APPENDIX E

Geotechnical Investigation

PREPARED FOR:

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AND COMMUNITY ENRICHMENT
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GEOCON

GEOCON PROJECT NO. S1145-05-21 **MARCH 2023**

Project No. S1145-05-21
March 27, 2023

VIA ELECTRONIC MAIL

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Subject: GEOTECHNICAL INVESTIGATION
DEL PASO PARK – RENFREE FIELD IMPROVEMENTS
3565 AUBURN BOULEVARD
SACRAMENTO, CALIFORNIA

Mr. Day:

In accordance with your authorization, we performed a geotechnical investigation for the subject project. The project consists of renovating the existing Renfree Field at Del Paso Park located at 3565 Auburn Boulevard in Sacramento, California.

The accompanying report presents our findings, conclusions, and recommendations regarding geotechnical aspects of the project as presently proposed. In our opinion, no adverse geotechnical conditions were encountered that would preclude the project, provided the recommendations of 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.

Respectfully Submitted,

GEOCON CONSULTANTS, INC.

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GEOTECHNICAL INVESTIGATION

1.0 PURPOSE AND SCOPE

This report presents the results of our geotechnical investigation for the proposed renovations for the existing Renfree Field at Del Paso Park in Sacramento, California. The approximate site location is depicted on the Vicinity Map, Figure 1.

The purpose of our geotechnical investigation was to observe and sample the subsurface conditions encountered at the site and provide conclusions and recommendations relative to the geotechnical aspects of site improvements as presently proposed.

To prepare this report, we:

- Performed a limited geologic literature review to aid in evaluating the geologic and seismic conditions present at the site. A list of referenced material is included in Section 9.0 of this report.
- Reviewed available conceptual plans to select exploratory boring locations.
- Performed a site reconnaissance to determine access and mark out the proposed exploration locations.
- Notified subscribing utility companies via Underground Service Alert (USA) a minimum of two working days (as required by law) prior to performing excavations at the site.
- Performed five (5) exploratory borings (B1 through B5) with a truck-mounted drill rig equipped with 6-inch-diameter solid-flight augers to depths ranging from approximately 6½ to 16½ feet.
- Obtained representative samples from the exploratory borings.
- Logged the borings in general accordance with the Unified Soil Classification System (USCS).
- Upon completion, backfilled the exploratory borings with soil cuttings.
- Performed laboratory tests to evaluate pertinent geotechnical parameters.
- Prepared this report summarizing our findings, conclusions, and recommendations regarding the geotechnical aspects of site improvements as presently proposed.

Approximate locations of the exploratory borings are shown on the Site Plan, Figure 2 and Proposed Development Plan, Figure 3. Details of our field exploration program including exploratory boring logs are presented in Appendix A. Details of our laboratory testing program and test results are summarized in Appendix B. Landscape soil suitability test results and recommendations by Sunland Analytical Laboratory are presented in Appendix C.

2.0 SITE AND PROJECT DESCRIPTION

The project consists of renovating the existing Renfree Field at Del Paso Park located at 3565 Auburn Boulevard in Sacramento, California. The site is generally flat with approximate surface elevations ranging from 66 to 70 feet above mean sea level (MSL). The park currently includes a baseball field, a playground, a picnic area, a parking lot, concrete walkways, mature trees, and landscaping. The current site configuration is shown on the Site Plan, Figure 2.

The project will include constructing a pedestrian and vehicle concrete pathway, two baseball fields with 30-foot-tall baseball backdrops and 6- to 8-foot tall chain link overthrow fencing, concrete pads for benches and tables, an asphalt parking lot with curbs and driveway, an asphalt basketball court, two pickleball courts, turf planter areas, an irrigation system and well, and street frontage improvements along Auburn Boulevard and Bridge Road. The renovation will likely include the construction of shade structures which will be supported on cast-in-drilled hole (CIDH) concrete piers. The proposed 30-foot-tall baseball fencing will also likely be supported on CIDH concrete piers. The proposed project configuration is shown on the Proposed Development Plan, Figure 3.

3.0 SOIL AND GEOLOGIC CONDITIONS

We identified geologic and soil conditions by observing and sampling exploratory borings and reviewing the referenced geologic literature (Section 9.0). Soil descriptions below include the USCS symbol where applicable. Based on the *Preliminary Geologic Map of the Sacramento 30' x 60' Quadrangle*, California Geological Survey (CGS), 2011, the site is underlain by Quaternary-aged Riverbank Formation (map symbol Qr_2).

3.1 Existing Pavement

In Borings B1 and B2, we encountered approximately 2½ and 3 inches of hot-mix asphalt (HMA) pavement, respectively. We did not encounter pavement in Borings B3 through B5.

3.2 Alluvium (Riverbank Formation)

We encountered alluvium in each of our borings to the maximum depth explored of approximately 16½ feet. The alluvium generally consists of interbedded layers of very loose to very dense silty sand (SM), clayey sand (SC), poorly graded sand (SP), and soft to hard lean clay, sandy lean clay (CL), silty clay (CL-ML), and sandy silty clay (CL-ML). Soil conditions described in the previous paragraphs are generalized. The exploratory boring logs included in Appendix A detail soil type, color, moisture, consistency, and USCS classification of the soils encountered at specific locations and elevations.

3.3 Landscape Soil Suitability

Per the City of Sacramento's request, we collected a surface soil sample within the proposed turf area of the project (future baseball/soccer fields) and submitted it for laboratory analysis of landscape soil suitability. The sample was placed in a re-sealable plastic bag, labeled, and transported to Sunland Analytical Laboratory in Rancho Cordova, California. The laboratory analytical report, prepared by Sunland Analytical, is attached as Appendix C.

4.0 GROUNDWATER

We did not encounter groundwater in our exploratory borings on February 6,2023 to a maximum depth of approximately 16½ feet.

We reviewed available depth-to-groundwater data on the California Department of Water Resources (DWR) *Sustainable Groundwater Management Act (SGMA) Data Viewer* (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#gwlevels). The SGMA Data Viewer website indicates that depth to groundwater at the site ranges from approximately 100 feet to 110 feet (Spring 2022).

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 level observed during our investigation.

5.0 SEISMICITY AND 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. Mapped regional active faults are located several miles away from the site. Therefore, we consider the potential for ground rupture due to onsite active faulting to be low.

5.2 Historical Earthquakes and Ground Shaking

The Sacramento region has a history of relatively low seismicity in comparison with more active seismic regions such as the San Francisco Bay Area or Southern California. The two most commonly referred to earthquakes that resulted in some reported building damage in Sacramento are the Winters and Vacaville events in 1892. There are no reported occurrences of seismic-related ground failure in the Sacramento region due to earthquakes.

We used the United States Geological Survey (USGS) *Unified Hazard Tool* (https://earthquake.usgs.gov/hazards/interactive/) to determine the deaggregated seismic source parameters including controlling magnitude and fault distance. The USGS estimated modal magnitude is 6.7 and the estimated Peak Ground Acceleration (PGA) for the Maximum Considered Earthquake (MCE) with a 2,475-year return period is 0.30g.

5.3 Liquefaction

Liquefaction is a phenomenon in which loose, saturated, cohesionless soil deposits located beneath the groundwater table lose strength when subjected to intense and prolonged ground shaking. The seismic excitation increases pore water pressure, creating a buoyant effect of the loose soil. When liquefaction occurs, building foundations may sink or tilt and differential ground settlement may occur. Other effects include sand boils (ground loss) and lateral spreading if the liquefiable soil is located adjacent to a steep free face. The areas that have the greatest potential for liquefaction are those in which the water table is less than 50 feet below ground surface and the soils are predominately clean, poorly graded sand deposits of loose to medium-dense relative density.

The site is not located in a currently established State of California Seismic Hazard Zone for liquefaction. Based on the geologic conditions encountered at the site, including the lack of groundwater above 50 feet below ground surface, liquefaction potential at the site is expected to be low during seismic events. Mitigation and specific design measures with respect to liquefaction are not necessary for the project.

5.4 Expansive Soil

Laboratory Plasticity Index and Expansion Index tests on selected near-surface soil samples indicate low plasticity and corresponding low expansion potential. Mitigation and specific design measures with respect to expansive soil are not necessary.

5.5 Soil Corrosion Potential

We performed pH, resistivity, chloride, and sulfate tests on representative soil samples to generally evaluate the corrosion potential of the soil with respect to proposed subsurface structures. These tests were performed in accordance with California Test Method (CTM) Nos. 643, 422, and 417. The results are presented in Table 5.6A and should be considered for design of underground structures.

