.
- The upper 12 inches of subgrade soil in exterior flatwork areas should be uniformly moisture-conditioned at least 2% above optimum and compacted to at least 95% relative compaction.
- Adequate construction and crack control joints following ACI or PCA recommendations should be used to control cracking inherent in concrete construction. Construction joints that abut building foundations should include a felt strip, or approved equivalent, that extends the full depth of the exterior slab. Exterior slabs should be structurally independent of building foundations except at doorways where vertical offset could affect doorway operation. At these locations, exterior slabs should be doweled.
- To reduce the potential for concrete cracking, exterior concrete flatwork could be reinforced with No. 3 reinforcing bars spaced 18 inches center to center, each way.
- To reduce the potential for water from landscaped areas migrating under flatwork, consideration should be given to using full-depth curbs in areas where flatwork abuts irrigated landscaping. The full-depth curbs should be at least 4 inches wide and extend at least 4 inches or more into the soil subgrade.

6.13 Pavement – Hot Mix Asphalt

6.13.1 R-Value test results for untreated, clayey soil were less than 5 (Appendix B). We recommend using an R-Value of 5, which is the minimum used for design.

6.13.2 We recommend the following alternative hot mix asphalt (HMA) pavement sections for design. The project civil engineer should determine the appropriate Traffic Index (TI) based on anticipated traffic conditions. Table 6.13 provides alternative pavement sections based on assumed TIs. We can provide additional sections based on other TIs if necessary.

TABLE 6.13
FLEXIBLE PAVEMENT SECTIONS

Street Type	Design TI	HMA[1] (inches)	AB[2] (inches)
Parking Areas	5.0	3.0	10.0
		3.0	4.0
Driveways / Bus Areas	6.5	4.0	13.5
		4.0	4.0

Notes:
1. HMA = Hot Mix Asphalt (Type A) conforming to Section 39 of Caltrans' latest *Standard Specifications*.
2. AB = Class 2 Aggregate Base conforming to Section 26 of Caltrans' latest Standard Specifications.

6.13.3 The recommended alternative pavement sections are based on the following assumptions:

1. Untreated subgrade soil has an R-Value of 5.
2. Class 2 AB has a minimum R-Value of 78 and meets the requirements of Section 26 of the Caltrans' latest *Standard Specifications*.
3. Class 2 AB is compacted to 95% or higher relative compaction at or near optimum moisture content. Prior to placing HMA, the AB should be proof-rolled with a loaded water truck to verify stability.
4. Pavement subgrade should be compacted in accordance with the recommendations presented in this report.
5. HMA should conform to Section 39 of Caltrans' latest *Standard Specifications.*
6. Periodic maintenance of HMA pavements is performed.

6.13.4 To reduce the potential for water from landscaped areas migrating under pavement into the AB, consideration should be given to using full-depth curbs in areas where pavement abuts irrigated landscaping. The full-depth curbs should be at least 4 inches wide and extend at least 4 inches or more into the soil subgrade beneath the AB. In addition, drop-inlets with weep-holes at the approximate AB-subgrade interface may be used to encourage accumulated water to drain from beneath the pavement.

6.13.5 Asphalt pavement section recommendations for driveways and parking areas are based on the design procedures of the Caltrans *Highway Design Manual*, latest edition. Most rational pavement design procedures are based on projected street or highway traffic conditions and, hence, may not be representative of vehicular loading that occurs in parking lots and driveways. Pavement proximity to landscape irrigation, reduced traffic speed, and short turning radii increase the potential for pavement distress to occur in parking lots even though the volume of traffic is significantly less than that of an adjacent street. The *Highway Design Manual* indicates that the resulting pavement sections for parking lots are "minimized to keep initial costs down but are reasonable because additional AC surfacing can be added later if needed, and generally without incurring traffic hazards or traffic handling problems." It is generally not economically feasible to design and construct the entire parking lot and driveways for the unique loading conditions previously described.

6.13.6 We have prepared our pavement recommendations in accordance with local standards; however, it is essential to establish a pavement management program and implement periodic maintenance procedures early before degradation can occur.

6.14 Pavement - Rigid Concrete

6.14.1 Rigid concrete pavement may be used in heavy traffic and bus areas. Based on the soil conditions encountered at the site, and PCA guidelines (*Thickness Design for Concrete Highway and Street Pavements*, 1984), concrete pavement should consist of at least 6 inches Portland Cement Concrete (PCC) overlying at least 6 inches of Class 2 AB meeting the requirements of Section 26 of Caltrans' *Standard Specifications*.

6.14.2 PCC should have a minimum 28-day compressive strength of 3,500 psi. Adequate construction and crack control joints should be used to control cracking inherent in concrete construction. It would be advantageous to provide minimal reinforcement, such as No. 3 steel bars placed 18 inches on center in both horizontal directions to help control cracking. Adequate dowels should also be used at joints to facilitate load transfer and reduce vertical offset.

6.14.3 In general, we recommend that concrete pavements be designed, constructed, and maintained in accordance with industry standards such as those provided by the American Concrete Pavement Association.

6.15 Site Drainage and Moisture Protection

6.15.1 Adequate site drainage is critical to reduce the potential for differential soil movement, soil expansion, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to building foundations. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with the 2013 CBC or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices.

6.15.2 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

6.15.3 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. We recommend use of area drains to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes. In addition, where landscaping is planned adjacent to the pavement or flatwork, we recommend construction of a cutoff wall (deepened curb) along the edge of the pavement/flatwork that extends at least 4 inches into the soil subgrade below the bottom of the base material.

6.15.4 The soil conditions at the site (expansive, low-permeability clays) are not conducive to water infiltration devices such as vegetated swales. However, Low Impact Development (LID) devices can be installed to reduce velocity and the amount of water entering the storm drain system. The LID devices should be properly constructed to prevent water infiltration into the surrounding soil. If water infiltrates the expansive soils, distress may be caused to adjacent pavements, flatwork, or structures. Vegetated swales and basin areas (if used) should be lined with an impermeable liner (e.g. high-density polyethylene, HDPE, with a thickness of about 12 mil or equivalent polyvinyl chloride liner) to reduce infiltration.

6.15.5 We recommend that roof drains be connected to water-tight subdrains that direct the water to the storm drain system. However, we understand that LID and Leadership in Engineering and Environmental Design (LEED) requests disconnecting the roof drains to help obtain certification. The water from the roof drains should be directed away from buildings. Consideration should be given to draining roofs to lined planter boxes or placing liners below the proposed landscape areas to prevent infiltration of the water. Geocon can be contacted for additional recommendations.

6.15.6 Since near-surface soils at the site are expansive, we recommend implementing measures to reduce infiltrating irrigation water near buildings, flatwork, or pavements. Such measures may include:

- Selecting drought-tolerant plants that require little or no irrigation, especially within 3 feet of buildings, slabs-on-grade, or pavements.
- Using drip irrigation or low-output sprinklers.
- Using automatic timers for irrigation systems.
- Using appropriately spaced area drains.

The project landscape architect should consider incorporating these measures into the landscaping plans.

6.15.7 Experience has shown that even with these provisions, subsurface seepage may develop in areas where no such water conditions existed prior to site development. This is particularly true where a substantial increase in surface water infiltration has resulted from an increase in landscape irrigation.

7.0 FURTHER GEOTECHNICAL SERVICES

7.1 Plan and Specification Review

7.1.1 We should review the improvement plans and specifications prior to final design submittal to assess whether our recommendations have been properly implemented and evaluate if additional analysis and/or recommendations are required.

7.2 Testing and Observation Services

7.2.1 The recommendations provided in this report are based on the assumption that we will continue as Geotechnical Engineer of Record (GER) throughout the construction phase and provide testing and observation services. It is important to maintain continuity of geotechnical interpretation and confirm that field conditions encountered are similar to those anticipated during design. If we are not retained for these services, we cannot assume any responsibility for other's interpretation of our recommendations or the future performance of the project.

8.0 LIMITATIONS

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, we should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous materials or environmental contamination was not part of our scope of services.

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

The recommendations contained in this report are preliminary until verified during construction by representatives of our firm. 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 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 partially or wholly by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

Our professional services were performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices used in the site area at this time. No warranty is provided, express or implied.

9.0 REFERENCES

1. Blake, T.F., 2000, EQFAULT, *A Computer Program for the Deterministic Prediction of Peak Horizontal Acceleration from Digitized California Faults*, Version 3.00b.

2. Bryant, W.A., and E.W. Hart, 2007, *Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act With Index to Earthquake Fault Zone Maps*, California Geological, Special Publication 42, Interim Revision 2007, 42 pp.

