

GEOTECHNICAL INVESTIGATION

**Dixon Fire Station 82
Pitt School Road and Lavender Lane
Dixon, California**

PREPARED FOR:
CITY OF DIXON
600 EAST A STREET
DIXON, CALIFORNIA 95620



PREPARED BY:
GEOCON CONSULTANTS, INC.
3160 GOLD VALLEY DRIVE, SUITE 800
RANCHO CORDOVA, CALIFORNIA 95742



GEOCON PROJECT NO. S9731-05-37

MARCH 2023
Revised June 2023



Project No. S9731-05-37
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VIA ELECTRONIC MAIL

Deborah Barr, PE
City Engineer
City of Dixon
600 East A Street
Dixon, California 95620

Subject: GEOTECHNICAL INVESTIGATION
DIXON FIRE STATION 82
PITT SCHOOL ROAD AND LAVENDER LANE
DIXON, SOLANO COUNTY, CALIFORNIA

Ms. Barr:

In accordance with your authorization of our proposal (Geocon Proposal No. S9731-05-37P, dated December 8, 2022), we performed a geotechnical investigation for the subject project located on the southeast corner of the intersection of Pitt School Road and Lavender Lane, in Dixon, Solano County, 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.

Richard C. Church, PE
Senior Project Engineer



Jeremy J. Zorne, PE, GE
Senior Engineer



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GEOTECHNICAL INVESTIGATION

1.0 PURPOSE AND SCOPE

This report presents the results of our geotechnical investigation for the proposed construction of a new fire station on the southeast corner of the intersection of Pitt School Road and Lavender Lane, in Dixon, Solano County, 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 project plans to select exploratory boring locations.
- Performed a site reconnaissance to review project limits, determine exploration equipment 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.
- Obtained a soil boring permit from the Solano County Environmental Health Division (SCEHD).
- Performed five (5) exploratory borings (B1 through B5) with a track-mounted drill rig equipped with 8-inch diameter hollow-stem augers to depths ranging between approximately 6½ feet and 51½ 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 borings with neat cement grout in accordance with SCEHD permit requirements and the infiltration tests 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.

2.0 SITE AND PROJECT DESCRIPTION

The approximate 0.74-acre site generally consists of undeveloped, previously graded former agricultural land. Based on topographic information provided by Cartwright Engineers (Cartwright, February 2023), site elevations range from approximately 65 feet to 65.4 feet above mean sea level (msl). The site is part of the Homestead Development (residential development) and was rough graded as part of the development. Rough grading appears to have resulted in approximately three feet of fill blanketing the site. The current site configuration is shown on the Site Plan, Figure 2.

The project consists of constructing a new fire station and associated improvements. The building will be single-story, wood- or steel-framed and/or concrete masonry construction and will be supported on a shallow foundation with an interior concrete slab-on-grade. The proposed building pad grade is approximately 63 feet msl, or approximately 3 feet lower than current site grade. Associated improvements will likely include flexible hot mix asphalt (HMA) and/or rigid Portland cement concrete (PCC) parking lots and driveways, landscaping, and underground utility infrastructure. Approximate locations and features of the proposed improvements are shown on the Proposed Development Plan, Figure 3. We anticipate that site grading will include cuts and fills on the order of 5 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 the referenced geologic literature (Section 9.0). Soil descriptions below include the USCS symbol where applicable. Site geology generally consists of alluvial soil mapped as Alluvial Fan Deposits (CGS, 2009).

3.1 Fill

We encountered fill in each of our exploratory borings (B1 through B5) to depth of approximately 3 feet. The fill generally consists of layers of medium stiff to very stiff lean clay (CL) with sand. Documentation regarding fill placement was not available for our review. Based on the current site design, the majority of the existing fill will be removed as part of grading to achieve site grades.

3.2 Alluvium (Alluvial Fan Deposits)

We encountered alluvium mapped as Alluvial Fan Deposits below the fill in each of our exploratory borings (B1 through B5) to the maximum explored depth of approximately 51½ feet. The alluvium generally consists of layers of medium stiff to hard lean clay (CL) with sand, fat clay (CH) with sand, soft to very stiff sandy silt (ML), and soft to hard SILT (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.

4.0 GROUNDWATER

Groundwater was encountered in Boring B1 performed on February 9, 2023 at a depth of approximately 29 feet.

Review of the Department of Water Resources *Groundwater Information Center Interactive Map Application* (<https://gis.water.ca.gov/app/gicima/>) indicates that between Spring 2017 and Fall 2021 the groundwater depth in the site vicinity ranged from approximately 25 to 80 feet below ground surface.

It should be noted that fluctuations in the level of groundwater may occur due to variations in precipitation, 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

Based on our research, analyses, and observations, the site is not located on or near 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 Ground Shaking

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 6.6 and the estimated Peak Ground Acceleration (PGA) for the Maximum Considered Earthquake (MCE) with a 2,475-year return period is 0.53g.