TABLE 5.5A
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)
B3 Bulk	0-5	8.1	1,770	3.2	186.4

Note: ppm = parts per million

Soil with a low pH (higher acidity) is considered corrosive as it can react with lime in cement to leach out soluble reaction products and result in a more porous and weaker concrete. Per Caltrans *Corrosion Guidelines* (Caltrans, 2021), soil with a pH of 5.5 or lower may be corrosive to concrete or steel in contact with the ground. Based on the laboratory pH test results and Caltrans criteria, soil at the locations tested does not have a higher propensity for corrosion.

Soil resistivity is the measure of the soil's ability to transmit electric current. Corrosion of buried ferrous metal is proportional to the resistivity of the soil. A lower resistivity indicates a higher propensity for transmitting electric currents that can cause corrosion of buried ferrous metal items. In general, the higher the resistivity, the lower the rate for corrosion. Per Caltrans *Corrosion Guidelines*, resistivity serves as an indicator parameter for the possible presence of soluble salts and it is not included as a parameter to define a corrosive area for structures. A minimum resistivity value for soil less than 1,500 ohm-cm may indicate the presence of high quantities of soluble salts and a higher propensity for corrosion. Based on the laboratory minimum resistivity test results and Caltrans criteria, soil at the locations tested does not have a higher propensity for corrosion.

Table 5.6B presents a summary of concrete requirements set forth by the California Building Code (CBC) Section 1904 and American Concrete Institute (ACI) 318 for possible chloride exposure. Chlorides can break down the protective oxide layer on steel surfaces resulting in corrosion. Sources of chloride include, but are not limited to, deicing chemicals, salt, brackish water, seawater, or spray from these sources.

TABLE 5.6B
REQUIREMENTS FOR CONCRETE EXPOSED TO CHLORIDE-CONTAINING SOLUTIONS
(AFTER ACI 318 TABLES 19.3.1.1 and 19.3.2.1)

Chloride Severity	Exposure Class	Condition	Maximum Water to Cement Ratio by Weight	Minimum Compressive Strength (psi)
Not Applicable	C0	Concrete dry or protected from moisture	N/A	2,500
Moderate	C1	Concrete exposed to moisture but not to external sources of chlorides	N/A	2,500
Severe	C2	Concrete exposed to moisture and an external source of chlorides	0.40	5,000

The appropriate Chloride Severity/Exposure Class should be determined by the project designer based on the specific conditions at the location of the proposed structure. Further guidance is provided in ACI 318. Per Caltrans *Corrosion Guidelines*, soil with a chloride concentration of 500 ppm or higher may be corrosive to steel structures or steel reinforcement in concrete. Based on Caltrans criteria, soil at the locations tested is not corrosive with respect to chloride content.

Table 5.6C presents a summary of concrete requirements set forth by CBC Section 1904 and ACI 318 for sulfate exposure. Similar to chlorides, sulfates can break down the protective oxide layer on steel leading to corrosion. Sulfates can also react with lime in cement to soften and crack concrete.

TABLE 5.6C
REQUIREMENTS FOR CONCRETE EXPOSED TO SULFATE-CONTAINING SOLUTIONS
(AFTER ACI 318 TABLES 19.3.1.1 and 19.3.2.1)

Sulfate Severity	Exposure Class	Water-Soluble Sulfate (SO_4) Content		Cement Type (ASTM C 150)	Maximum Water to Cement Ratio by Weight[1]	Minimum Compressive Strength (psi)
		Percent By Mass	Parts Per Million (ppm)			
Not Applicable	S0	$SO_4 < 0.10$	$SO_4 < 1,000$	No Type Restriction	N/A	2,500
Moderate	S1	$0.10 \le SO_4 < 0.20$	$1,000 \le SO_4 < 2,000$	II	0.50	4,000
Severe	S2	$0.20 \le SO_4 \le 2.00$	$2,000 \le SO_4 \le 20,000$	V	0.45	4,500
Very Severe	S3 – Option 1	$SO_4 > 2.00$	$SO_4 > 20,000$	V+Pozzolan or Slag	0.45	4,500
	S3 – Option 2			V	0.40	5,000

Notes:

1. Maximum water to cement ratio limits are different for lightweight concrete, see ACI 318 for details.

Based on the laboratory test results, the Sulfate Severity is classified as “Not Applicable”, and the Exposure Class is S0. The concrete mix deign(s) should be developed accordingly. The presence of water-soluble sulfates is not a visually discernible characteristic; therefore, other soil samples from the site could yield different concentrations. Additionally, over time landscaping activities (i.e., addition of fertilizers and other soil nutrients) may affect the concentration.

Geocon does not practice in the field of corrosion engineering and the above information is provided as screening criteria only. If corrosion sensitive improvements are planned, we recommend that further evaluations by a corrosion engineer be performed to incorporate the necessary precautions to avoid premature corrosion on buried metal pipes and metal or concrete structures in direct contact with the soils.

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 Conclusions and recommendations provided in this report are based on our review of referenced literature, analysis of data obtained from our field exploration, laboratory testing program, and our understanding of the proposed development at this time. 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 Seismic design of the structure should be performed in accordance with the provisions of the 2019 California Building Code (CBC) which is based on the American Society of Civil Engineers (ASCE)/Structural Engineering Institute (SEI) publication: *ASCE/SEI 7-16, Minimum Design Loads and Associated Criteria for Buildings and Other Structures* (ASCE/SEI, 2017). We used the *Structural Engineers Association of California* (SEAOC) and *Office of Statewide Health Planning and Development* (OSHPD) web application *Seismic Design Maps* (https://seismicmaps.org/) to evaluate site-specific seismic design parameters in accordance with ASCE 7-16.

For seismic design purposes, sites are classified as Site Class "A" through "F" as follows:

- Site Class A – Hard Rock;
- Site Class B – Rock;
- Site Class C – Very Dense Soil and Soft Rock;
- Site Class D – Stiff Soil;
- Site Class E – Soft Clay Soil; and
- Site Class F – Soils Requiring Site Response Analysis.

Based on the subsurface conditions at the site, the Site Classification is Site Class "D" per Table 20.3-1 of ASCE/SEI 7-16. For the purposes of evaluating code-based seismic parameters for design, we assumed a seismic Risk Category I, II, or III (per the CBC) for the project. Results are summarized in Table 6.2.1.

TABLE 6.2.1
ASCE 7-16 SEISMIC DESIGN PARAMETERS
SITE CLASS "D" – STIFF SOIL

Parameter	Value	ASCE 7-16 Reference
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	0.484g	Figure 22-1
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.232g	Figure 22-2
Site Coefficient, F_A	1.413	Table 11.4-1
Site Coefficient, F_V	2.136	Table 11.4-2
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	0.684g	Eq. 11.4-1
Site Class Modified MCE_R Spectral Response Acceleration (1 sec), S_{M1}	0.744g*	Eq. 11.4-2
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.456g	Eq. 11.4-3
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.496g*	Eq. 11.4-4

* Per Supplement 3 of ASCE7-16 (effective November 5, 2021), a ground motion hazard analysis (GMHA) shall be performed for projects on Site Class "D" sites with 1-second spectral acceleration (S1) greater than or equal to 0.2g, which is true for this site. However, Supplement 3 of ASCE 7-16 provides an exception stating that that the GMHA may be waived provided that the parameter SM1 is increased by 50% for all applications of SM1. The values for parameters SM1 and SD1 presented above have been increased in accordance with Supplement 3 of ASCE 7-16.

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 7-16 for the mapped maximum considered geometric mean (MCE_G).

TABLE 6.2.2
ASCE 7-16 SITE ACCELERATION DESIGN PARAMETERS

Parameter	Value	ASCE 7-16 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.204g	Figure 22-7
Site Coefficient, F_{PGA}	1.396	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.285g	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 Soil Excavation Characteristics

6.3.1 In our opinion, grading and excavations at the site may be accomplished with standard effort using heavy-duty grading/excavation equipment. We do not anticipate project excavations to generate oversized rock material (greater than 6 inches in dimension) or boulders.

6.3.2 Temporary excavations must meet Cal-OSHA requirements as appropriate. 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 to protect nearby utilities, structures, and other improvements that may be damaged by earth movements.

6.3.3 The excavation support recommendations provided by Cal-OSHA are generally geared toward protecting human life and not necessarily toward 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.