3. California Department of Transportation, 2008, *Highway Design Manual*, Sixth Edition, July 1, 2008.

4. California Geological Survey, *Preliminary Geologic Map of the Sacramento 30' x 60' Quadrangle, California*, 2011.

5. *EQFAULT*, Version 3, Blake, 2000.

6. Lenity Architecture, *Placer County Retirement Residence, Placer County California, Conceptual Site Plan*, dated January 6, 2016.

7. Morrow Surveying, *ALTA/NSPS Land Title Survey, Old Auburn Road at Sierra College Boulevard, County of Placer, State of California*, Sheets 1 through 4, dated February 2016.

8. Portland Cement Association, *Concrete Floors on Ground*, 2001.

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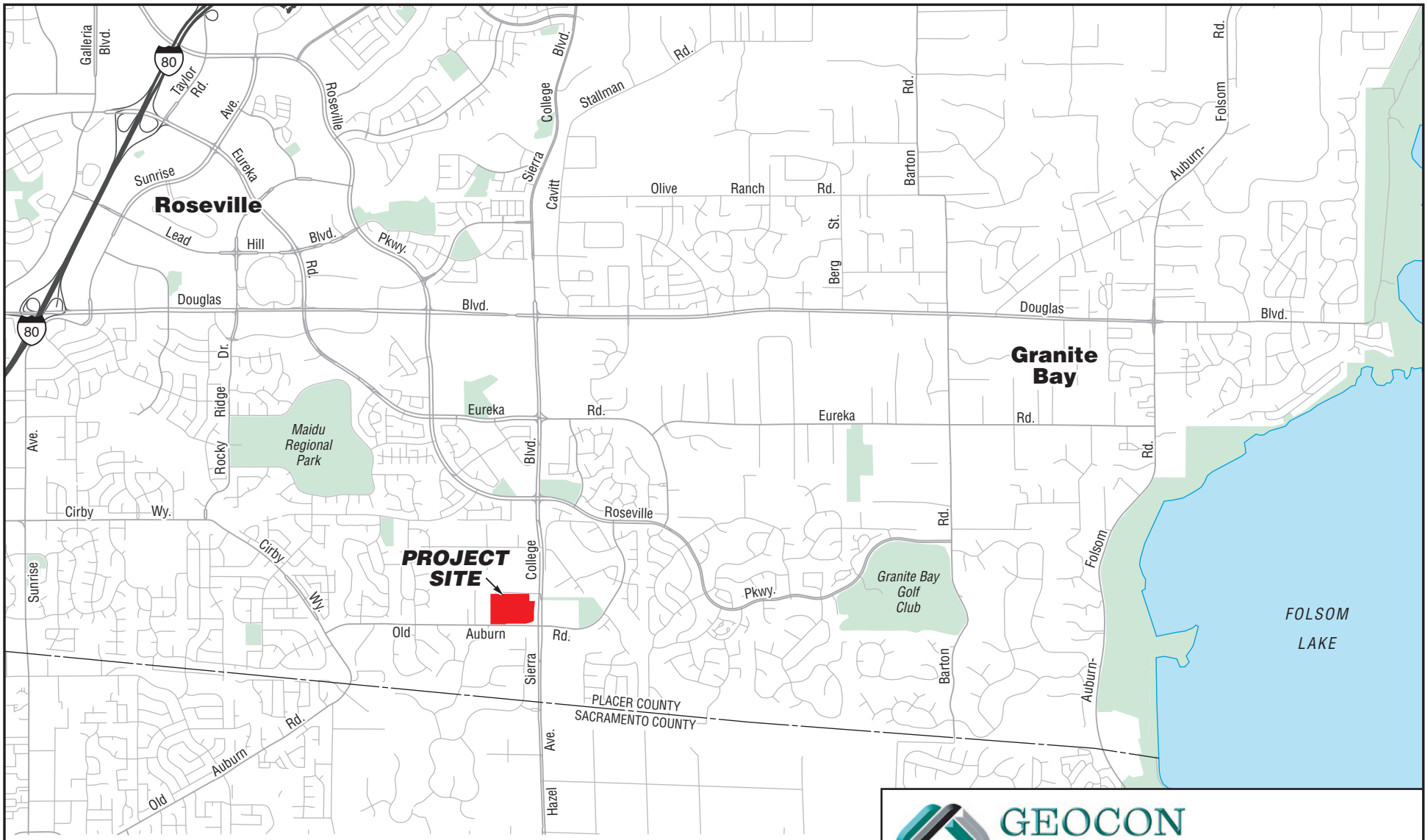
10. United States Geological Survey, *2008 Interactive Deaggregations*, http://eqint.cr.usgs.gov/deaggint/2002/index.php., accessed February 29, 2016.

11. United States Geological Survey, 2015, U.S. Seismic Design Maps, Online Application: http://earthquake.usgs.gov/hazards/designmaps/usdesign.php, accessed February 29, 2016.

12. United States Geological Survey, *Seismic Hazard Curves and Uniform Response Spectra*, Version 5.0.8, November 2007.

13. Unpublished reports, aerial photographs, and maps on file with Geocon.



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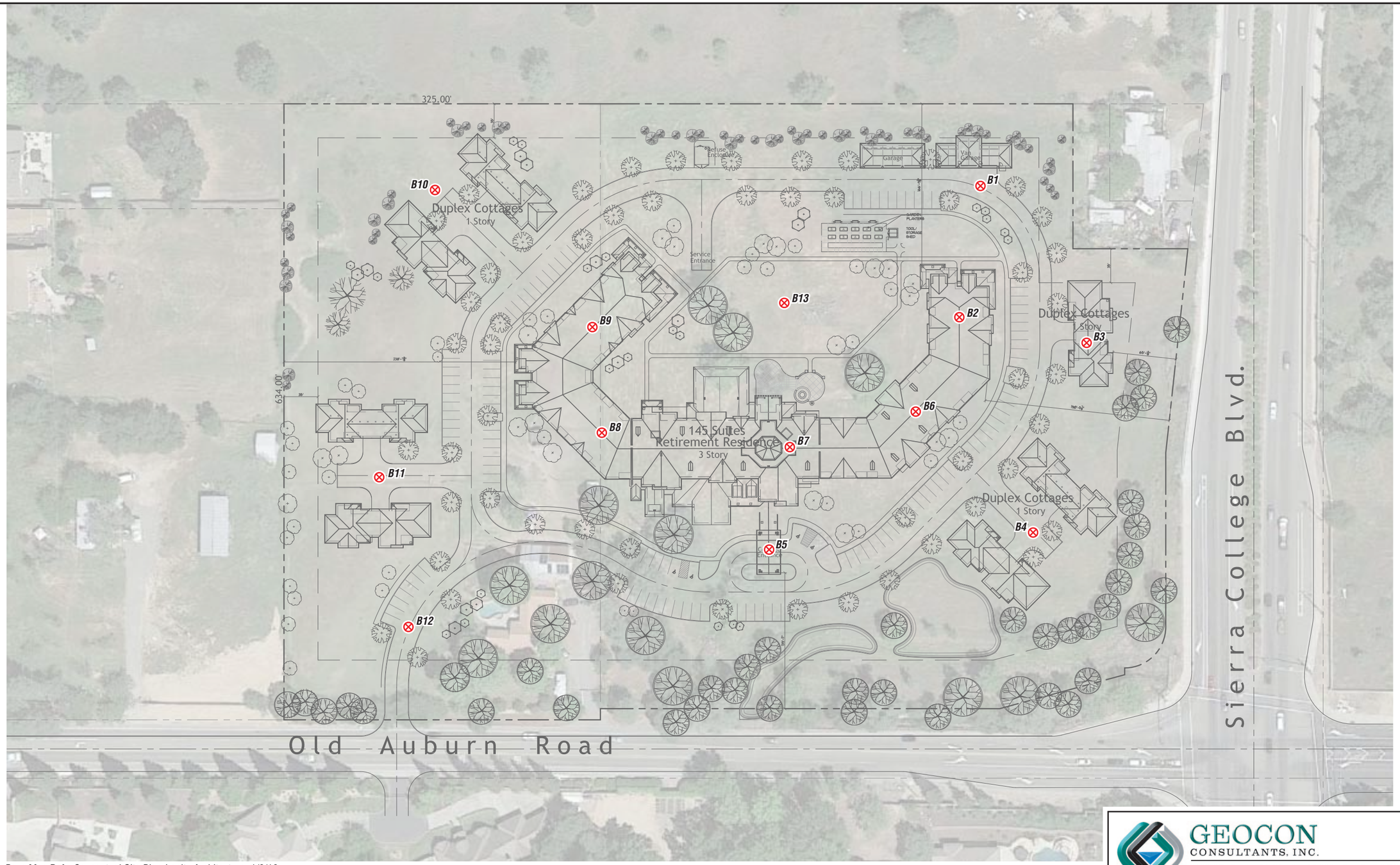
Placer Retirement Residence

