GEOTECHNICAL INVESTIGATION

Carmichael Parks Project
Carmichael Park
5750 Grant Avenue
Carmichael, California

PREPARED FOR:

CARMICHAEL RECREATION AND PARK DISTRICT
5750 GRANT AVENUE
CARMICHAEL, CALIFORNIA 95608

PREPARED BY:

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GEOCON PROJECT NO. S2890-05-01

DECEMBER 2024

Project No. S2890-05-01
December 19, 2024

VIA ELECTRONIC MAIL

Mike Blondino
District Administrator
Carmichael Recreation and Park District
5750 Grant Avenue
Carmichael, California 95608

Subject: GEOTECHNICAL INVESTIGATION
CARMICHAEL PARKS PROJECT
CARMICHAEL PARK
5750 GRANT AVENUE
CARMICHAEL, CALIFORNIA

Mr. Blondino:

In accordance with your contract purchase order #24-0018 dated September 25, 2024, we performed a geotechnical investigation for the proposed park improvements at Carmichael Park located at 5750 Grant Avenue in Carmichael, California.

The accompanying report presents our findings, conclusions, and recommendations for the project as presently proposed. In our opinion, no adverse geotechnical conditions were encountered that would preclude development at the site provided 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 park improvements at Carmichael Park located at 5750 Grant Avenue in Carmichael, 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 the following scope of services:

- 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 design plans to select exploratory excavation locations;
- Performed a site reconnaissance to review project limits, determine access, and mark out the proposed exploratory excavation locations;
- Notified subscribing utility companies via Underground Service Alert (USA) a minimum of two working days (as required by law) prior to performing exploratory borings at the site;
- Retained a private utility locator to further locate potential underground utilities near the exploration locations;
- Performed two (2) exploratory borings (B1 and B2) at locations designated by the project architect using a truck-mounted CME 55 drill equipped with 5-inch solid-flight augers to depths of approximately 21 feet;
- Obtained representative samples from the exploratory borings;
- Logged the borings in 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; and
- Prepared this report to summarize our findings, conclusions, and recommendations with respect to design and construction of the project.

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

2.0 SITE AND PROJECT DESCRIPTION

Improvements to Carmichael Park (the site) are part of the larger Carmichael Parks Project which includes improvements to park access and installations at four park facilities within the Carmichael Recreation and Park District.

Carmichael Park consists of an irregularly shaped 38-acre developed community park located at 5750 Grant Avenue in Carmichael, California. The site is bounded on the north, west, and south by residential development, and on the east by residential and commercial development. The site is relatively flat and level with elevations ranging from approximately 100 to 115 feet above mean sea level (MSL; Google Earth, 2024). The park facility is presently developed with baseball fields; tennis, pickleball, and basketball courts; a disc golf course; a horseshoe pit; playgrounds; a dog park; picnic areas; a community clubhouse and pavilion; and restrooms. Roadways and parking areas throughout the site are paved with hot-mix asphalt (HMA). The site is landscaped with turf and mature trees and bushes.

Planned improvements to the site include:

- replacement of the playground structure and rubberized playground surface at the Veteran's Memorial Building;
- removal of perimeter curb and pavers, addition of concrete surrounding the playground area, and updating of the accessible ramp at Veteran's Memorial Building;
- replacement of existing pickleball poles and netting, and resurfacing and restriping of pickleball courts;
- pavement rehabilitation along Green Park Lane and the eastern portion of Carmichael Park Road; and
- installation of an approximately 130-square-foot restroom building and associated utilities at the tennis courts.

Plans for the new restroom building are not available at this time. We understand that it will be a pre-fabricated structure and assume it will be supported on permanent conventional shallow foundations with an interior concrete slab-on-grade. We anticipate that site grading will include cuts and fills on the order of 3 feet or less. Some underground utilities may require deeper excavations.

3.0 SOIL AND GEOLOGIC CONDITIONS

We identified soil and geologic conditions by observing exploratory borings and reviewing referenced geologic literature (Section 9.0). Descriptions provided below include the USCS symbol where applicable.

3.1 Site and Regional Geology

The site is located within the Great Valley Geomorphic Province of California, more commonly referred to as the Sacramento Valley. This valley is a broad depression bounded by the Sierra Nevada range to the east and the Coast Ranges to the west which has been filled with a thick sequence of sediments derived from weathering of the adjacent mountain ranges, resulting in a stratigraphic section of Cretaceous, Tertiary, and Quaternary deposits.

Based on the *Preliminary Geologic Map of the Sacramento 30' X 60' Quadrangle* (Gutierrez, 2011), the site is underlain by Pleistocene-aged Riverbank Formation – Middle unit (map symbol Qr_2), an alluvial deposit described as interbedded layers of sand and silt forming alluvial terraces and dissected alluvial fans along streams.

3.2 Pavement

We encountered 4 inches of asphalt concrete pavement at the surface of Boring B2. No aggregate base (AB) was present below the asphalt.

3.3 Fill

We encountered fill material at the surface in Boring B1 and below the asphalt pavement in Boring B2 to a depth of approximately 3 to 5 feet. The fill generally consists of moist silt (ML) or loose to medium dense, moist silty sand (SM).

3.4 Riverbank Formation – Middle Unit

Below the fill material, we encountered Riverbank Formation – Middle Unit alluvium in Borings B1 and B2 to the maximum depth explored of approximately 21 feet. The alluvium generally consists of layers of very stiff to hard sandy silt (ML) and lean clay with sand (CL), or medium dense to very dense silty sand (SM) and clayey sand (SC).

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.

4.0 GROUNDWATER

We did not encounter groundwater in our exploratory borings to the maximum depth explored of approximately 21 feet on October 3, 2024.

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) indicate that depth to groundwater at the site was approximately 120 to 130 feet in Spring 2023.