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

6.3.5 If grading occurs during or after the wet season (typically winter and spring), or in periods of precipitation, in-place and excavated soils will likely be wet. Earthwork contractors should be aware of moisture sensitivity of clayey and fine-grained soils and potential compaction/workability difficulties.

6.3.6 Earthwork and pad preparation operations in these conditions will likely be difficult with low productivity. 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. Conversely, during dry summer and fall months, dry clay soils may require additional grading effort (discing, mixing, or other means) to attain proper moisture conditioning.

6.3.7 Based on laboratory testing, in-situ moisture content of site soils ranges from approximately 9% to 25% which is higher than optimum moisture content, which is approximately 8%. Due to the fine-grained nature of the soils and measured in-situ moisture contents above optimum, additional drying efforts to attain moisture contents suitable for compaction should be anticipated regardless of the time of year. Mitigation alternatives may include aerating/drying the exposed soils (assuming favorable weather conditions), or chemical treatment (e.g., lime treatment). Unstable excavation bottoms may require overexcavating 12 to 18 inches and placing geotextile fabric/geogrid covered with aggregate, for stabilization. We can provide specific recommendations during construction, based on conditions encountered.

6.4 Materials for Fill

6.4.1 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. Due to high in-situ moisture content, native soils reused as engineered fill will likely require aerating/drying to attain suitable moisture content for compaction, regardless of the time of year.

6.4.2 Import soil for general use (if needed) should be similar to onsite, native soils (e.g., similar plasticity and grain size distribution characteristics). Import soil should be free of organic material and construction debris, and should not contain rock/cementations larger than 6 inches in greatest dimension.

6.4.3 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.

6.5 Grading

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

6.5.2 All references to relative compaction and optimum moisture content in this report are based on the latest ASTM D1557 Test Procedure. Structural areas should be considered the areas extending a minimum of 5 feet beyond the outside dimensions of structures, including footings or overhangs carrying structural loads.

6.5.3 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.

6.5.4 Site preparation should begin with complete removal of existing pavement, underground utilities, debris, and organic-rich topsoil. 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.

6.5.5 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.

6.5.6 After site preparation and over-excavation (where needed), exposed soil should be scarified 6 to 8 inches, uniformly moisture-conditioned at or above optimum moisture content, and compacted to at least 90% relative compaction. Scarification and recompaction operations should be performed in the presence of a Geocon representative to evaluate performance of the subgrade under compaction equipment loading and to identify any loose or unstable soil conditions that could require additional excavation.

6.5.7 Engineered fill consisting of onsite native sources and/or import fill material should be compacted in horizontal lifts not exceeding 8 inches (loose thickness) and brought to final subgrade elevations. Each lift should be moisture-conditioned at or above optimum and compacted to at least 90% relative compaction.

6.5.8 Final pavement subgrade, whether completed at-grade, by excavation, or by filling should be uniformly moisture-conditioned at or above optimum moisture content, compacted to at least 95% relative compaction and be stable. The 95% relative compaction requirement applies to the top 6 inches of pavement area subgrade; however, underlying materials must be sufficiently compacted and stable. We 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). We note that deeper scarification, moisture-conditioning, and compaction efforts may be required in order to achieve overall stability and compaction.

6.5.9 Underground utility trenches within structural areas should be backfilled with properly compacted material. 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 or 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.

6.6 Foundations – Shade Structures and Baseball Field Fencing

6.6.1 Proposed shade structure foundations and baseball field fencing will consist of CIDH concrete friction piers. CIDH piers should have a minimum diameter of 12 inches, a minimum embedment depth of 6 feet, and be designed using an allowable unit skin friction of 450 pounds per square foot (psf) to resist vertical downward loads. An allowable unit skin friction of 300 psf plus the weight of the pier may be used to resist uplift loads. The allowable downward capacity and allowable uplift capacity may be increased by one-third when considering transient wind or seismic loads. Piers should have a minimum center-to-center spacing of at least three pier diameters.

6.6.2 Allowable passive pressure used to resist lateral movement of the piers may be assumed to be equal to a fluid weighing 300 pounds per cubic foot (pcf) with a maximum earth pressure of 3,000 psf. The allowable passive pressure may be applied over two pier diameters for isolated piers with a minimum center-to-center spacing of at least three pier diameters. The allowable passive pressure assumes a horizontal surface extending at least 5 feet or three times the surface generating the passive pressure, whichever is greater. The upper 1 foot should not be included in the design for lateral resistance.

6.6.3 The bottom of pier excavations should be cleaned of loose cuttings prior to the placement of steel and concrete. Experience indicates that backspinning the auger does not remove loose material, and a flat cleanout plate is necessary.

6.6.4 Suction effects created during auger withdrawal from the piers (during construction) can induce caving in fine-grained/clay soils. The contractor should be aware and prepared to mitigate for these potential caving conditions during construction.

6.6.5 If seepage or groundwater is encountered, water should be pumped from the pier excavation prior to placement of concrete.

6.6.6 A Geocon representative should be present during pier drilling to confirm that subsurface conditions encountered are consistent with those expected. If unexpected conditions are encountered, foundation modifications may be required.

6.7 Retaining Walls

6.7.1 Design of retaining walls and buried structures may be based on the lateral earth pressures (equivalent fluid pressure) summarized in Table 6.7.1.

TABLE 6.7.1
RECOMMENDED LATERAL EARTH PRESSURES

Condition	Equivalent Fluid Density
Active	40 pcf
At-Rest	60 pcf
Seismic[1]	Not Applicable

1. Based on recent research (Lew, et al. 2010), the seismic increment of earth pressure may be neglected if the maximum peak ground acceleration (PGA) at the site is 0.4 g or less. The Site Class Modified MCE_G Peak Ground Acceleration (PGAM) for this site is 0.21g; therefore, the seismic increment of earth pressure may be neglected.

6.7.2 Unrestrained walls 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 (such as basement walls) should be designed using the at-rest case. The soil pressures above assume that the backfill material within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall will be composed of the existing onsite soils.

6.7.3 Retaining wall foundations with a minimum depth of 18 inches may be designed using an allowable bearing capacity of 2,000 psf. To resist lateral movement of retaining wall foundations, an allowable passive earth pressure equivalent to a fluid density of 350 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 0.35 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%.

6.7.4 The lateral earth pressure values listed in Table 6.7.1 assume drained backfill conditions. Retaining walls taller than 2 feet should be provided with a drainage system and 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.

6.7.5 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 retained height of 10 feet. In the event that walls higher than 10 feet or other types of walls are planned, Geocon should be consulted for additional recommendations.

6.8 Concrete Sidewalks and Flatwork

6.8.1 Sidewalk, curb, and gutter within City right-of-way should be designed and constructed in accordance with the latest City of Sacramento standards and details as applicable. The City of Sacramento requires at least 6 inches of compacted Class 2 aggregate base (AB) below concrete sidewalks for sites with an Expansion Index less than 75.

6.8.2 Onsite exterior concrete flatwork not subject to traffic loads should be at least 4 inches thick and be underlain by at least 6 inches of Class 2 AB compacted to at least 90% relative compaction.

6.8.3 We recommend using construction and control joints in accordance with ACI and/or PCA guidelines. 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 movement could impact doorway operation. Dowels should be used at these locations.

6.9 Hot Mix Asphalt Pavement

6.9.1 We performed Resistance-Value (R-Value) testing on a representative bulk soil sample from proposed pavement areas. Our testing resulted in an R-Value of 12 (Appendix B). To account for subgrade soil variability, we recommend using an R-Value of 10 for pavement design.

6.9.2 The project civil engineer should determine the appropriate Traffic Index (TI) for pavement design. Table 6.9.2 provides alternative pavement sections based on the design methods of Caltrans' *Highway Design Manual* for various TIs. We can provide additional section designs upon request.

TABLE 6.9.2
FLEXIBLE PAVEMENT SECTIONS

Traffic Index	5.0	6.0	6.5	7.0
HMA (in.)	3.0	3.5	4.0	4.0
AB (in.)	9.0	12.0	13.0	14.0
Total Section Thickness (in.)	12.0	15.5	17.0	18.0

6.9.3 The recommended pavement section is based on the following assumptions:

1. Pavement subgrade soil has an R-Value of at least 10.
2. Class 2 AB has a minimum R-Value of 78 and meets the requirements of Section 26 of Caltrans' *Standard Specifications*.
3. Class 2 AB and the top 6 inches of subgrade are compacted to 95% or higher relative compaction at or near optimum moisture content.
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.