Placer County, California

VICINITY MAP

S1140-05-01	March 2016	Figure 1



Base Map Ref: *Conceptual Site Plan,* Lenity Architecture, 1/6/16

LEGEND:

B13 ⊗ Approximate Boring Location

0 100
Scale in Feet

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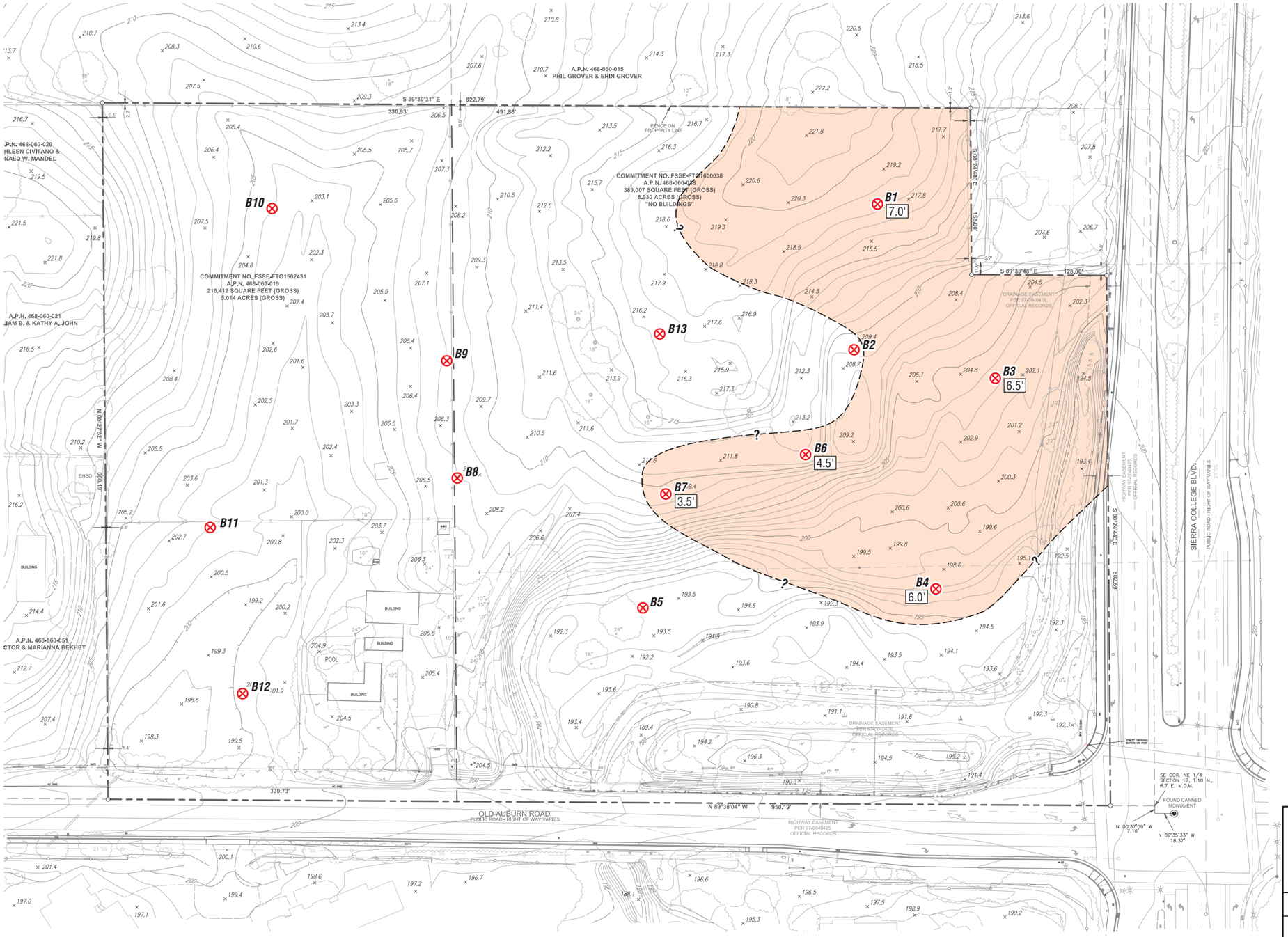
Placer Retirement Residence

Placer County,
California

SITE PLAN

S1140-05-01	March 2016	Figure 2



LEGEND:

- B13 ⊗ Approximate Boring Location
- Undocumented Fill
- 7.0' Approximate Filll Thickness

0 100

Scale in Feet

Base Map Ref: Morrow Surveying, Feb. 2016

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Placer Retirement Residence

Placer County,
California

TOPOGRAPHIC MAP

S1140-05-01	March 2016	Figure 3

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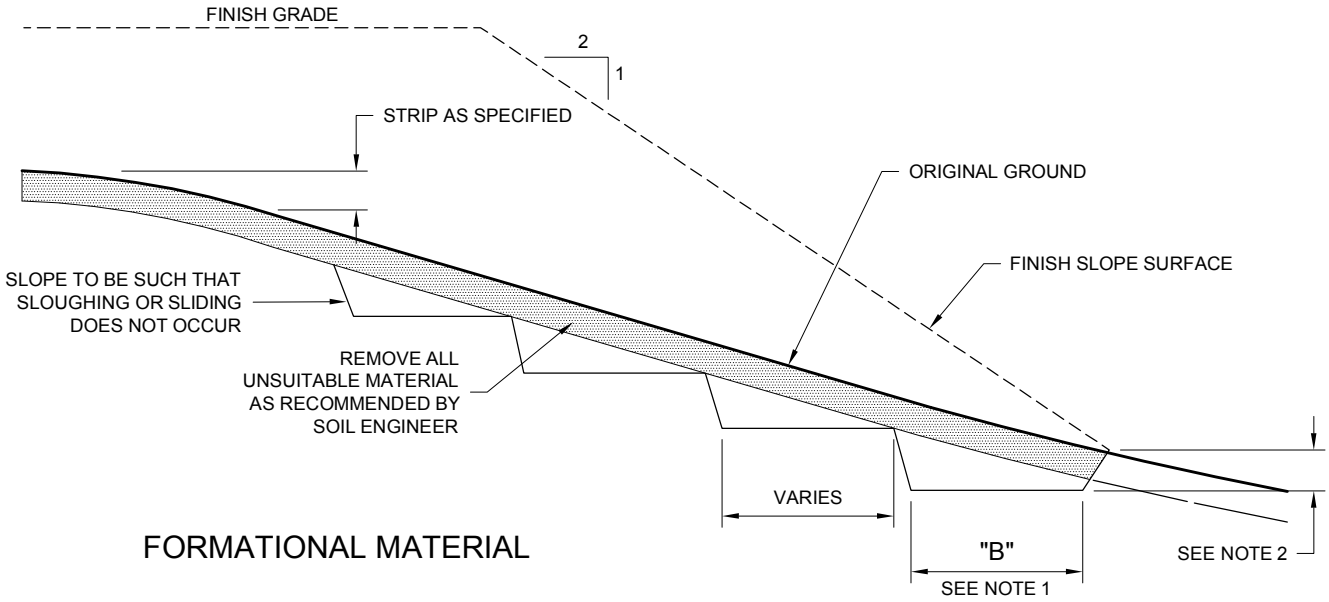
Placer Retirement Residence

Placer County,
California

HISTORICAL SITE PHOTO (2002)

S1140-05-01	March 2016	Figure 4



NOT TO SCALE

Notes:

1) Key width "B" shall be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment.

2) The outside edge of bottom key shall be below topsoil or loose surface material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the engineer.

   Keys are required where the natural slopes are steeper than 5 horizontal to 1 vertical or where specified by soil engineer.

   The base of the key and each bench shall be inclined slightly into the slope.

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Placer Retirement Residence

Placer County,
California

Typical Keying and Benching Detail

S1140-05-01	March 2016	Figure 5

APPENDIX A

APPENDIX A

FIELD EXPLORATION

We performed our geotechnical field exploration on February 9 and 10, 2016. Our field exploration program consisted of drilling 13 exploratory borings (B1 through B13) at the approximate locations depicted on the Site Plan, Figure 2.