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 observed during our investigation.

5.0 GEOLOGIC HAZARDS

5.1 Regional Active Faults / Surface Fault Rupture Hazard

The numerous faults in California include Holocene-active, pre-Holocene (Quaternary), and inactive faults (pre-Quaternary). The criteria for these major groups were developed by the California Geological Survey (CGS, formerly known as the California Division of Mines and Geology) for the Alquist-Priolo Earthquake Fault Zone Program (CGS, 2018). By definition, a Holocene-active fault is one that has had surface displacement within Holocene time (about the last 11,700 years). A pre-Holocene fault has demonstrated surface displacement during Quaternary time (approximately the last 1.6 million years) but has had no known Holocene movement. Faults that have not moved in the last 1.6 million years are considered inactive.

According to the Fault Activity Map of California by the California Geological Survey (CGS, https://maps.conservation.ca.gov/cgs/fam/), the closest fault with historic displacement is the Green Valley fault, approximately 52.5 miles west-southwest of the site. Based on online mapping by the United States Geological Survey (USGS, https://www.usgs.gov/programs/earthquake-hazards/faults), the closest mapped Holocene-active fault to the site is the Hunting Creek-Berryessa fault system located approximately 50 miles west of the site. The closest mapped pre-Holocene (Quaternary) fault to the site is in the Foothills fault system, approximately 20 miles northeast of the site.

The site is not within a state-designated Alquist-Priolo Earthquake Fault Zone for surface fault rupture hazards (CGS, 2024). No Holocene-active or pre-Holocene faults with the potential for surface fault rupture are known to pass directly beneath the site. Therefore, the potential for surface rupture due to faulting occurring beneath the site during the design life of the proposed development is considered 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 5.5 and the estimated Peak Ground Acceleration (PGA) for the Maximum Considered Earthquake (MCE) with a 2,475-year return period is 0.29g.

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. The site could be subjected to ground shaking in the event of an earthquake along the faults mentioned above or other area faults.

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. Primary factors that trigger liquefaction are moderate to strong ground shaking (seismic source), relatively clean, loose granular soils (primarily poorly graded sands and silty sands), and saturated soil conditions (shallow groundwater). Due to the increasing overburden pressure with depth, liquefaction of granular soils is generally limited to the upper 50 feet of a soil profile.

The site is not located in a currently established State of California Seismic Hazard Zone for liquefaction. Based on the subsurface conditions encountered at the site and the anticipated seismic and groundwater conditions, liquefaction potential is not considered a hazard for this site. Mitigation and specific design measures with respect to liquefaction are not necessary.

5.4 Expansive Soil

Laboratory Plasticity Index (PI) and Expansion Index (EI) tests on one near-surface soil sample indicate low to moderate plasticity and very low expansion potential (Appendix B). Mitigation and specific design measures with respect to expansive soil are not necessary for the project.

5.5 Soil Corrosion Screening

We performed pH, resistivity, chloride, and sulfate tests on one near-surface bulk sample 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 the following table 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)
B1 BULK	0-5	6.33	3,480	7.3	24.4

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 location 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* (Caltrans 2021), resistivity serves as an indicator parameter for the possible presence of soluble salts and 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 location tested does not have a higher propensity for corrosion.

The following table 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 5.5B
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.

The following table 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 5.5C
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	$0.10 \leq SO_4 < 0.20$	$1,000 \leq SO_4 < 2,000$	II	0.50	4,000
Severe	S2	$0.20 \leq SO_4 \leq 2.00$	$2,000 \leq SO_4 \leq 20,000$	V	0.45	4,500
Very Severe	S3	$SO_4 > 2.00$	$SO_4 > 20,000$	V+Pozzolan or Slag	0.45	4,500

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 design(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 sulfate 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 The primary geotechnical constraints identified in our investigation are:

- **Existing surface and subsurface improvements:** The site currently contains improvements including paved roadways and underground utilities. Existing improvements within proposed development areas may require removal and/or relocation.
- **Undocumented fill:** The site is blanketed by approximately 3 to 5 feet of undocumented fill. Undocumented fill underlying the proposed restroom building location will need to be removed to expose undisturbed native soil and replaced with engineered fill compacted in accordance with the recommendations of this report.
- **High in-situ soil moisture content:** Near surface soils generally exhibit higher than optimum in-situ water content which may require drying in order to achieve suitable compaction.

6.1.3 Conclusions and recommendations provided in this report are based on our review of referenced literature, analysis of data obtained from our exploratory field exploration program and laboratory testing program, and our understanding of the proposed project at this time. Geocon should be retained to review the project plans as they develop further, provide engineering consultation as needed, and perform geotechnical observation and testing services during construction.

6.2 Seismic Site Class / Seismic Design Criteria

6.2.1 Seismic design of the structure should be performed in accordance with the provisions of the 2022 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 and measured penetration resistance in our borings, the Site Classification is Site Class "D – Stiff Soil" per Table 20.3-1 of ASCE/SEI 7-16. For the purpose of evaluating code-based seismic parameters for design, we assumed a seismic Risk Category II (per the CBC) for the project. Results are summarized in Table 6.2.1.

TABLE 6.2.1
ASCE 7-16 (CODE-BASED) 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	0.466g	Figure 22-1
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.227g	Figure 22-2
Site Coefficient, F_A	1.428	Table 11.4-1
Site Coefficient, F_V	2.146	Table 11.4-2
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	0.665g	Eq. 11.4-1
Site Class Modified MCE_R Spectral Response Acceleration (1 sec), S_{M1}	0.731g*	Eq. 11.4-2
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.443g	Eq. 11.4-3
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.488g*	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 (S_1) 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 S_{M1} is increased by 50% for all applications of S_{M1}. The values for parameters S_{M1} and S_{D1} 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	0.196g	Figure 22-7
Site Coefficient, F_{PGA}	1.407	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.276g	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 and Stability

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 grading and excavations will generate cobbles or boulders that would require special handling or placement.