6.9.4 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 extend at least 6 inches or more into the soil subgrade beneath the AB. Alternatively, modified drop-inlets that contain weep-holes may be used to encourage accumulated water to drain from beneath the pavement.

6.9.5 Asphalt pavement section recommendations for driveways and parking areas are based on the design procedures of Caltrans' *Highway Design Manual* (Design Manual), Chapter 600, updated December 20, 2004. It should be noted that 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 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. Periodic maintenance of the pavement in these areas, therefore, should be anticipated.

6.10 Rigid Concrete Pavement

6.10.1 If rigid PCC pavement is used in automobile/light-truck traffic areas and in front of trash bin areas, we recommend that the concrete be at least 6 inches thick. PCC pavement should be underlain by at least 6 inches of Class 2 AB meeting the requirements of Section 26 of Caltrans' *Standard Specifications* and compacted to at least 95% relative compaction. Subgrade soils should be prepared and compacted in accordance with the recommendations of this report.

6.10.2 Subgrade soils should be prepared and compacted in accordance with the recommendations of this report. Subgrade should be finished to a smooth, unyielding surface and proof-rolled with a loaded water truck to verify stability.

6.10.3 PCC should have a minimum 28-day compressive strength of 3,500 pounds per square inch (psi). Adequate construction and crack control joints should be used to control cracking inherent in concrete construction. We note that the American Concrete Pavement Association (ACPA) recommends a maximum joint spacing no greater than 24X the slab thickness for PCC pavements directly underlain by granular bases.

6.10.4 Steel reinforcement, if used, should be detailed in accordance with PCA, ACI, or similar guidelines. Alternatively, macro synthetic fibers (Euclid Chemical Tuf-Strand SF or equivalent) mixed into the concrete mix may be considered in lieu of conventional steel reinforcement provided they meet the requirements of ASTM C1116 and ASTM D7508 for Type III Synthetic Fibers.

6.10.5 Adequate dowels should also be used at joints to facilitate load transfer and reduce vertical offset. In addition, the recommendations in Section 6.11.4 pertaining to deepened curbs, moisture cut-offs, and subsurface drainage apply to concrete pavements, sidewalks and flatwork, as well as asphalt pavements.

6.10.6 In general, we recommend that concrete pavements be detailed, designed, constructed, and maintained in accordance with industry standards such as those provided by the ACI and ACPA.

6.11 Site Drainage and Moisture Protection

6.11.1 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 2019 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.

6.11.2 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.

6.11.3 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; or
- Using appropriately spaced area drains.

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

6.11.4 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 foundation and grading plans prior to final design submittal to assess whether our recommendations have been properly incorporated 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 throughout the construction phase and provide construction observation and testing services. Providing these services during construction is important to maintain continuity of geotechnical interpretation and to confirm that field conditions encountered during construction are similar to those anticipated during design. Testing and observation services by the Geotechnical Engineer of Record are necessary to verify that construction has been performed in accordance with this report, approved plans, and specifications. 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 AND UNIFORMITY OF CONDITIONS

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.

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 that 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

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3. California Building Standards Commission, *2019 California Building Code*, based on *2018 International Building Code*, International Code Council.
4. California Department of Transportation, *Highway Design Manual, Chapter 600*, updated November 20, 2017.
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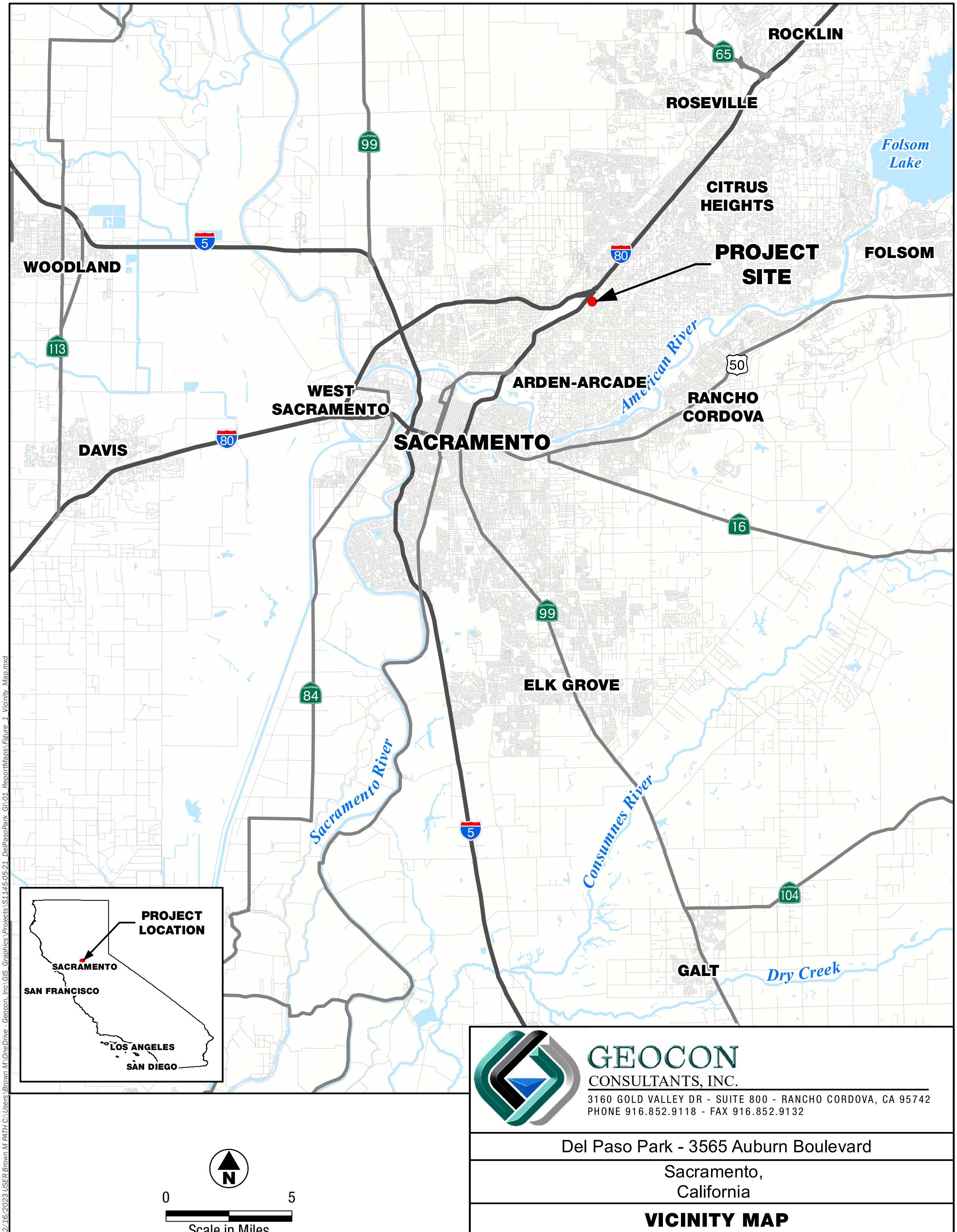