Borings were performed using a track-mounted CME 75 drill rig equipped with 8-inch outside diameter (OD) hollow stem augers. The drill rig sampled the soil using an automatic 140-pound hammer with a 30-inch drop. We obtained samples using a 3-inch OD split-spoon (California Modified) sampler and 2-inch OD Standard Penetration Test (SPT) sampler. We recorded the number of blows required to drive the sampler the last 12 inches (or portion thereof) of the 18-inch sampling interval on the boring logs. Upon completion, the borings were backfilled with soil cuttings generated from the borings.

We visually examined, classified, and logged the subsurface conditions in the exploratory borings in general accordance with the American Society for Testing and Materials (ASTM) Practice for Description and Identification of Soils (Visual-Manual Procedure D2488-90). This system uses the Unified Soil Classification System (USCS) for soil designations. The logs depict soil and geologic conditions encountered and depths at which we obtained samples. The logs also include our interpretation of the conditions between sampling intervals. Therefore, the logs contain both observed and interpreted data. We determined the lines designating the interface between soil materials on the logs using visual observations, drill rig penetration rates, excavation characteristics, and other factors. The transition between materials may be abrupt or gradual. Where applicable, we revised the field logs based on subsequent laboratory testing.

UNIFIED SOIL CLASSIFICATION

MAJOR DIVISIONS				TYPICAL NAMES
COARSE-GRAINED SOILS MORE THAN HALF IS COARSER THAN NO. 200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO.4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
			GP	POORLY GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, SILTY GRAVELS WITH SAND
			GC	CLAYEY GRAVELS, CLAYEY GRAVELS WITH SAND
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO.4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
			SP	POORLY GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS WITH OR WITHOUT GRAVEL
			SC	CLAYEY SANDS WITH OR WITHOUT GRAVEL
FINE-GRAINED SOILS MORE THAN HALF IS FINER THAN NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50% OR LESS		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTS WITH SANDS AND GRAVELS
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, CLAYS WITH SANDS AND GRAVELS, LEAN CLAYS
			OL	ORGANIC SILTS OR CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50%		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OR CLAYS OF MEDIUM TO HIGH PLASTICITY
	HIGHLY ORGANIC SOILS		PT	PEAT AND OTHER HIGHLY ORGANIC SOILS

BORING/TRENCH LOG LEGEND

- No Recovery
- Shelby Tube Sample
- Bulk Sample
- SPT Sample
- Modified California Sample
- Groundwater Level (At Completion)
- Groundwater Level (Seepage)

PENETRATION RESISTANCE

SAND AND GRAVEL			SILT AND CLAY			
RELATIVE DENSITY	BLOWS PER FOOT (SPT)*	BLOWS PER FOOT (MOD-CAL)*	CONSISTENCY	BLOWS PER FOOT (SPT)*	BLOWS PER FOOT (MOD-CAL)*	COMPRESSIVE STRENGTH (tsf)
VERY LOOSE	0 - 4	0 - 6	VERY SOFT	0 - 2	0 - 3	0 - 0.25
LOOSE	5 - 10	7 - 16	SOFT	3 - 4	4 - 6	0.25 - 0.50
MEDIUM DENSE	11 - 30	17 - 48	MEDIUM STIFF	5 - 8	7 - 13	0.50 - 1.0
DENSE	31 - 50	49 - 79	STIFF	9 - 15	14 - 24	1.0 - 2.0
VERY DENSE	OVER 50	OVER 79	VERY STIFF	16 - 30	25 - 48	2.0 - 4.0
			HARD	OVER 30	OVER 48	OVER 4.0

*NUMBER OF BLOWS OF 140 LB HAMMER FALLING 30 INCHES TO DRIVE LAST 12 INCHES OF AN 18-INCH DRIVE

MOISTURE DESCRIPTIONS

FIELD TEST	APPROX. DEGREE OF SATURATION, S (%)	DESCRIPTION
NO INDICATION OF MOISTURE; DRY TO THE TOUCH	S<25	DRY
SLIGHT INDICATION OF MOISTURE	25≤S<50	DAMP
INDICATION OF MOISTURE; NO VISIBLE WATER	50≤S<75	MOIST
MINOR VISIBLE FREE WATER	75≤S<100	WET
VISIBLE FREE WATER	100	SATURATED

QUANTITY DESCRIPTIONS

APPROX. ESTIMATED PERCENT	DESCRIPTION
<5%	TRACE
5 - 10%	FEW
11 - 25%	LITTLE
26 - 50%	SOME
>50%	MOSTLY

GRAVEL/COBBLE/BOULDER DESCRIPTIONS

CRITERIA	DESCRIPTION
PASS THROUGH A 3-INCH SIEVE AND BE RETAINED ON A NO. 4 SIEVE (#4 TO 3")	GRAVEL
PASS A 12-INCH SQUARE OPENING AND BE RETAINED ON A 3-INCH SIEVE (3"-12")	COBBLE
WILL NOT PASS A 12-INCH SQUARE OPENING (>12")	BOULDER

BEDDING SPACING DESCRIPTIONS

THICKNESS/SPACING	DESCRIPTOR
GREATER THAN 10 FEET	MASSIVE
3 TO 10 FEET	VERY THICKLY BEDDED
1 TO 3 FEET	THICKLY BEDDED
3 5/8-INCH TO 1 FOOT	MODERATELY BEDDED
1 1/4-INCH TO 3 5/8-INCH	THINLY BEDDED
5/8-INCH TO 1 1/4-INCH	VERY THINLY BEDDED
LESS THAN 5/8-INCH	LAMINATED

STRUCTURE DESCRIPTIONS

CRITERIA	DESCRIPTION
ALTERNATING LAYERS OF VARYING MATERIAL OR COLOR WITH LAYERS AT LEAST 1/4-INCH THICK	STRATIFIED
ALTERNATING LAYERS OF VARYING MATERIAL OR COLOR WITH LAYERS LESS THAN 1/4-INCH THICK	LAMINATED
BREAKS ALONG DEFINITE PLANES OF FRACTURE WITH LITTLE RESISTANCE TO FRACTURING	FISSURED
FRACTURE PLANES APPEAR POLISHED OR GLOSSY, SOMETIMES STRIATED	SLICKENSIDED
COHESIVE SOIL THAT CAN BE BROKEN DOWN INTO SMALLER ANGULAR LUMPS WHICH RESIST FURTHER BREAKDOWN	BLOCKY
INCLUSION OF SMALL POCKETS OF DIFFERENT SOIL, SUCH AS SMALL LENSES OF SAND SCATTERED THROUGH A MASS OF CLAY	LENSED
SAME COLOR AND MATERIAL THROUGHOUT	HOMOGENOUS

CEMENTATION/INDURATION DESCRIPTIONS

FIELD TEST	DESCRIPTION
CRUMBLES OR BREAKS WITH HANDLING OR LITTLE FINGER PRESSURE	WEAKLY CEMENTED/INDURATED
CRUMBLES OR BREAKS WITH CONSIDERABLE FINGER PRESSURE	MODERATELY CEMENTED/INDURATED
WILL NOT CRUMBLE OR BREAK WITH FINGER PRESSURE	STRONGLY CEMENTED/INDURATED

IGNEOUS/METAMORPHIC ROCK STRENGTH DESCRIPTIONS

FIELD TEST	DESCRIPTION
MATERIAL CRUMBLES WITH BARE HAND	WEAK
MATERIAL CRUMBLES UNDER BLOWS FROM GEOLOGY HAMMER	MODERATELY WEAK
1/8-INCH INDENTATIONS WITH SHARP END FROM GEOLOGY HAMMER	MODERATELY STRONG
HAND-HELD SPECIMEN CAN BE BROKEN WITH **ONE** BLOW FROM GEOLOGY HAMMER	STRONG
HAND-HELD SPECIMEN CAN BE BROKEN WITH **COUPLE** BLOWS FROM GEOLOGY HAMMER	VERY STRONG
HAND-HELD SPECIMEN CAN BE BROKEN WITH **MANY** BLOWS FROM GEOLOGY HAMMER	EXTREMELY STRONG