6.3.2 Temporary excavations deeper than 4 feet and intended for worker entry must meet Cal/OSHA requirements as appropriate. Excavation shoring, 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 which 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 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.

6.3.5 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.

6.3.6 Based on laboratory testing, in-situ moisture content of site soils ranges from approximately 11% to 23%, which is generally higher than optimum moisture content for this type of material (optimum moisture is approximately 10%). Due to the fine-grained nature of some site 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 soil generated from cut operations at the site are suitable for use as engineered fill in structural areas provided they are screened to exclude deleterious matter, significant organics/roots, and cementations larger than 6 inches in maximum dimension. Due to high in-situ moisture content, onsite soils reused as engineered fill will likely require aerating/drying to attain suitable moisture content for compaction. During dry summer and fall months, soils may be dry and require additional grading effort to attain proper moisture conditioning per Section 6.3.6. All material used as fill should have an organic content of 3 percent or less by dry unit weight.

6.4.2 Import material should be primarily granular with a “very low” expansion potential (Expansion Index less than 20), a Liquid Limit less than 50, and 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.

6.4.3 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 our firm.

6.5.2 References to relative compaction and optimum moisture content in this report are based on the American Society for Testing and Materials (ASTM) D1557 Test Procedure, latest edition. 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.

6.5.3 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 underground utilities, debris, existing vegetation, trees and associated root systems, and other surface/subsurface structures. 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.

6.5.5 At the time of our investigation, the proposed restroom building site was vegetated with a moderate growth of irrigated natural turf. Surface vegetation consisting of turf and other similar vegetation should be removed by stripping to a sufficient depth to remove organic-rich topsoil. We estimate required stripping depths will range from approximately 2 to 3 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.

6.5.6 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.

6.5.7 Because of the disturbance that will be caused by removing the existing underground utilities, the new building pad should be over-excavated: (1) to remove all existing undocumented fill, (2) at least the depth of the deepest former footing or underground utility, and/or (3) no more than 4 feet below existing grade, whichever is deeper, and re-compacted as engineered fill. Over-excavation and re-compaction operations should be performed in the presence of a Geocon representative to evaluate performance of the subgrade under compaction equipment loading.

6.5.8 Over-excavation areas, cut bottoms, areas to receive fill, or areas left at-grade should be thoroughly scarified to a minimum depth of 12 inches, uniformly moisture-conditioned at or above optimum moisture content, and compacted to at least 90% relative compaction. Our representative should observe scarification and re-compaction operations to evaluate performance of the subgrade under compaction equipment loading and to identify any areas that may require removals.

6.5.9 Engineered fill 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.

6.5.10 The top 12 inches of flatwork subgrade areas (non-vehicular), whether completed at-grade, by excavation, or by filling, should be uniformly moisture-conditioned at or above optimum moisture content and compacted to 90% relative compaction.

6.5.11 The top 6 inches of concrete flatwork 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.

6.5.12 Underground utility trenches should be backfilled with properly compacted material. Pipe bedding, shading, and backfill should conform to the requirements of the appropriate utility authority. Soil 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. We note that site soils will likely require additional effort to suitably moisture condition and compact. Trench backfill should be placed in loose lifts not exceeding 8 inches. Lifts should be compacted to a minimum of 90% relative compaction at or near optimum moisture content. Compaction should be performed by mechanical means only; jetting of trench backfill is not recommended.

6.6 Foundations

6.6.1 Provided the building pad is graded in accordance with the recommendations of this report, the proposed restroom building may be supported on conventional shallow foundations bearing on engineered fill.

6.6.2 To reduce potential for moisture variations beneath the building and associated soil expansion, 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.

6.6.3 Continuous footings should be at least 12 inches wide and spread footings should be at least 18 inches square. All footings should be embedded at least 12 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 within 18 inches laterally of the footing, beneath the footing, and within a 1:1 plane extending out and down from the bottom of the footing.

6.6.4 Continuous footings should be reinforced with at least two No. 4 reinforcement bars, one each placed near the top and bottom of the footing to allow footings to span isolated soil irregularities. 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

6.6.5 Foundations proportioned as recommended above may be designed using an allowable soil bearing capacity of 2,000 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.

6.6.6 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%.

6.6.7 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 30 feet or the length of the building, if shorter. The majority of settlement will be immediate and occur as the building is constructed.

6.6.8 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.

6.7 Interior Slabs-on-Grade

6.7.1 An interior concrete slab-on-grade floor in conjunction with spread footings recommended in this report is suitable for the proposed building.

6.7.2 Slab thickness and reinforcement should be determined by the structural engineer based on anticipated loading. However, at a minimum, the slab should be at least 4 inches thick and reinforced with No. 3 reinforcing bars placed 24 inches on center, each way. Structural requirements may require additional reinforcement or thicker concrete slabs.

6.7.3 If the near-surface soils of the building pad become dry prior to constructing the slab-on-grade, the building pad 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 48 hours before concrete placement. Our representative should verify moisture conditions prior to slab-on-grade construction.

6.7.4 Migration of moisture through concrete slabs or moisture otherwise released from slabs is not a geotechnical issue. However, for the convenience of the owner and design team, 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.

6.7.5 In areas where floor coverings are planned, 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 slab-on-grade concrete water-cement ratio is 0.45 or less. 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. 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.

6.7.6 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. Midrange plasticizers could be used to facilitate concrete placement and workability.

6.7.7 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.