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Sacramento,
California

VICINITY MAP

S1145-05-21	March 2023	Figure 1

Legend

B5 ⊗ Approximate Boring Location

N

0 100

Scale in Feet

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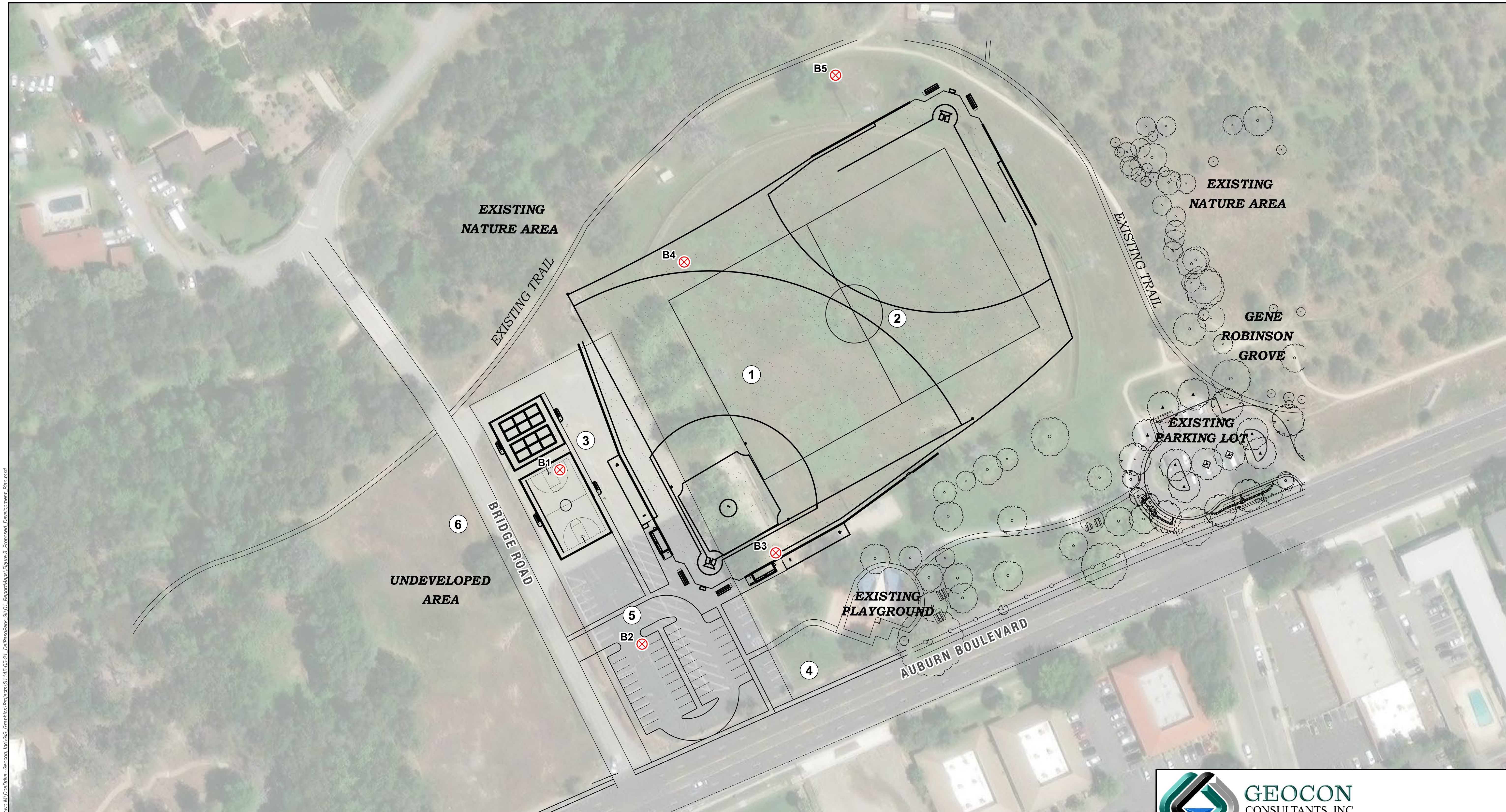
SITE PLAN

S1145-05-21	March 2023	Figure 2



Proposed Development Plan; City of Sacramento 08/2022

Legend

B5 ⊗ Approximate Boring Location

1. New Youth Basebal 300' and 2nd Ballfield
2. New Soccer Field (210' x 300')
3. New Basketball and 2 Pickleball Courts
4. New Walkway to Science Center
5. Parking Lot (36 Spaces)
6. Regrade and Hydroseed

N

0 100

Scale in Feet

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PROPOSED DEVELOPMENT PLAN

S1145-05-21	March 2023	Figure 3

APPENDIX A

APPENDIX A

FIELD EXPLORATION

We performed our geotechnical field exploration on February 6,2023. Our field exploration program consisted of performing five exploratory borings (B1 through B5). The approximate locations of our borings are shown on the Site Plan, Figure 2 and the Proposed Development Plan, Figure 3.

Exploratory borings were performed using a truck-mounted CME55 drill rig equipped with 6-inch outside diameter (OD) solid-flight augers. Soil sampling was performed using an automatic 140-pound hammer with a 30-inch drop. We obtained samples using a 3-inch OD split-spoon (California Modified) sampler or a 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.

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

LABORATORY TEST KEY

- CP – COMPACTION CURVE (ASTM D1557)
- CR – CORROSION ANALYSIS (CTM 422, 643, 417)
- DS – DIRECT SHEAR (ASTM D3080)
- EI – EXPANSION INDEX (ASTM D4829)
- GSA – GRAIN SIZE ANALYSIS (ASTM D422)
- MC – MOISTURE CONTENT (ASTM D2216)
- PI – PLASTICITY INDEX (ASTM D4318)
- R – R-VALUE (CTM 301)
- SE – SAND EQUIVALENT (CTM 217)
- TXCU – CONSOLIDATED UNDRAINED TRIAXIAL (ASTM D4767)
- TXUU – UNCONSOLIDATED UNDRAINED TRIAXIAL (ASTM D2850)
- UC – UNCONFINED COMPRESSIVE STRENGTH (ASTM D2166)

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
3/8-INCH TO 1 1/4-INCH	VERY THINLY BEDDED
LESS THAN 3/8-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

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KEY TO LOGS

Figure A1

BORING B1

ELEV. (MSL.) ____________ DATE COMPLETED **2/6/2023**

ENG./GEO. **T. Henderson** DRILLER **V&W Drilling**

EQUIPMENT **CME 55 Truck-mounted Drill w/ 6" SFA** HAMMER TYPE **Automatic | 140 lb.**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	B1-BULK				**ASPHALT CONCRETE (AC)** 2.5 inches				CP
				SM	**ALLUVIUM** Very loose, moist, brown, Silty SAND, trace clay				
1									
	B1-1.5						106.7	14.7	
2	B1-2					4			
3					- loose				
	B1-3.5						108.8	14.7	
4	B1-4					8			
5	B1-5				- medium dense				
	B1-5.5								
6	B1-6					17			

BORING TERMINATED AT 6.5 FEET
NO GROUNDWATER ENCOUNTERED
BACKFILLED WITH SOIL CUTTINGS
CAPPED WITH RAPID SET CONCRETE

Figure A2, Log of Boring, page 1 of 1

IN PROGRESS S1145-05-21 DEL PASO PARK.GPJ 03/20/23

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

PROJECT NO. **S1145-05-21** PROJECT NAME **Del Paso Park - Renfree Field**

BORING B2

ELEV. (MSL.) ____ DATE COMPLETED **2/6/2023**

ENG./GEO. **T. Henderson** DRILLER **V&W Drilling**

EQUIPMENT **CME 55 Truck-mounted Drill w/ 6" SFA** HAMMER TYPE **Automatic | 140 lb.**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	B2-BULK				**ASPHALT CONCRETE (AC)** 3 inches				PI, GSA, R
1				CL-ML	**ALLUVIUM** Soft, moist, brown, Sandy SILTY CLAY				
2	B2-1.5, B2-2					6	113.4	16.3	
					- dark brown				
3				CL	Hard, moist, brown, Lean CLAY, PP>4.5 tsf				
	B2-3.5						97.1	25.3	
4	B2-4				- hardpan layer	76/10"			
5									
	B2-5.5			SC	Dense, moist, yellowish brown, Clayey SAND				
6	B2-6					64			

BORING TERMINATED AT 6.5 FEET
NO GROUNDWATER ENCOUNTERED
BACKFILLED WITH SOIL CUTTINGS
CAPPED WITH RAPID SET CONCRETE

GEOCON

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

BORING B3

ELEV. (MSL.) ___________ DATE COMPLETED **2/6/2023**

ENG./GEO. **T. Henderson** DRILLER **V&W Drilling**

EQUIPMENT **CME 55 Truck-mounted Drill w/ 7" HSA** HAMMER TYPE **Automatic | 140 lb.**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	B3-BULK			SC	**ALLUVIUM** Medium dense, moist, brown and gray, Clayey SAND, few gravel				PI, GSA, EI, CR
1									
	B3-1.5							9.4	
2	B3-2					19			
3				CL	Very stiff, moist, brown, Sandy Lean CLAY, PP=3.5 tsf				
	B3-3.5						117.8	14.8	
4	B3-4			SC	Medium dense, moist, brown, Clayey SAND	25			
5									
	B3-5.5			CL	Hard, moist, brown, Sandy Lean CLAY, PP>4.5 tsf				
6	B3-6					54	116.7	14.9	
7									
8	B3-8			SC	Dense, moist, reddish grayish brown, Clayey SAND				
	B3-8.5					61			
9									
10	B3-10				- damp	50/5"			
11									
12									
13									
14				SP	Medium dense, damp, grayish tan, Poorly Graded SAND				
15	B3-15								
	B3-15.5								
16	B3-16					40			
					BORING TERMINATED AT 16.5 FEET NO GROUNDWATER ENCOUNTERED BACKFILLED WITH SOIL CUTTINGS				