IGNEOUS/METAMORPHIC ROCK WEATHERING DESCRIPTIONS

DEGREE OF DECOMPOSITION	FIELD RECOGNITION	ENGINEERING PROPERTIES
SOIL	DISCOLORED, CHANGED TO SOIL, FABRIC DESTROYED	EASY TO DIG
COMPLETELY WEATHERED	DISCOLORED, CHANGED TO SOIL, FABRIC MAINLY PRESERVED	EXCAVATED BY HAND OR RIPPING (Saprolite)
HIGHLY WEATHERED	DISCOLORED, HIGHLY FRACTURED, FABRIC ALTERED AROUND FRACTURES	EXCAVATED BY HAND OR RIPPING, WITH SLIGHT DIFFICULTY
MODERATELY WEATHERED	DISCOLORED, FRACTURES, INTACT ROCK-NOTICEABLY WEAKER THAN FRESH ROCK	EXCAVATED WITH DIFFICULTY WITHOUT EXPLOSIVES
SLIGHTLY WEATHERED	MAY BE DISCOLORED, SOME FRACTURES, INTACT ROCK-NOT NOTICEABLY WEAKER THAN FRESH ROCK	REQUIRES EXPLOSIVES FOR EXCAVATION, WITH PERMEABLE JOINTS AND FRACTURES
FRESH	NO DISCOLORATION, OR LOSS OF STRENGTH	REQUIRES EXPLOSIVES

IGNEOUS/METAMORPHIC ROCK JOINT/FRACTURE DESCRIPTIONS

FIELD TEST	DESCRIPTION
NO OBSERVED FRACTURES	UNFRACTURED/UNJOINTED
MAJORITY OF JOINTS/FRACTURES SPACED AT 1 TO 3 FOOT INTERVALS	SLIGHTLY FRACTURED/JOINTED
MAJORITY OF JOINTS/FRACTURES SPACED AT 4-INCH TO 1 FOOT INTERVALS	MODERATELY FRACTURED/JOINTED
MAJORITY OF JOINTS/FRACTURES SPACED AT 1-INCH TO 4-INCH INTERVALS WITH SCATTERED FRAGMENTED INTERVALS	INTENSELY FRACTURED/JOINTED
MAJORITY OF JOINTS/FRACTURES SPACED AT LESS THAN 1-INCH INTERVALS; MOSTLY RECOVERED AS CHIPS AND FRAGMENTS	VERY INTENSELY FRACTURED/JOINTED

GEOCON CONSULTANTS, INC.
3160 GOLD VALLEY DR – SUITE 800 – RANCHO CORDOVA, CA 95742
PHONE 916.852.9118 – FAX 916.852.9132

KEY TO LOGS | Figure A1

PROJECT NO. **S1140-05-01** PROJECT NAME **Placer Retirement Residence**

BORING B1

ELEV. (MSL.) **Approx. 219** DATE COMPLETED **02/09/16**

ENG./GEO. **Sean Dixon** DRILLER **All Well Abandonment**

EQUIPMENT **Track-mounted CME75 w/8" HSA** HAMMER TYPE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**FILL** Medium stiff to stiff, moist, reddish brown with gray, Sandy lean CLAY with sparse gravel			
1	B1-Bulk							
	B1-1.5							
2	B1-2.0					14	111.1	17.8
3	B1-3.0							
	B1-3.5					13		
4								
5								
	B1-5.5							
6	B1-6.0					21	119.0	11.1
7				CL	**TURLOCK LAKE FORMATION** Hard, moist, light brown, Lean CLAY			
8	B1-8.0							
	B1-8.5					67		
9								
10	B1-10.0				- becomes very stiff, with sand	24		
11								
					BORING TERMINATED AT 11.5 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED WITH SOIL CUTTINGS			

Figure A2, Log of Boring, page 1 of 1

IN PROGRESS S1140-05-01 PLACER CO. RETIREMENT CENTER.GPJ 03/01/16

GEOCON

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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.

PROJECT NO. **S1140-05-01** PROJECT NAME **Placer Retirement Residence**

BORING B10

ELEV. (MSL.) **Approx. 207** DATE COMPLETED **02/10/16**

ENG./GEO. **Sean Dixon** DRILLER **All Well Abandonment**

EQUIPMENT **Track-mounted CME75 w/8" HSA** HAMMER TYPE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**TURLOCK LAKE FORMATION** Soft, moist, dark brown with gray (mottled), Lean CLAY			
1								
	B10-1.5							
2	B10-2.0			SC	Dense, moist, light brown, Lean CLAY	7	114.1	16.8
3	B10-3.0							
	B10-3.5					50/5"	121.7	9.0
4								
5	B10-5.0			CL	Hard, moist, light brown, Lean CLAY	55		
6								
7								
8								
9								
10	B10-10.0					48		
11								
					BORING TERMINATED AT 11.5 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED WITH SOIL CUTTINGS			

Figure A10, Log of Boring, page 1 of 1

IN PROGRESS S1140-05-01 PLACER CO. RETIREMENT CENTER.GPJ 03/01/16

GEOCON

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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.

PROJECT NO. **S1140-05-01** PROJECT NAME **Placer Retirement Residence**

BORING B11

ELEV. (MSL.) **Approx. 204** DATE COMPLETED **02/10/16**

ENG./GEO. **Sean Dixon** DRILLER **All Well Abandonment**

EQUIPMENT **Track-mounted CME75 w/8" HSA** HAMMER TYPE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**TURLOCK LAKE FORMATION** Soft, moist, reddish brown, Sandy lean CLAY			
1				CL	Hard, moist, light brown, Sandy lean CLAY			
2	B11-1.5 B11-2.0 B11-2.5					73 30	115.6	15.3
3								
4								
5	B11-5.0					33		
6								
7								
8								
9								
10	B11-10.0					40		
11								

BORING TERMINATED AT 11.5 FEET
GROUNDWATER NOT ENCOUNTERED
BACKFILLED WITH SOIL CUTTINGS

Figure A11, Log of Boring, page 1 of 1

IN PROGRESS S1140-05-01 PLACER CO. RETIREMENT CENTER.GPJ 03/01/16

GEOCON

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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.

PROJECT NO. **S1140-05-01** PROJECT NAME **Placer Retirement Residence**

BORING B12

ELEV. (MSL.) **Approx. 200** DATE COMPLETED **02/10/16**

ENG./GEO. **Sean Dixon** DRILLER **All Well Abandonment**

EQUIPMENT **Track-mounted CME75 w/8" HSA** HAMMER TYPE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
1	B12-1.0			CL	**TURLOCK LAKE FORMATION** Soft, moist, reddish brown, Sandy lean CLAY	6		
2				CL	Stiff to very stiff, moist, light brown, Sandy lean CLAY			
3	B12-2.5					23		
4								
5	B12-5.0				- becomes hard	43		
6								
					BORING TERMINATED AT 6.5 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED WITH SOIL CUTTINGS			

Figure A12, Log of Boring, page 1 of 1

IN PROGRESS S1140-05-01 PLACER CO. RETIREMENT CENTER.GPJ 03/01/16

GEOCON

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL
... DISTURBED OR BAG SAMPLE
... STANDARD PENETRATION TEST
... CHUNK SAMPLE
... DRIVE SAMPLE (UNDISTURBED)
... WATER TABLE OR SEEPAGE

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.

PROJECT NO. **S1140-05-01** PROJECT NAME **Placer Retirement Residence**

BORING B13

ELEV. (MSL.) **Approx. 218** DATE COMPLETED **02/10/16**

ENG./GEO. **Sean Dixon** DRILLER **All Well Abandonment**

EQUIPMENT **Track-mounted CME75 w/8" HSA** HAMMER TYPE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**TURLOCK LAKE FORMATION** Soft, moist, light brown, Sandy lean CLAY			
1	B13-1.0					83/10"		
2					- becomes hard			
3								
4								
5	B13-5.0					56		
6								
7								
8								
9								
10	B13-10.0					53		
11								
12								
13								
14								
15	B13-15.0					55		
16								
17								
18								
19								
20	B13-20.0					36		
21								
					BORING TERMINATED AT 21.5 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED WITH SOIL CUTTINGS			

Figure A13, Log of Boring, page 1 of 1

IN PROGRESS S1140-05-01 PLACER CO. RETIREMENT CENTER.GPJ 03/01/16

GEOCON

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

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.