6.7.8 If building pad soils become dry, they should be re-moistened prior to concrete slab-on-grade construction. Building pads should be moistened to at least 2% above optimum moisture content, at least 48 hours before placing the vapor barrier. Our representative should verify moisture conditions prior to placement of the vapor barrier.

6.8 Concrete Sidewalks and Flatwork

6.8.1 Sidewalk, curb, gutter, and driveway encroachments in Sacramento County right of way should be designed and constructed in accordance with the latest Sacramento County standards and details as applicable.

6.8.2 We are providing the following recommendations to reduce post-construction distress to concrete flatwork. Recommendations include moisture conditioning subgrade soils, using low-expansive fill (LEF) underlayment, 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 should be at least 4 inches thick and underlain by at least 4 inches of LEF. LEF may consist of Class 2 aggregate base (AB) or soil meeting the requirements of Section 6.4.2 of this report. LEF should be compacted to at least 90% relative compaction. In addition, doweling could be provided at joints to reduce the potential for vertical offset.
- The upper 12 inches of subgrade soil for exterior flatwork should be uniformly moisture-conditioned at or above optimum moisture content and compacted to at least 90% relative compaction prior to placing LEF.

- For 4-inch-thick flatwork, we recommend using a maximum control joint spacing of 8 feet in each direction and construction joint spacing of 10 to 12 feet. 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 doweling should be provided to reduce vertical offset.

6.9 Pavement – Hot Mix Asphalt

6.9.1 We performed Resistance-Value (R-Value) testing on one representative bulk soil sample. Our testing resulted in an R-Value of 33 (see Appendix B). To account for subgrade soil variability and based on our experience in the area, we recommend using an R-Value of 30 for the purpose of pavement design.

6.9.2 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. The table below provides alternative pavement sections based on assumed TIs. We can provide additional sections based on other TIs if necessary.

TABLE 6.9.2
FLEXIBLE PAVEMENT SECTIONS

Street Type	Design TI	HMA[1] (inches)	AB[2] (inches)
Automobile Driving Areas	5.0	3	5.5
Bus Routes / Higher Truck Traffic	6.5	4	8.5

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*.

6.9.3 The recommended pavement sections are based on the following assumptions:

1. Subgrade soil has a minimum R-Value of 30.
2. Subgrade soil is stable, moisture-conditioned, and compacted in accordance with the recommendations of this report. Prior to placing AB, subgrade soil should be proof rolled with a loaded water truck to verify stability.
3. Class 2 AB has a minimum R-Value of 78 and meets the requirements of Section 26 of the latest Caltrans *Standard Specifications*.

4. 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.

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 4 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.

6.10 Site Drainage and Moisture Protection

6.10.1 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 2022 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.

6.10.2 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.

6.10.3 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. It is important to maintain continuity of geotechnical interpretation and 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 others' 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

1. American Concrete Institute (ACI), ACI 318-19, *Building Code Requirements for Structural Concrete and Commentary*, 2019.

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7. California Geological Survey (CGS), *Earthquake Fault Zones: A Guide for Government Agencies, Property Owners / Developers, and Geoscience Practitioners for Assessing Fault Rupture Hazards in California,* Special Publication 42, 93 pp., Revised 2018.

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9. CGS, *Fault Activity Map of California* interactive map, https://maps.conservation.ca.gov/cgs/fam/, accessed October 2024.

10. Gutierrez, C. I., *Preliminary Geologic Map of the Sacramento 30' x 60' Quadrangle, California*, California Geological Survey, Preliminary Geologic Map PGM-11-06, map scale 1:100,000, 2011.

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15. USGS, *Unified Hazard Tool*, https://earthquake.usgs.gov/hazards/interactive/, accessed October 2024.

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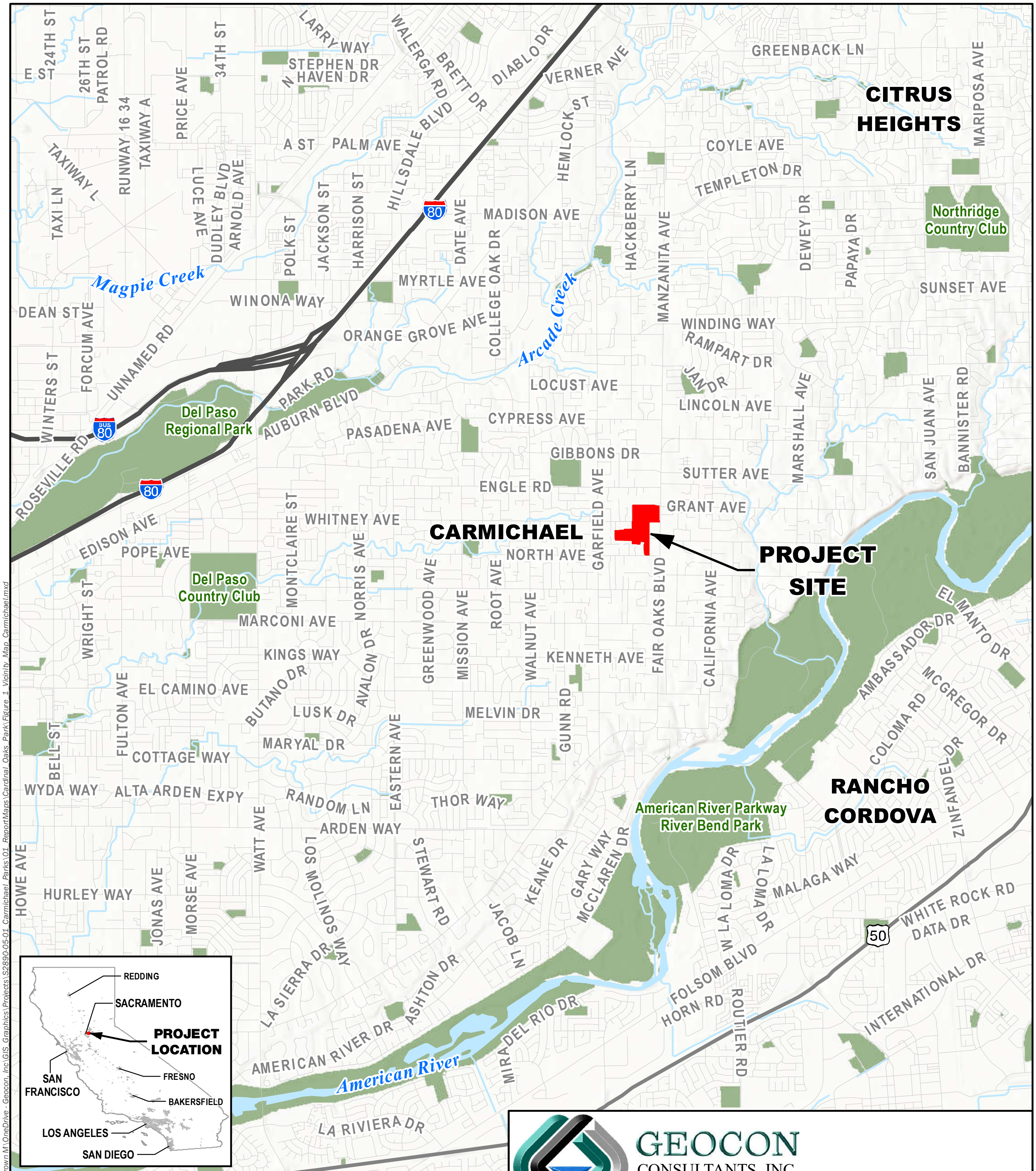