Figure A4, Log of Boring, page 1 of 1

IN PROGRESS S1145-05-21 DEL PASO PARK.GPJ 03/20/23

GEOCON

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ☒ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◪ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

PROJECT NO. **S1145-05-21** PROJECT NAME **Del Paso Park - Renfree Field**

BORING B4

ELEV. (MSL.) ____________ DATE COMPLETED **2/6/2023**

ENG./GEO. **T. Henderson** DRILLER **V&W Drilling**

EQUIPMENT **CME 55 Truck-mounted Drill w/ 6" SFA** HAMMER TYPE **Automatic | 140 lb.**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	B4-BULK			SM	**ALLUVIUM** Very loose, moist, brown, Silty SAND				
1	B4-1							12.3	
2						5			
3									
4	B4-4					17	111.0	15.7	
5	B4-5 B4-5.5			SP	Medium dense, moist to wet, yellowish brown, Poorly Graded SAND				
6	B4-6			SC	Medium dense, moist, reddish brown, Clayey SAND, hardpan layer	42			

BORING TERMINATED AT 6.5 FEET
NO GROUNDWATER ENCOUNTERED
BACKFILLED WITH SOIL CUTTINGS

Figure A5, Log of Boring, page 1 of 1

GEOCON

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

PROJECT NO. **S1145-05-21** PROJECT NAME **Del Paso Park - Renfree Field**

BORING B5

ELEV. (MSL.) ____________ DATE COMPLETED **2/6/2023**

ENG./GEO. **T. Henderson** DRILLER **V&W Drilling**

EQUIPMENT **CME 55 Truck-mounted Drill w/ 7" HSA** HAMMER TYPE **Automatic | 140 lb.**

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	B5-BULK			SM	**ALLUVIUM** Very loose, moist, dark brown, Silty SAND				PI, GSA
1									
2	B5-1.5, B5-2					5	113.1	14.5	
3					- loose, moist to wet, brown				
4	B5-3.5, B5-4				- with some clay	7	109.4	19.0	
5									
6	B5-5.5, B5-6				- medium dense, wet	19	108.8	16.5	
7									
8	B5-8, B5-8.5			CL-ML	Hard, moist, brownish gray with orange mottling, Silty CLAY, PP>4.5 tsf	97/9"			
9									
10	B5-10, B5-10.5					70/12"			
11				SC	Very dense, damp, yellowish brown, Clayey SAND				
12									
13									
14				SP	Medium dense, damp, grayish tan, Poorly Graded SAND				
15	B5-15, B5-15.5								
16	B5-16					39			

BORING TERMINATED AT 16.5 FEET
NO GROUNDWATER ENCOUNTERED
BACKFILLED WITH SOIL CUTTINGS

Figure A6, Log of Boring, page 1 of 1

GEOCON

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

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, fines content, corrosion potential, expansion potential, pavement support characteristics and moisture-density relationship. The results of the laboratory tests are presented on the following pages.

TABLE B1
EXPANSION INDEX TEST RESULTS
ASTM D4829

Sample Number	Depth (feet)	Moisture Content (%)		Expansion Index	Classification*
		Before Test	After Test		
B3-Bulk	0 – 5	9.0	16.2	16	Very Low

Expansion Potential Classification per ASTM D4829

TABLE B2
R-VALUE TEST RESULTS
ASTM D2844

Sample Number	Depth (feet)	Average Dry Density (pcf)	Average Moisture Content (%)	R-Value
B2-Bulk	0 – 5	121.1	12.5	12

Sample ID	Depth (feet)	Liquid Limit	Plastic Limit	Plasticity Index	Expansion Index	%<#200 Sieve	Water Content (%)	Dry Density (pcf)
B1-1.5	1.5						14.7	106.7
B1-3.5	3.5						14.7	108.8
B2-Bulk	0-5	18	14	4		57.9		
B2-2	2						16.3	113.4
B2-3.5	3.5						25.3	97.1
B3-Bulk	0-5	25	15	10	16	49.3		
B3-1.5	1.5						9.4	
B3-3.5	3.5						14.8	117.8
B3-6	6						14.9	116.7
B4-1	1						12.3	
B4-4	4						15.7	111.0
B5-Bulk	0-5	18	17	1		38.6		
B5-2	2						14.5	113.1
B5-4	4						19.0	109.4
B5-6	6						16.5	108.8

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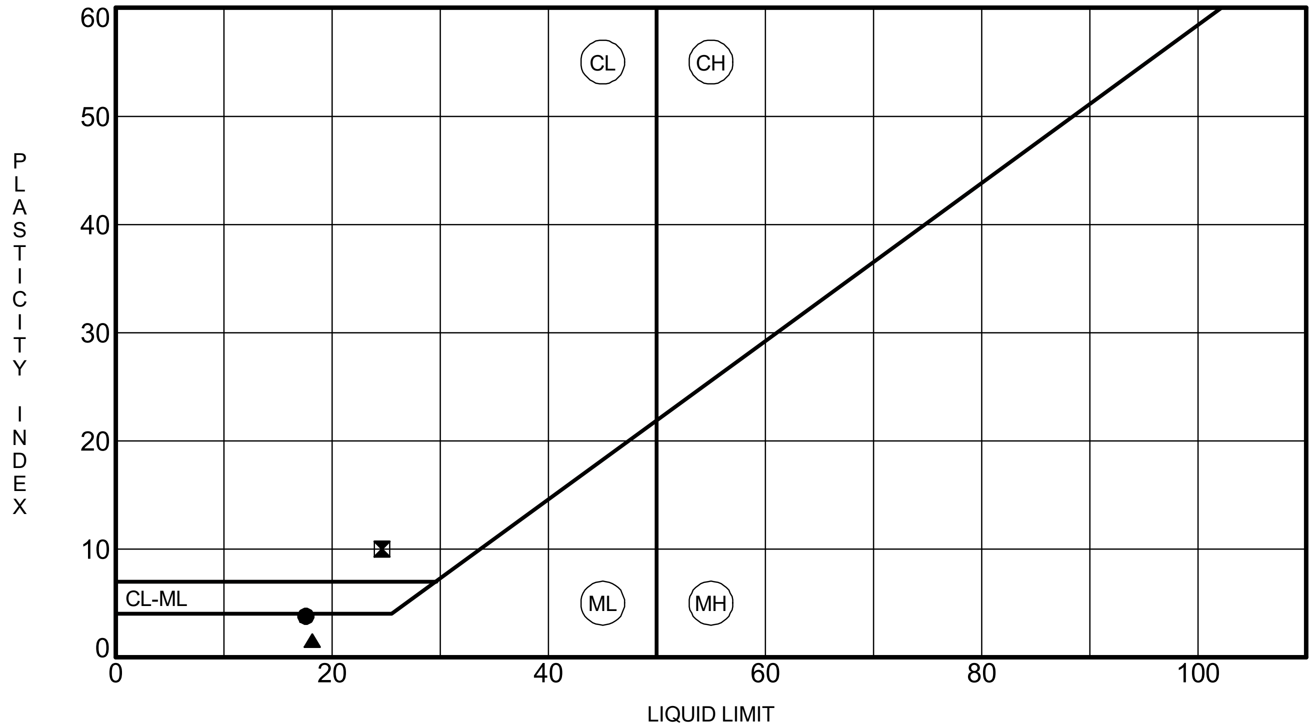
Geocon Consultants, Inc.
3160 Gold Valley Drive, Suite 800
Rancho Cordova, CA 95742
Telephone: 916-852-9118

Summary of Laboratory Results

Project: Del Paso Park - Renfree Field
Location: Sacramento, California
Number: S1145-05-21
Figure: B1



	Sample No.	Liquid Limit	Plastic Limit	Plasticity Index	% Pass #200 Sieve	Unified Soil Classification Description	Preparation Method
●	**B2-Bulk**	**18**	**14**	**4**	**57.9**	**SANDY SILTY CLAY(CL-ML)**	**dry**
⊠	**B3-Bulk**	**25**	**15**	**10**	**49.3**	**CLAYEY SAND(SC)**	**dry**
▲	**B5-Bulk**	**18**	**17**	**1**	**38.6**	**SILTY SAND(SM)**	**dry**