PROJECT NO. **S1140-05-01** PROJECT NAME **Placer Retirement Residence**

BORING B2

ELEV. (MSL.) **Approx. 209** DATE COMPLETED **02/09/16**

ENG./GEO. **Sean Dixon** DRILLER **All Well Abandonment**

EQUIPMENT **Track-mounted CME75 w/8" HSA** HAMMER TYPE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**TURLOCK LAKE FORMATION** Hard, moist, light brown, Sandy lean CLAY			
1								
2	B2-1.5, B2-2.0					49	125.2	12.4
3	B2-Bulk, B2-3.0			SC	Dense to very dense, moist, light brown, Clayey SAND			
4	B2-3.5					90	127.1	9.5
5	B2-5.0					39		
6								
7								
8	B2-7.5					37		
9								
10	B2-10.0			CL	Hard, moist, light brown, Sandy lean CLAY	33		
11								
12								
13								
14								
15	B2-15.0					40		
16								
17								
18								
19								
20	B2-20.0				- becomes very stiff	19		
21								

BORING TERMINATED AT 21.5 FEET
GROUNDWATER NOT ENCOUNTERED
BACKFILLED WITH SOIL CUTTINGS

Figure A2, Log of Boring, page 1 of 1

IN PROGRESS S1140-05-01 PLACER CO. RETIREMENT CENTER.GPJ 03/01/16

GEOCON

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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.

PROJECT NO. **S1140-05-01** PROJECT NAME **Placer Retirement Residence**

BORING B3

ELEV. (MSL.) **Approx. 206** DATE COMPLETED **02/09/16**

ENG./GEO. **Sean Dixon** DRILLER **All Well Abandonment**

EQUIPMENT **Track-mounted CME75 w/8" HSA** HAMMER TYPE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**FILL** Medium stiff, moist, reddish brown, Sandy lean CLAY with sparse gravel			
1	B3-Bulk B3-1.5							
2	B3-2.0					8	106.7	15.4
3	B3-2.5					10		
4								
5								
6	B3-5.5 B3-6.0				- becomes stiff	21	125.0	11.9
7				CL	**TURLOCK LAKE FORMATION** Very hard, moist, light brown, Lean CLAY			
8	B3-8.0 B3-8.5							
9						85/10"		
10	B3-10.0					50		
11								
					BORING TERMINATED AT 11.5 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED WITH SOIL CUTTINGS			

Figure A3, Log of Boring, page 1 of 1

IN PROGRESS S1140-05-01 PLACER CO. RETIREMENT CENTER.GPJ 03/01/16

GEOCON

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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.

PROJECT NO. **S1140-05-01** PROJECT NAME **Placer Retirement Residence**

BORING B4

ELEV. (MSL.) **Approx. 198** DATE COMPLETED **02/09/16**

ENG./GEO. **Sean Dixon** DRILLER **All Well Abandonment**

EQUIPMENT **Track-mounted CME75 w/8" HSA** HAMMER TYPE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**FILL** Soft, moist, reddish brown, Sandy lean CLAY with sparse gravel			
1								
2	B4-2.0					6	100.1	21.9
3	B4-3.0 B4-3.5				- becomes stiff	20	121.9	11.3
4								
5								
6	B4-5.5 B4-6.0			SC	**TURLOCK LAKE FORMATION** Medium dense, moist, light brown, Clayey SAND with gravel	26		
7								
8	B4-7.5 B4-8.0			CL	Hard, moist, light brown, Lean CLAY	50/6"		
9								
10	B4-10.0					45		
11								

BORING TERMINATED AT 11.5 FEET
GROUNDWATER NOT ENCOUNTERED
BACKFILLED WITH SOIL CUTTINGS

Figure A4, Log of Boring, page 1 of 1

IN PROGRESS S1140-05-01 PLACER CO. RETIREMENT CENTER.GPJ 03/01/16

GEOCON

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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.

PROJECT NO. **S1140-05-01** PROJECT NAME **Placer Retirement Residence**

BORING B5

ELEV. (MSL.) **Approx. 194** DATE COMPLETED **02/09/16**

ENG./GEO. **Sean Dixon** DRILLER **All Well Abandonment**

EQUIPMENT **Track-mounted CME75 w/8" HSA** HAMMER TYPE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**ALLUVIUM** Medium stiff, moist, dark brown and gray (mottled), Lean CLAY with minor organics			
1								
2	B5-2.0					10	110.3	16.0
3								
4	B5-3.5			SC	Medium dense, moist, light brown, Clayey SAND with gravel	18	123.3	12.5
5	B5-5.0			CL	**TURLOCK LAKE FORMATION** Very stiff to stiff, moist, light brown, Sandy lean CLAY	21		
6								
7			▼					
8	B5-7.5					13		
9								
10	B5-10.0					14		
11								
					BORING TERMINATED AT 11.5 FEET GROUNDWATER ENCOUNTERED AT 7 FEET BACKFILLED WITH SOIL CUTTINGS			

Figure A5, Log of Boring, page 1 of 1

IN PROGRESS S1140-05-01 PLACER CO. RETIREMENT CENTER.GPJ 03/01/16

GEOCON

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL ◧ ... STANDARD PENETRATION TEST ■ ... DRIVE SAMPLE (UNDISTURBED)

⊠ ... DISTURBED OR BAG SAMPLE ◪ ... CHUNK SAMPLE ▼ ... WATER TABLE OR SEEPAGE

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.

PROJECT NO. **S1140-05-01** PROJECT NAME **Placer Retirement Residence**

BORING B6

ELEV. (MSL.) **Approx. 207** DATE COMPLETED **02/09/16**

ENG./GEO. **Sean Dixon** DRILLER **All Well Abandonment**

EQUIPMENT **Track-mounted CME75 w/8" HSA** HAMMER TYPE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**FILL** Medium stiff to stiff, moist, brown, Sandy lean CLAY with sparse gravel			
1								
2	B6-1.5, B6-2.0					13	86.1	30.7
3	B6-3.0, B6-3.5					15		
4								
5				CL	**TURLOCK LAKE FORMATION** Hard, moist, light brown, Sandy lean CLAY			
6	B6-5.5, B6-6.0					90/10"	122.5	12.6
7								
8	B6-7.5					61		
9								
10	B6-10.0					48		
11								
12								
13								
14				SC	Dense, moist, light brown, SAND with clay			
15	B6-15.0					45		
16								
					BORING TERMINATED AT 16.5 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED WITH SOIL CUTTINGS			

Figure A6, Log of Boring, page 1 of 1

IN PROGRESS S1140-05-01 PLACER CO. RETIREMENT CENTER.GPJ 03/01/16

GEOCON

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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.

PROJECT NO. **S1140-05-01** PROJECT NAME **Placer Retirement Residence**

BORING B7

ELEV. (MSL.) **Approx. 210** DATE COMPLETED **02/09/16**

ENG./GEO. **Sean Dixon** DRILLER **All Well Abandonment**

EQUIPMENT **Track-mounted CME75 w/8" HSA** HAMMER TYPE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**FILL** Medium stiff, moist, reddish brown, Sandy lean CLAY			
1								
	B7-1.5							
2	B7-2.0					11	111.2	16.0
3	B7-3.0							
	B7-3.5			CL	**TURLOCK LAKE FORMATION** Very stiff to hard, moist, light brown, Sandy lean CLAY	47	112.7	16.4
4								
5	B7-5.0					70		
6								
7								
8								
9								
10	B7-10.0					26		
11								
12								
13								
14								
15	B7-15.0					47		
16								
17								
18								
19								
20	B7-20.0					50/5"		
					BORING TERMINATED AT 20.9 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED WITH SOIL CUTTINGS			

Figure A7, Log of Boring, page 1 of 1

IN PROGRESS S1140-05-01 PLACER CO. RETIREMENT CENTER.GPJ 03/01/16

GEOCON

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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.

PROJECT NO. **S1140-05-01** PROJECT NAME **Placer Retirement Residence**

BORING B8

ELEV. (MSL.) **Approx. 208** DATE COMPLETED **02/09/16**

ENG./GEO. **Sean Dixon** DRILLER **All Well Abandonment**

EQUIPMENT **Track-mounted CME75 w/8" HSA** HAMMER TYPE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**TURLOCK LAKE FORMATION** Medium stiff, moist, reddish brown, Sandy lean CLAY			
1								
2	B8-1.5, B8-2.0					11	105.1	20.9
3	B8-3.0, B8-3.5				- becomes hard	77	122.0	13.2
4								
5								
6	B8-5.5					50/4"		
7								
8								
9								
10	B8-10.0					50		
11								
12								
13								
14								
15	B8-15.0					50		
16								

BORING TERMINATED AT 16.5 FEET
GROUNDWATER NOT ENCOUNTERED
BACKFILLED WITH SOIL CUTTINGS

Figure A8, Log of Boring, page 1 of 1

IN PROGRESS S1140-05-01 PLACER CO. RETIREMENT CENTER.GPJ 03/01/16

GEOCON

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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.