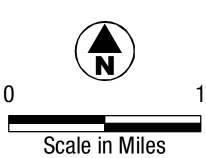

GEOCON
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Carmichael Parks – Carmichael Park

5750 Grant Avenue
Carmichael, California

VICINITY MAP

S2890-05-01	December 2024	Figure 1

GEOCON 10/24/2024 USER Brown M PATH C:\Users\Brown M\OneDrive - Geocon, Inc\GIS_Graphics\Projects\S2890-05-01_Carmichael_Parks\01_ReportMaps\Cardinal_Oaks_Park\Figure_1_Vicinity_Map_Carmichael.mxd

GEOCON 10/25/2024 USER Brown M PATH C:\Users\Brown M\OneDrive - Geocon, Inc\GIS_Graphics\Projects\S2890-05-01_Carmichael_Parks\01_ReportMaps\Carmichael_Park\Figure_2_Site_Plan_Carmichael.mxd

Legend

B2 ⊗ Approximate Boring Location

Approximate Site Boundary

N

0 250

Scale in Feet

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Carmichael Parks – Carmichael Park

5750 Grant Avenue
Carmichael, California

SITE PLAN

S2890-05-01	December 2024	Figure 2

APPENDIX A

APPENDIX A

FIELD EXPLORATION

We performed our geotechnical field exploration on October 3, 2024. Our field exploration program consisted of two exploratory borings (B1 and B2) at the approximate locations shown on the Site Plan, Figure 2.

The exploratory borings were performed using a truck-mounted CME 55 drill rig equipped with 5-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. 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. Where borings were in pavement, they were capped with cold-patch asphalt at surface.

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, 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 (NOREC)
- Chunk Sample (CHK)
- Shelby Tube Sample (ST)
- Bulk Sample (B)
- Standard Penetration Test Sample (SPT)
- Modified California Sample (MC)
- Continuous Push (CP)
- Groundwater Level (At Time of Drilling)
- Groundwater Level (After Drilling)
- Groundwater Level (Seepage Encountered)

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	FIRM	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

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	$25 \le S < 50$	DAMP
INDICATION OF MOISTURE; NO VISIBLE WATER	$50 \le S < 75$	MOIST
MINOR VISIBLE FREE WATER	$75 \le S < 100$	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
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

GEOCON

KEY TO LOGS

SOIL BORING NUMBER: B 1

GEOCON

PROJECT NAME Carmichael Park
LOGGED BY Alice Orton, PG
PROJECT NUMBER S2890-05-01
LATITUDE / LONGITUDE 38.628964, -121.329982
DATE STARTED 10/03/2024 **COMPLETED** 10/03/2024
DEPTH 21' **SURFACE ELEVATION** ~109.1'
LOCATION 5750 Grant Ave, Carmichael
DRILLING FIRM V&W Drilling, Inc
RIG TYPE CME-55
METHOD Auger **BORING DIAMETER** 5 in
HAMMER TYPE Auto
HAMMER WEIGHT / DROP 140 lb / 30 in

Depth (ft)	USCS	Water Levels	Material Description	Bulk	Driven	Sample Number	Blow Counts/6"	Penetration Resistance (blows/foot)	Pocket Penetrometer (tsf)	Moisture Content (%)	Dry Density (pcf)
0	ML		**FILL** (**Turf Surface**) Moist, dark brown, **SILT**	X		Bulk-B1					
	SM		Medium dense, moist, reddish brown, **Silty SAND**, fine grained	X	■	B1-1.5 B1-2.0	13 12 8	20			
			Fine to medium; trace roots	X	■	B1-3.5 B1-4.0	13 22 22	44		11.60	117.00
5	SC		**RIVER BANK FORMATION - MIDDLE UNIT** (**Qr2**) Very dense, moist, light brown, **Clayey SAND**		■	B1-5.5 B1-6.0	14 21 38	59	4.5+	23.00	100.10
	CL		Very stiff, moist, light brown with red mottling, **Sandy LEAN CLAY**; white calcite streaks		■	B1-7.5 B1-8.0	13 17 21	38	4.5		
10			Hard, brown		■	B1-10.5 B1-11.0	19 24 30	54	4.5+		
	SM		Dense, moist, brown, **Silty SAND**								
15	CL		Hard, damp, light brown with red mottling, **LEAN CLAY**; trace porosity		■	B1-15.5 B1-16.0	19 35 50	85	4.5+		
20					■	B1-20.0 B1-20.5	18 50	68			

Boring Terminated
Backfilled with Soil Cuttings

DRAFT

Water Levels

▽ No free water encountered on 10/03

▼ -

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. THE STRATIFICATION LINES PRESENTED HEREIN REPRESENT THE APPROXIMATE BOUNDARY BETWEEN EARTH TYPES; THE TRANSITIONS MAY BE GRADUAL.