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

5.3 Liquefaction

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary loss of shear strength due to pore pressure buildup under the cyclic shear stresses associated with intense earthquakes. 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 very stiff to hard, fine-grained (cohesive) soils encountered below the water table, liquefaction potential at the site is expected to be low during seismic events. Mitigation or special design measures with respect to liquefaction are not necessary.

5.4 Expansive Soil

Laboratory Plasticity Index (PI) and Expansion Index (EI) tests on near surface soil samples indicate low to moderate plasticity and corresponding medium expansion potential (Appendix B). Specific recommendations with respect to expansive soils are provided in this report.

5.5 Soil Corrosion Screening

We performed pH, resistivity, chloride, and sulfate tests on one 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 Table 5.5A 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)
B3-3	3	7.1	1,450	18.7	120.4

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*, 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 have a higher propensity for corrosion.

Table 5.5B 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.

Table 5.5C 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 ≤ SO ₄ < 0.20	1,000 ≤ SO ₄ < 2,000	II	0.50	4,000
Severe	S2	0.20 ≤ SO ₄ ≤ 2.00	2,000 ≤ SO ₄ ≤ 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 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 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 The primary geotechnical constraints identified in our investigation is the presence of near-surface expansive clay soil and undocumented fill throughout the site. Mitigation recommendations for these constraints are provided in this report. Based on the existing site grade of approximately 65 feet msl, the proposed building pad elevation of approximately 63 feet msl, and the recommendations for mitigation of expansive clay soils presented below, the existing undocumented fill will likely be removed from the building pad footprint during grading.
- 6.1.3 Conclusions and recommendations provided in this report are based on our review of referenced literature, analysis of data obtained from our field exploration program, laboratory testing program, and our understanding of the proposed development at this time.
- 6.1.4 We should review the project plans as they develop further, provide engineering consultation as needed during final design, and perform geotechnical observation and testing services during construction.

6.2 Seismic Site Class / Seismic Design Criteria

- 6.2.1 Seismic design of the structures 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 purposes of evaluating code-based seismic parameters for design, we assumed a seismic Risk Category IV (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	1.025g	Figure 22-1
MCE _R Ground Motion Spectral Response Acceleration – Class B (1 sec), S ₁	0.38g	Figure 22-2
Site Coefficient, F _A	1.2	Table 11.4-1
Site Coefficient, F _V	1.92	Table 11.4-2
Site Class Modified MCE _R Spectral Response Acceleration (short), S _{MS}	1.12g	Eq. 11.4-1
Site Class Modified MCE _R Spectral Response Acceleration (1 sec), S _{M1}	1.095g*	Eq. 11.4-2
5% Damped Design Spectral Response Acceleration (short), S _{DS}	0.75g	Eq. 11.4-3
5% Damped Design Spectral Response Acceleration (1 sec), S _{D1}	0.73g*	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 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	0.428g	Figure 22-7
Site Coefficient, F _{PGA}	1.172	Table 11.8-1
Site Class Modified MCE _G Peak Ground Acceleration, PGA _M	0.501g	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 to moderate 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 excavation slopes 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 protecting nearby utilities, structures, and other improvements which may be damaged by earth movements.
- 6.3.3 The excavation support recommendations provided by Cal/OSHA are generally geared towards protecting human life and not necessarily towards preventing damage to nearby structures or surface improvements. The contractor should be responsible for using the proper active shoring systems or sloping to prevent damage to any structure or improvements near underground excavations.
- 6.3.4 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 the near-surface granular 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.

6.4 Materials for Fill

- 6.4.1 Excavated soils generated from cut operations at the site are suitable for use as fill in structural¹ 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.
- 6.4.3 Near-surface soil at the site includes expansive clay. A layer of low expansive fill (LEF) will be required below buildings and concrete flatwork. Import and LEF material should be primarily granular with a “low” expansion potential (Expansion Index less than 50), have a Plasticity Index less than 15, be free of organic material and construction debris, not contain rock larger than 6 inches in greatest dimension, and contain sufficient fines to act as a binder to reduce caving potential when excavated. LEF may consist of Class 2 aggregate base (AB) meeting the requirements of the Caltrans’ latest Standard Specifications. LEF may also consist of lime-treated native soil. If lime-treatment is selected, additional sampling and laboratory testing will be required to evaluate the amount of lime required to stabilize the soil. Based on our experience with similar soil types, adding lime at a rate of approximately 3% to 5% by dry unit weight is typically sufficient for reduction of expansion potential.
- 6.4.4 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 References to relative compaction and optimum moisture content in this report are based on the latest American Society for Testing and Materials (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.

¹ Structural areas are defined as engineered fill that supports buildings or improvements. Excavated native soil may not be suitable for the upper portion of structural fill if a layer of Low Expansive Fill (LEF) is specified in this report.