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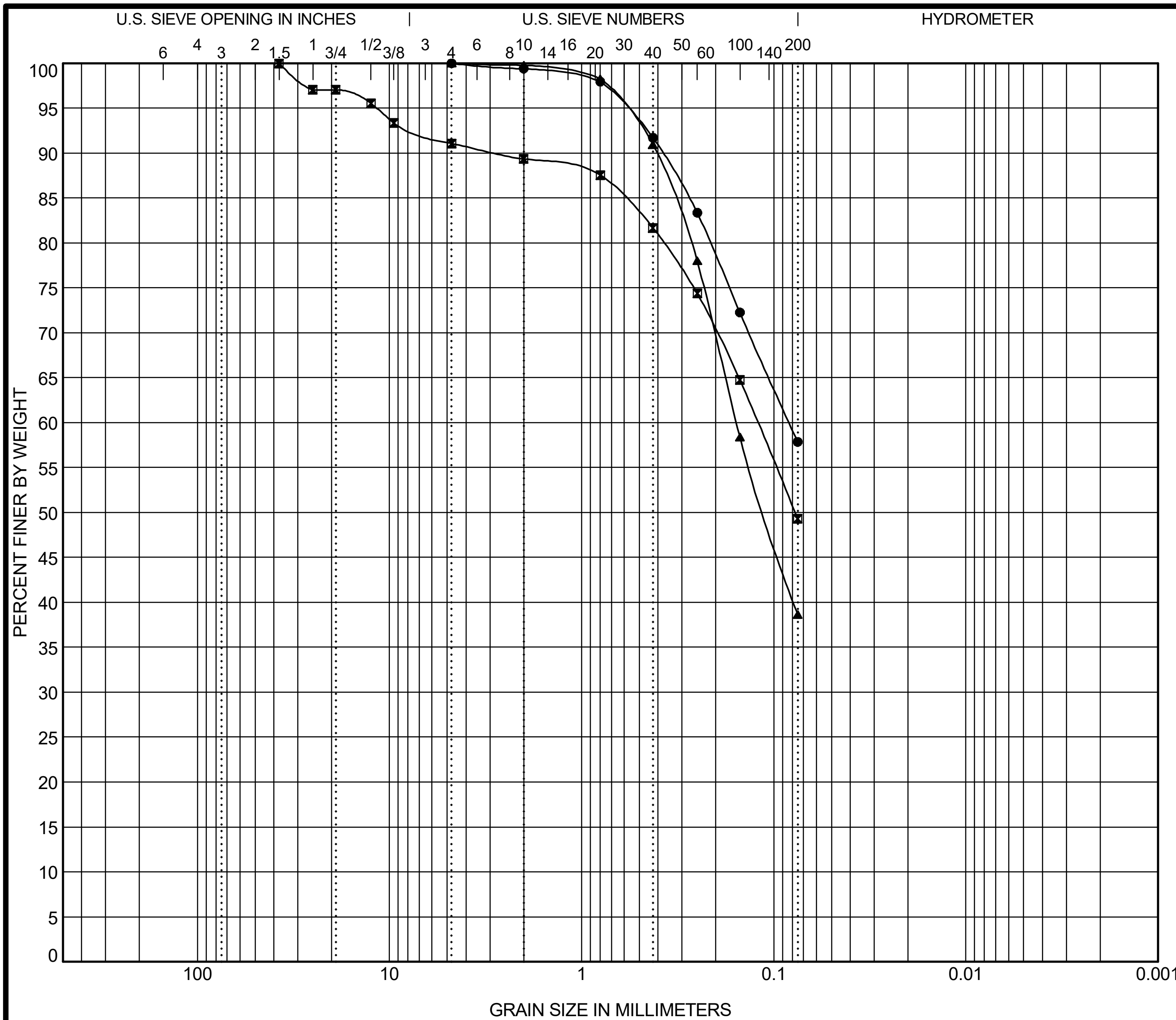
ATTERBERG LIMITS (ASTM D4318)

Project: Del Paso Park - Renfree Field
Location: Sacramento, California
Number: S1145-05-21
Figure: B2 Date:



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample No.	Classification	LL	PL	PI	Cc	Cu
●	**B2-Bulk**	**SANDY SILTY CLAY(CL-ML)**	**18**	**14**	**4**		
⊠	**B3-Bulk**	**CLAYEY SAND(SC)**	**25**	**15**	**10**		
▲	**B5-Bulk**	**SILTY SAND(SM)**	**18**	**17**	**1**		

	Sample No.	D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B2-Bulk**	**4.75**				**0.0**	**42.1**	**57.9**	
⊠	**B3-Bulk**	**37.5**	**0.077**			**8.9**	**41.8**	**49.3**	
▲	**B5-Bulk**	**4.75**	**0.112**			**0.0**	**61.4**	**38.6**	

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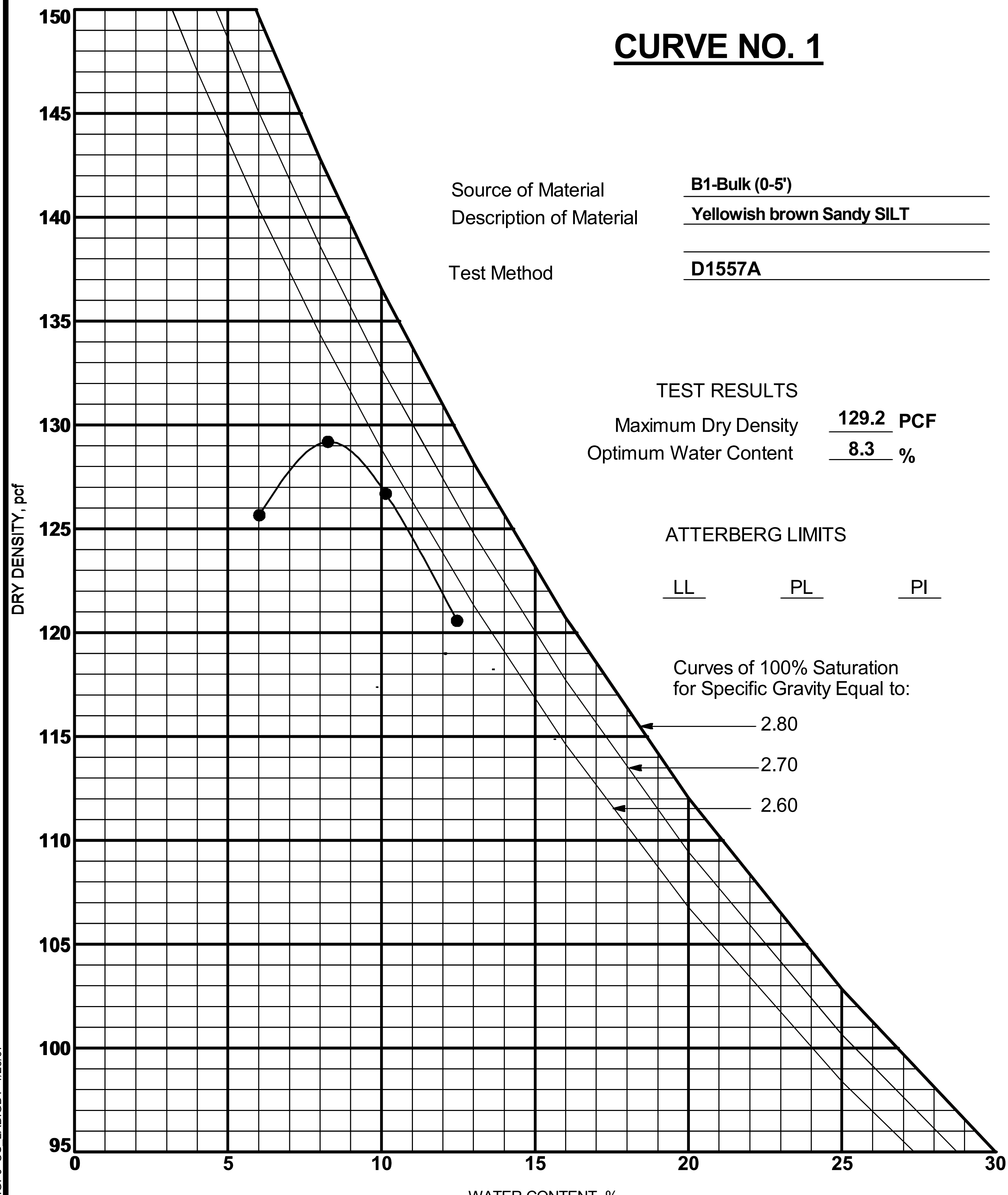
GRAIN SIZE DISTRIBUTION (ASTM D422, D6913)