GEOCON

SOIL BORING NUMBER: B 2

PROJECT NAME Carmichael Park
LOGGED BY Alice Orton, PG
PROJECT NUMBER S2890-05-01
LATITUDE / LONGITUDE 38.627541, -121.330440
DATE STARTED 10/03/2024 **COMPLETED** 10/03/2024
DEPTH 21' **SURFACE ELEVATION** ~106.4'
LOCATION 5750 Grant Ave, Carmichael
DRILLING FIRM V&W Drilling, Inc
RIG TYPE CME-55
METHOD Auger **BORING DIAMETER** 5 in
HAMMER TYPE Auto
HAMMER WEIGHT / DROP 140 lb / 30 in

Depth (ft)	Graphic Log	USCS	Water Levels	Material Description	Bulk / Driven	Sample Number	Blow Counts/6"	Penetration Resistance (blows/foot)	Pocket Penetrometer (tsf)	Moisture Content (%)	Dry Density (pcf)
				ASPHALT; (4 inches), no aggregate base	Bulk	Bulk B2					
		SM		**FILL** Loose, moist, dark red, **Silty SAND**, fine grained	Driven	B2-1.5 B2-2.0	8 6 8	14			
				Fine to coarse grained							
		ML		**RIVERBANK FORMATION - MIDDLE UNIT** (**Qr2**) Hard, moist, light brown, **Sandy SILT**, fine grained	Driven	B2-3.0 B2-3.5	23 50/4"	73/10"	4.5+	12.80	115.00
5				Very stiff, brown; trace mica	Driven	B2-5.5 B2-6.0	15 15 19	34	4.5+	15.90	115.40
		SM		Medium dense, moist, red, **Silty SAND**	Driven	B2-7.5 B2-8.0	13 17 23	40	4.5+		
		CL		Hard, moist, light brown, **LEAN CLAY**, with sand, fine to coarse grained							
10				Damp, trace black mottling	Driven	B2-10.5 B2-11.0	18 31 37	68	3.5 4.5+		
15				Moist, fine grained	Driven	B2-15.5 B2-16.0	24 36 39	75	4.5+		
20		ML		Hard, damp, light brown, **Sandy SILT**, fine to coarse grained	Driven	B2-20.0 B2-20.5	19 50	69			

Boring Terminated
Backfilled with Cuttings
Capped with Cold Patch Asphalt

Water Levels

▽ No free water encountered on 10/03

▼ -

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. THE STRATIFICATION LINES PRESENTED HEREIN REPRESENT THE APPROXIMATE BOUNDARY BETWEEN EARTH TYPES; THE TRANSITIONS MAY BE GRADUAL.

DRAFT

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, grain size distribution, expansion properties, corrosion potential, moisture-density relationship, and pavement support characteristics. The results of the laboratory tests are presented below and 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		
B1 Bulk	0-5	8.2	15.8	O (zero)	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	121.5	11.9	33

Sample ID	Depth (feet)	Liquid Limit	Plastic Limit	Plasticity Index	Expansion Index	%<#200 Sieve	Water Content (%)	Dry Density (pcf)
B1-Bulk	0-5				0			
B1-4.0	4.0						11.6	117.1
B1-5.5	5.5						23.0	100.1
B1-6.0	6.0	34	21	13		47.5		
B2-3.5	3.5						12.8	115.0
B2-6	6						15.9	115.4
B2-8	8	42	16	26		84.3		