PROJECT NO. **S1140-05-01** PROJECT NAME **Placer Retirement Residence**

BORING B9

ELEV. (MSL.) **Approx. 209** DATE COMPLETED **02/10/16**

ENG./GEO. **Sean Dixon** DRILLER **All Well Abandonment**

EQUIPMENT **Track-mounted CME75 w/8" HSA** HAMMER TYPE

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**TURLOCK LAKE FORMATION** Hard, moist, light brown, Lean CLAY			
1								
2	B9-1.5 B9-2.0					80/11"	83.7	35.4
3	B9-2.5					45		
4								
5	B9-5.0					57		
6								
7								
8								
9								
10	B9-10.0					30		
11								
12								
13								
14								
15	B9-15.0					44		
16								
					BORING TERMINATED AT 16.5 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED WITH SOIL CUTTINGS			

Figure A9, Log of Boring, page 1 of 1

IN PROGRESS S1140-05-01 PLACER CO. RETIREMENT CENTER.GPJ 03/01/16

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SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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

APPENDIX B

LABORATORY TESTING PROGRAM

Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. Selected soil samples were tested for their in-place dry density and moisture content, plasticity characteristics, maximum dry density and optimum moisture content, corrosion potential, and pavement support characteristics. The results of the laboratory tests are presented in the following tables and on the following pages.

TABLE B1
EXPANSION INDEX TEST RESULTS
ASTM D4829

Sample Number	Sample Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Expansion Index	Classification*
		Before Test	After Test	Before Test	After Test		
B7&B11	1-5	11.7	23.9	104.4	97.6	65	Medium

**Expansion Potential Classification per ASTM D4829*

TABLE B2
SOIL CORROSION PARAMETER TEST RESULTS
(CALIFORNIA TEST METHODS 643, 417, AND 422)

Sample No.	Sample Depth (ft.)	pH	Minimum Resistivity (ohm-cm)	Chloride (ppm) / (%)	Sulfate (ppm) / (%)
B11 Bulk	5-10	7.1	1,400	70 / 0.007%	10 / 0.001%

*Caltrans considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil samples at the site:

- The pH is equal to or less than 5.5.
- The resistivity is equal to or less than 1,000 ohm-cm.
- Chloride concentration is equal to or greater than 500 parts per million (ppm).
- Sulfate concentration is equal to or greater than 2,000 ppm.

According to the 2013 California Building Code Section 1904.1 which refers to the durability requirements of American Concrete Institute (ACI) 318 (Chapter 4), Type II cement may be used where soluble sulfate levels in soil are below 2,000 ppm.

TABLE B3
R-VALUE TEST RESULTS
ASTM D2844

Boring Number	Sample Depth (feet)	Average Dry Density (pcf)	Average Moisture Content (%)	R-Value
B11 Bulk	5-10	108	19.6	5

Sample ID	Depth (feet)	Liquid Limit	Plastic Limit	Plasticity Index	Expansion Index	%<#200 Sieve	Water Content (%)	Dry Density (pcf)
B1-2.0	2						17.8	111.1
B1-6.0	6						11.1	119.0
B10-2.0	2						16.8	114.1
B10-3.5	3.5						9.0	121.7
B11-1.5	1.5	30	20	10				
B11-2.0	2						15.3	115.6
B2-2.0	2						12.4	125.2
B2-3.5	3.5						9.5	127.1
B3-2.0	2						15.4	106.7
B3-6.0	6						11.9	125.0
B4-2.0	2.0						21.9	100.1
B4-3.5	3.5						11.3	121.9
B5-2.0	B5-2.0						16.0	110.3
B5-3.5	3.5						12.5	123.3
B6-1.5	1.5	30	18	12				
B6-2.0	2						30.7	86.1
B6-6.0	6						12.6	122.5
B7 & B11 Comp.	0				65			
B7-2.0	2						16.0	111.2
B7-3.5	3.5						16.4	112.7
B8-2.0	2						20.9	105.1
B8-3.5	3.5						13.2	122.0
B9-2.0	2						35.4	83.7

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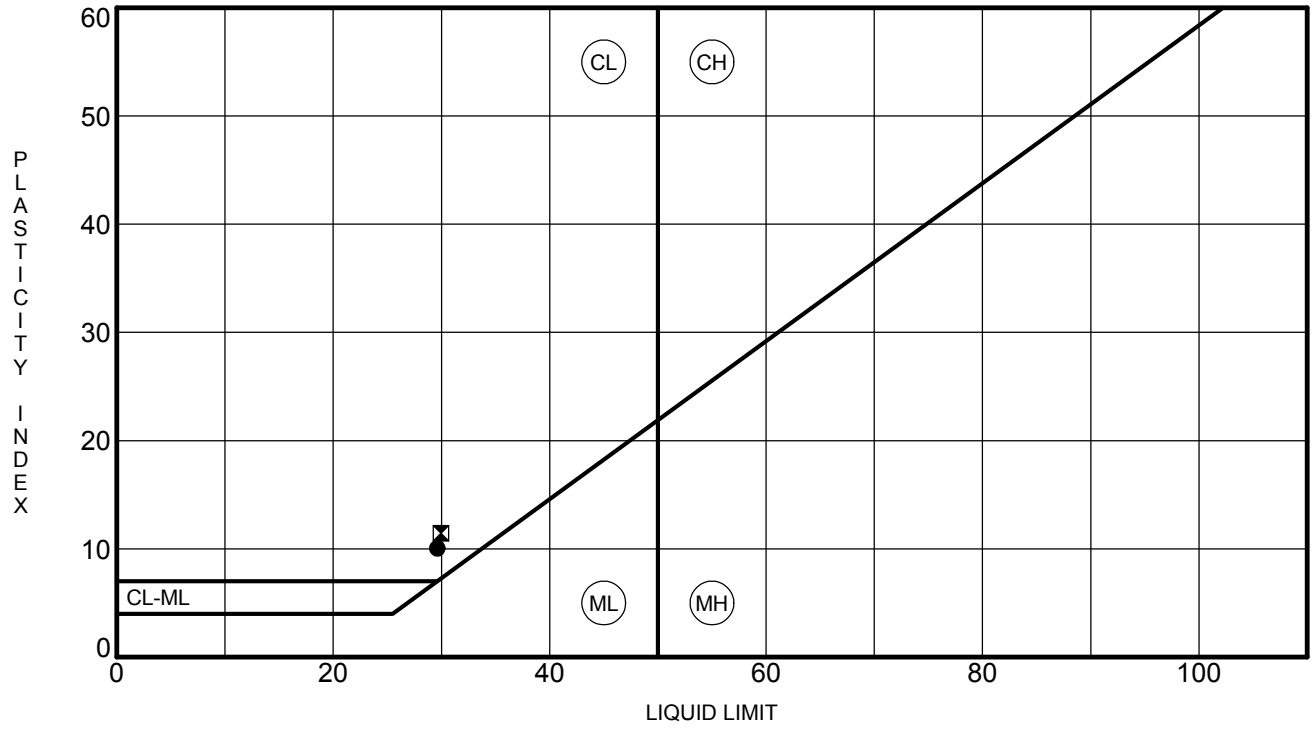
Summary of Laboratory Results

Project: Placer Retirement Residence
Location: Roseville, CA
Number: S1140-05-01
Figure: B1

US LAB SUMMARY GEOTECH 2 WITH EI COLUMN S1140-05-01 PLACER CO. RETIREMENT CENTER.GPJ US LAB.GDT 2/26/16



	Sample No.	Liquid Limit	Plastic Limit	Plasticity Index	% Pass #200 Sieve	Unified Soil Classification Description	Preparation Method
●	**B11-1.5**	**30**	**20**	**10**		**Sandy lean CLAY**	**dry**
⊠	**B6-1.5**	**30**	**18**	**12**		**Sandy lean CLAY with gravel**	**dry**