Project: Del Paso Park - Renfree Field

Location: Sacramento, California

Number: S1145-05-21

Figure: B3



CURVE NO. 1

Source of Material	B1-Bulk (0-5')
Description of Material	Yellowish brown Sandy SILT
Test Method	D1557A

TEST RESULTS

Maximum Dry Density 129.2 PCF

Optimum Water Content 8.3 %

ATTERBERG LIMITS

LL	PL	PI

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

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Geocon Consultants, Inc.
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Rancho Cordova, CA 95742
Telephone: (916) 852-9118
Fax: (916) 852-9132

MOISTURE-DENSITY RELATIONSHIP

Project: Del Paso Park - Renfree Field

Location: Sacramento, California

Number: S1145-05-21

Figure: B4

APPENDIX C

APPENDIX C
LANDSCAPE SOIL SUITABILITY TEST RESULTS
SUNLAND ANALYTICAL LABORATORY

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 03/01/2023
Date Submitted 02/23/2023

To: Mark Repking
Geocon
3160 Gold Valley Dr. #800
Rancho Cordova, CA 95742

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following:
Location : S1145-05-21 DEL PASO Site ID : B4-BULK.
Thank you for your business.

* For future reference to this analysis please use SUN # 89087-185029.

SOIL ANALYSIS

Saturation Percent (SP)	31	
pH	6.64	
E.C.	0.22	mmho/cm
Tot.Dissolved Salts	140.8	ppm
Infiltration Rate (0% Slope)	0.75	in/hr
% Organic Matter	3.1	
C.E.C.	4.6	meq/100g
Sodium Absorption Ratio (SAR)	1.7	
Exchangable Sodium Percent (ESP)	1.3	
Gypsum Req. (CaSO4*2H2O)	None Required	
est. Nitrogen Release	1.4	#/1000 sq.ft.

Soil Texture Sandy Loam

Nitrate	15.30	ppm	********
Phosphorus	7.55	ppm	*******
Potassium	61.63	ppm	**********
Sulfur	8.99	ppm	***********
Chloride	5.43	ppm	*******
Carbonates	25.58	ppm	************
Sodium	13.33	ppm	
Calcium	570.75	ppm	*************
Magnesium	182.15	ppm	********
Boron	0.15	ppm	****
Copper	0.72	ppm	******
Iron	38.90	ppm	*****************
Manganese	13.76	ppm	*****************
Zinc	0.85	ppm	*************

Very Low | Low | Adequate | Excessive

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

DATE 03/01/2023
SUN NUMBER 185029

Information requested by:
Mark Repking
Geocon

Information for:
S1145-05-21 DEL PASO
Sample ID: B4-BULK

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

SOIL pH (Acidity and Alkalinity)

The pH of this sample indicates the soil is in a range for normal growth of most plants. No modification is required.

DISSOLVED SALTS (Indicated by E.C. & TDS)

These conditions are in the normal range for plant growth.

SOIL TEXTURE AND RATE OF WATER INFILTRATION

The infiltration rate for all soil textures decreases with increasing ground slope. At 0 to 4%, 5 to 8%, 9 to 12%, 13 to 16% and above 16% the infiltration rate of this sample decreases from 0.75 to 0.60, 0.45, 0.30, 0.19, respectively. Infiltration rate also decreases with percent of ground cover and by compaction.

WATER PENETRATION OF SOIL DUE TO CHEMICAL CHARACTERISTICS

When exchangable Sodium increases in the soil, water penetration decreases. Based on SAR and ESP values this sample has no penetration problem due to soil Sodium. No Gypsum required.

ORGANIC MATTER

Organic matter provides a slow nitrogen release and aids water retention. This sample has a moderate Organic Matter content.
To maintain moisture and provide sustained nitrogen release a level of 10% organic matter is recommended. This can be accomplished by adding 3 yards per 1000 sq.ft. of ground fir bark that is approximately 75% organic matter (i.e. typically found in ground fir bark which also has naturally low salt and boron concentrations). In California, the MWELO ordenance requires a fixed application of four yards of COMPOST if the soil organic matter is less than 6%. However, of significant concern when applying COMPOST is the potential for the compost to have high salt, high boron content, high C to N ratio and having a higly variable pH (very high to very low). All of these COMPOST characteristics can have very negative affect on plant growth. Take care by having the compost analyzed or by seeing a recent analysis of the compost to be used.

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

DATE 03/01/2023
SUN NUMBER 185029

Information requested by:
Mark Repking
Geocon

Information for:
S1145-05-21 DEL PASO
Sample ID: B4-BULK

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

SOIL BORON

Boron concenrations are in a range allowing normal plant growth.

SOIL MICRONUTRIENTS

Micronutrients, Copper, Iron, Manganese and Zinc, in soil are present in small amounts. However, they play a necessary role in plant metabolism. Without appropriate amounts plants will not thrive. Apply the following per 1000/ sq.ft. Do not mix micronutrients during application (use a separate application for each element indicated).

Because copper, manganese and zinc are in very small amounts, dissolve (each) in 2 gallons of water and use a sprayer to obtain an even application.
Apply 0.2 # Copper Sulfate, 0.5 # Zinc Sulfate and water.

SOIL MACRONUTRIENTS : NITROGEN-PHOSPHORUS-POTASSIUM (N-P-K)

GENERAL N-P-K RECOMMENDATION

Use ONE of these NPK preparations for the first fertilizer application.

Standard NPK Fertilizer Preparations	6-24-24	5-20-10	16-16-16	0-10-10	28-3-4	21-0-0	Customer Choice None
#/1000 sq.ft.	10	17	N/A	N/A	N/A	N/A	**

GRASS OR SOD PREPARATION

Till in organic matter, N,P,K and micro nutrients in addition to any lime gypsum or sulfur as directed above. Smooth soil surface and follow seed or sod producers direction for moisture and product application.

TREES AND SHRUBS

Excavate holes for planting shrubs and trees to at least twice the volume of the container. Prepare backfill for tree and shrub planting holes by mixing three parts of native soil (or imported top soil) with one part organic amendment (preferably nitrogen and iron fortified) and 2.5 pounds of 6-24-24 per yard of mix. For extended fertilization, place slow release fertilizer tablets in each hole per manufacturer's instructions. If 6-24-24 was not directly added to backfill mix, during backfill apply uniformly 1/2 oz of 6-24-24 per gallon containers, 2.5 oz per 5 gallons, 6 oz per 24 inch boxes.

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

DATE 03/01/2023
SUN NUMBER 185029

Information requested by:
Mark Repking
Geocon

Information for:
S1145-05-21 DEL PASO
Sample ID: B4-BULK

SOIL RECOMMENDATIONS FOR LANDSCAPE GARDENING

Summary and Suggested Sequence of Soil Improvements (#/1000 Sq.Ft.)

Organic Amendment	3	Yd./1000 Sq.Ft. Bulk organic amendment (nitrified). or in Calif. if Org.Mat. less than 6% use 4 yd compost.
N-P-K Fertilizer	See above chart	
Micro Nutrients		
Copper	0.2	# Copper sulfate
Zinc	0.5	# Zinc Sulfate
Sulfate-Sulfur	2	# Ammonium Sulfate

Maintenance Fertilization

Apply 5 pounds of Ammonium sulfate (21-0-0) per 1000 sq.ft.every month until plants become established. After established, apply 28-3-4 (or similar preparation) to provide desired growth rate and color.

SUNLAND ANALYTICAL LAB
11419 Sunrise Gold Cr., Ste.10
Rancho Cordova, CA 95742
(916)852-8557

INVOICE
=======

Geocon
3160 Gold Valley Dr. #800
Rancho Cordova, CA 95742

ATTENTION ACCOUNTS PAYABLE

Inv.No. 109087

Date 03/01/2023
Terms: NET 30, 30+ 15%
Customer P.O.#
Requestor: Repking
* Please indicate Invo.# on remittance

SUN NOS.	SAMPLE LOCATION	ANALYSIS	PRICE
185029	S1145-05-21 DEL PASO B4-BULK	LTP.4	107.00
	********* Total *********		107.00