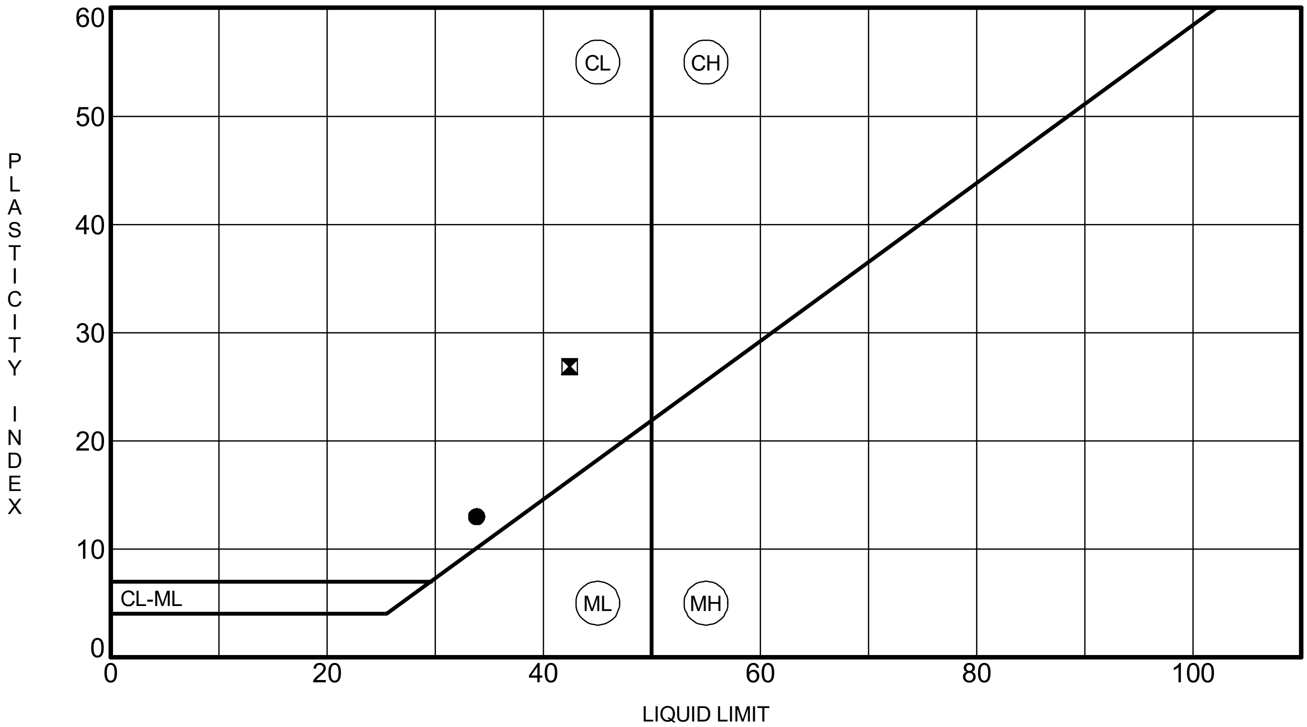
US LAB SUMMARY GEOTECH 2 WITH EI COLUMN S2890-05-01 CARMICHAEL PARK.GPJ US LAB.GDT 10/22/24

GEOCON

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

Summary of Laboratory Results

Project: Carmichael Parks: Carmichael Park
Location: Carmichael, CA
Number: S2890-05-01
Figure: B1



	Sample No.	Liquid Limit	Plastic Limit	Plasticity Index	% Pass #200 Sieve	Unified Soil Classification Description	Preparation Method
●	**B1-6.0**	**34**	**21**	**13**	**47.5**	**CLAYEY SAND(SC)**	**dry**
⧗	**B2-8**	**42**	**16**	**26**	**84.3**	**LEAN CLAY with SAND(CL)**	**dry**

GEOCON

Geocon Inc
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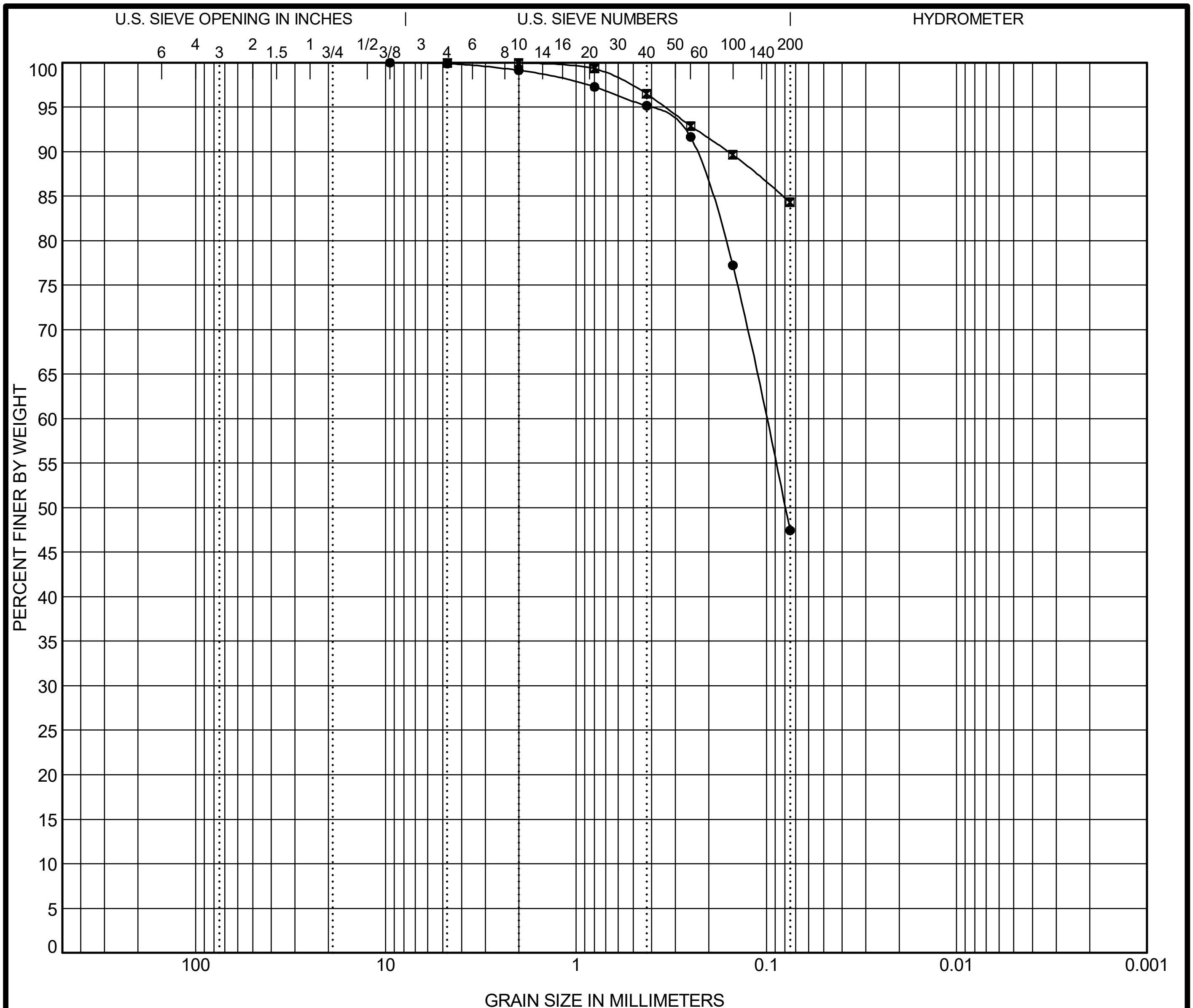
Rancho Cordova, CA 95742
Telephone: 858-558-6900