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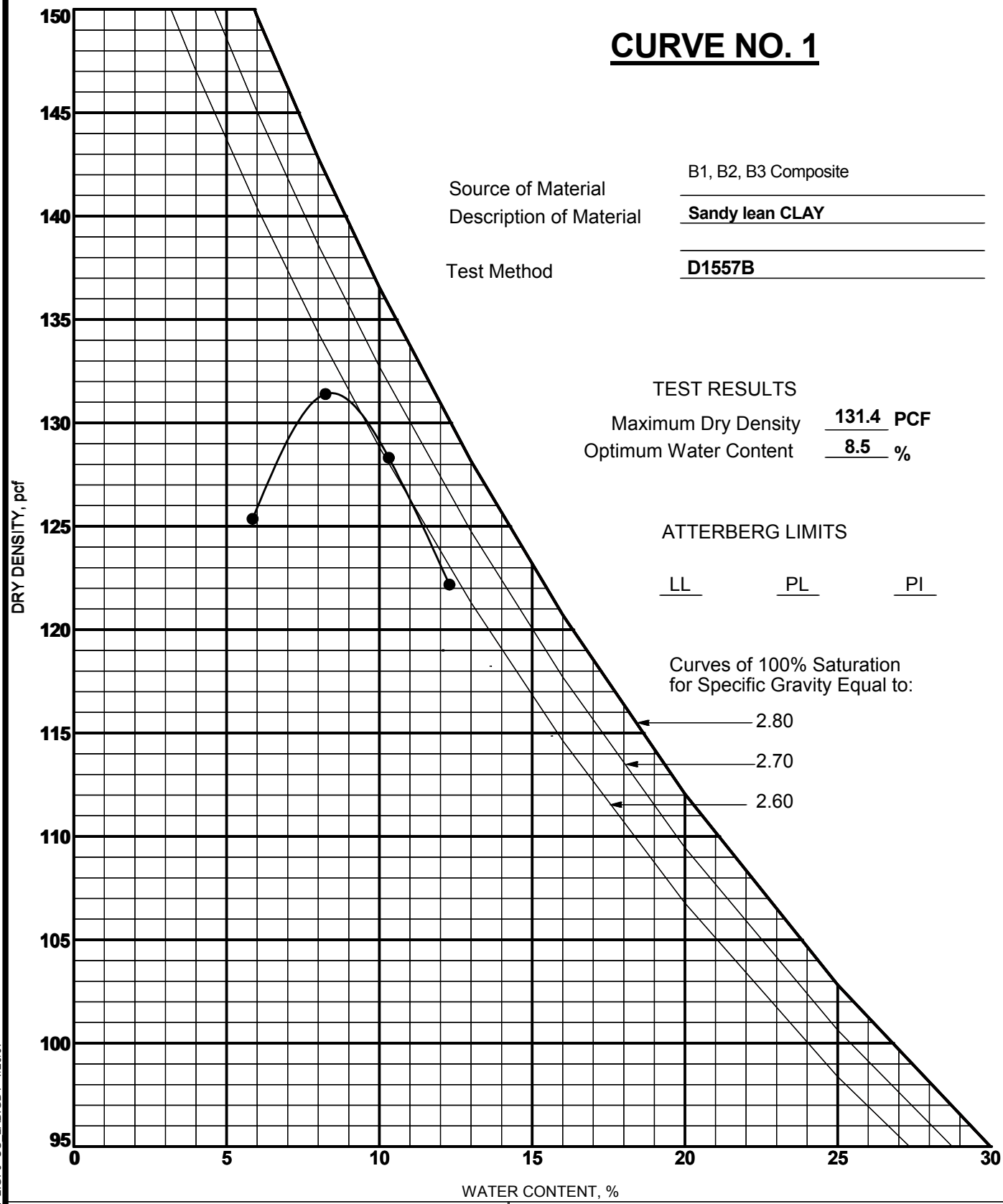
ATTERBERG LIMITS (ASTM D4318)

Project: Placer Retirement Residence
Location: Roseville, CA
Number: S1140-05-01
Figure: B2

PI COPY 2 S1140-05-01 PLACER CO. RETIREMENT CENTER.GPJ US_LAB.GDT 2/26/16

CURVE NO. 1



Source of Material: B1, B2, B3 Composite

Description of Material: **Sandy lean CLAY**

Test Method: **D1557B**

TEST RESULTS

Maximum Dry Density **131.4** **PCF**

Optimum Water Content **8.5** **%**

ATTERBERG LIMITS

LL PL PI

Curves of 100% Saturation for Specific Gravity Equal to:

2.80

2.70

2.60

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MOISTURE-DENSITY RELATIONSHIP

Project: Placer Retirement Residence

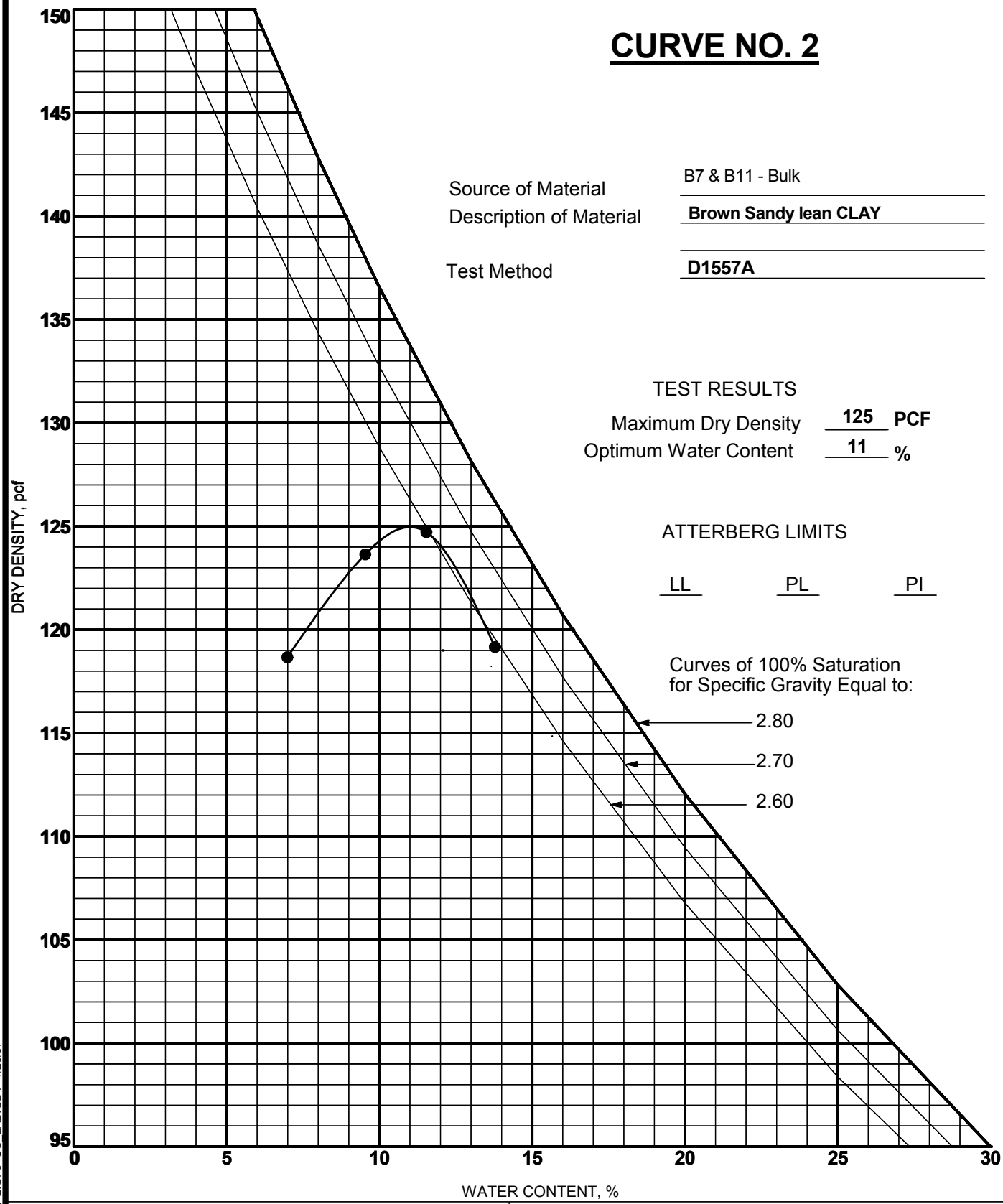
Location: Roseville, CA

Number: S1140-05-01

Figure: B3

US COMPACTION COPY 2.GPJ US LAB.GDT 1/26/07

CURVE NO. 2



Source of Material: B7 & B11 - Bulk

Description of Material: **Brown Sandy lean CLAY**

Test Method: **D1557A**

TEST RESULTS

Maximum Dry Density **125** **PCF**

Optimum Water Content **11** **%**

ATTERBERG LIMITS

LL PL PI

Curves of 100% Saturation for Specific Gravity Equal to:

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MOISTURE-DENSITY RELATIONSHIP

Project: Placer Retirement Residence

Location: Roseville, CA

Number: S1140-05-01

Figure: B4

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