ATTERBERG LIMITS (ASTM D4318)

Project: Carmichael Parks: Carmichael Park
Location: Carmichael, CA
Number: S2890-05-01
Figure: B2 Date:



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample No.	Classification	LL	PL	PI	Cc	Cu
●	**B1-6.0**	**CLAYEY SAND(SC)**	**34**	**21**	**13**		
⊠	**B2-8**	**LEAN CLAY with SAND(CL)**	**42**	**16**	**26**		

	Sample No.	D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B1-6.0**	**9.5**	**0.08**			**0.1**	**52.4**	**47.5**	
⊠	**B2-8**	**4.75**				**0.0**	**15.7**	**84.3**	

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GRAIN SIZE DISTRIBUTION (ASTM D422, D6913)

Project: Carmichael Parks: Carmichael Park
Location: Carmichael, CA
Number: S2890-05-01
Figure: B3

CURVE NO. 1

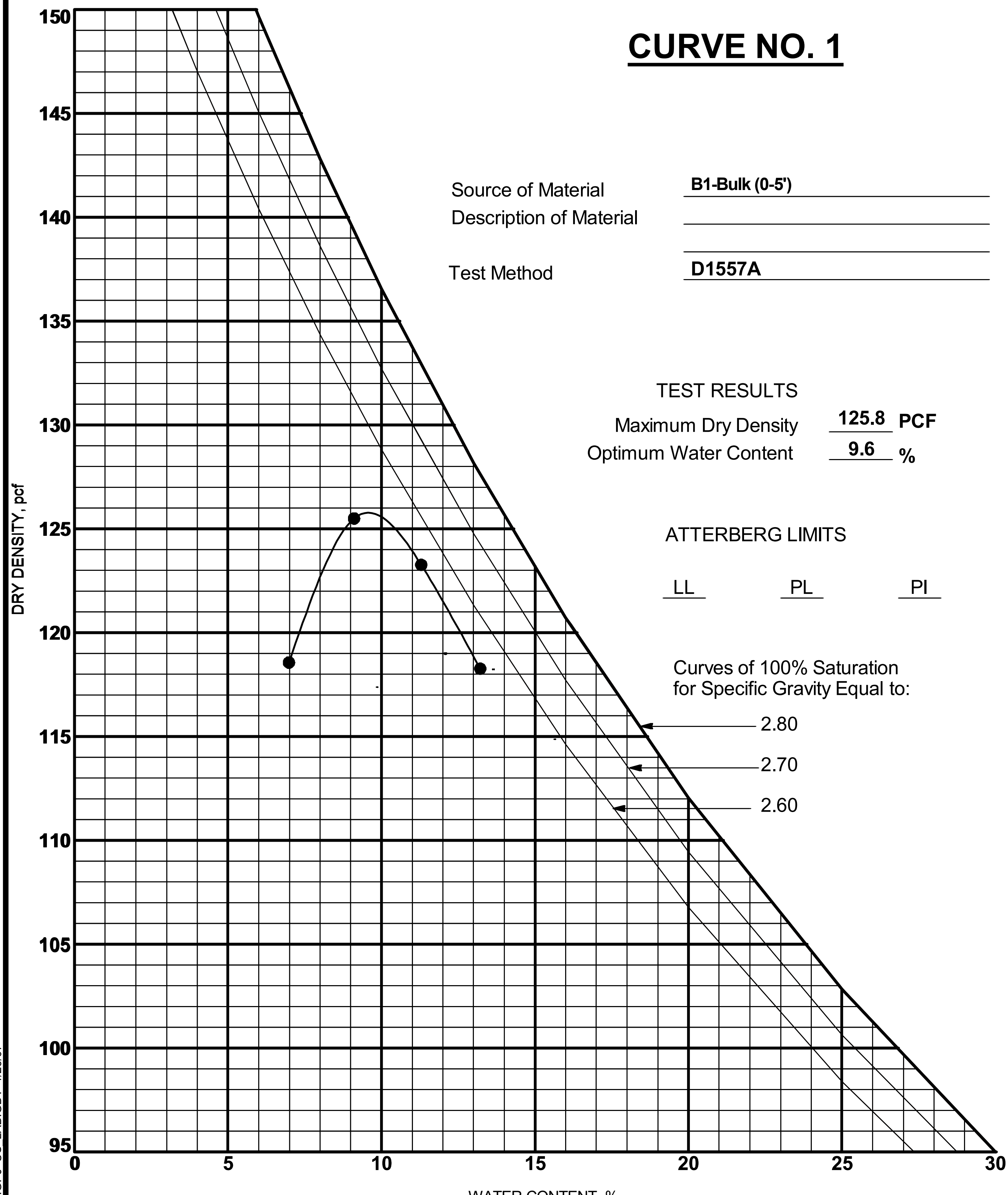
Source of Material	B1-Bulk (0-5')
Description of Material	
Test Method	D1557A

TEST RESULTS

Maximum Dry Density	125.8	PCF
Optimum Water Content	9.6	%

ATTERBERG LIMITS

LL	PL	PI



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

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MOISTURE-DENSITY RELATIONSHIP

Project: Carmichael Parks: Carmichael Park
Location: Carmichael, CA
Number: S2890-05-01
Figure: B4