- 6.5.4 Site preparation should begin with removal of complete removal of underground utilities, debris, and organic-rich topsoil, if any. 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, site vegetation primarily consisted of a light growth of annual grasses. Surface vegetation consisting of grasses 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 1 to 2 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 Within new building pad areas (as defined in Paragraph 6.5.2), existing fill should be completely removed to expose undisturbed native alluvial soil. Based on our borings, we anticipate the typical removal depths will be approximately 3 feet.
- 6.5.8 Over-excavation bottoms, cut areas, and areas to receive fill should be scarified 12 inches, uniformly moisture-conditioned at least 2% 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.
- 6.5.9 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 design elevations. Each lift should be moisture-conditioned at least 2% above optimum moisture content and compacted to at least 90% relative compaction. The top 12 inches of building pads, whether completely at-grade, by excavation, or filling should be uniformly moisture-conditioned at least 2% above optimum moisture content and compacted to at least 90% relative compaction.
- 6.5.10 Due to the expansive clay soils at the site, the upper 12 inches of building pads should consist of low-expansive fill (LEF) meeting the requirements of Section 6.4.3 of this report. The LEF should be moisture-conditioned at or above optimum moisture content and compacted to at least 90% relative compaction.

- 6.5.11 The top 6 inches of final vehicular pavement and concrete flatwork subgrade, whether completed at-grade, by excavation, or by filling, should be uniformly moisture-conditioned at least 2% above optimum moisture content, compacted to at least 93% relative compaction and be stable. The 93% 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 area is graded in accordance with the recommendations of this report, the proposed building may be supported on conventional shallow foundations bearing on undisturbed native soil or engineered fill.
- 6.6.2 To reduce potential for seasonal moisture variations beneath the building, foundations should consist of continuous perimeter footings with isolated interior spread footings or continuous footings. Perimeter footings should be continuous around the entire perimeter of the structure without breaks or discontinuities. Strip footings should be at least 12 inches wide and spread footings should be at least 24 inches square. All footings should be embedded at least 18 inches below lowest adjacent pad grade.
- 6.6.3 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 footings, and within a 1:1 plane extending out and down from the bottom of the footing.

- 6.6.4 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. A one-third increase in allowable bearing capacity is permitted for use with the alternative load combinations given in Section 1605.2 of the 2022 CBC.
- 6.6.5 Foundations designed in accordance with the recommendations above should experience total settlements of less than 1 inch and differential settlements of approximately ½ inch over a distance of approximately 30 feet. The majority of the settlement will be immediate and will occur as the loads are applied during construction.
- 6.6.6 Allowable passive pressure used to resist lateral movement of 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 of footings is 0.30 for concrete against soil. Combined passive resistance and friction may be utilized for footing design provided that the frictional resistance is reduced by 50%.
- 6.6.7 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.
- 6.6.8 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 Interior concrete slab-on-grade floors in conjunction with spread footings recommended in this report are suitable for the proposed building provided the upper 12 inches of the building pads consists of low-expansive fill (LEF) meeting the requirements of this report. This recommendation assumes that the slab will be supported on a minimum 4-inch-thick rock section. The 4-inch-thick rock section is in addition to the 12 inches of LEF. If a thinner or thicker slab or rock section is planned, we should be consulted to provide revised recommendations.
- 6.7.2 Slab thickness and reinforcement should be determined by the structural engineer based on anticipated loading. However, at a minimum, slabs 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 building pads become dry prior to constructing concrete slabs-on-grade, building pads should be re-moistened by soaking or sprinkling such that the upper 12 inches of soil is at or above optimum moisture content at least 48 hours before concrete placement.

6.8 Slab-on-Grade Moisture Protection Considerations

- 6.8.1 Migration of moisture through concrete slabs or moisture otherwise released from slabs is not a geotechnical issue. However, for the convenience of the owner 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.
- 6.8.2 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.
- 6.8.3 At least 4 inches of ½- or ¾-inch crushed rock, with no more than 5 percent passing the No. 200 sieve, may be placed below the vapor barrier to serve as a capillary break.
- 6.8.4 The concrete water/cement ratio should be as low as possible. The water/cement ratio should not exceed 0.45 for concrete placed directly on the vapor barrier. Midrange plasticizers could be used to facilitate concrete placement and workability.
- 6.8.5 Proper finishing, curing, and moisture vapor emission testing should be performed in accordance with the latest guidelines provided by the American Concrete Institute, Portland Cement Association, and ASTM.

6.9 Concrete Flatwork

- 6.9.1 Sidewalk, curb, gutter, and driveway encroachments in city right of way should be designed and constructed in accordance with the latest City of Dixon standards and details as applicable.
- 6.9.2 Onsite exterior concrete flatwork will likely experience seasonal movement. Therefore, some cracking and/or vertical offset should be anticipated. We are providing the following recommendations to reduce distress to concrete flatwork. Recommendations include

moisture conditioning subgrade soils, using aggregate 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, excluding concrete pavements subject to truck wheel loads, should be at least 6 inches thick and underlain by at least 4 inches of Class 2 AB compacted to at least 95% relative compaction. In addition, doweling could be provided at joints to reduce the potential for vertical offset.
- The upper 12 inches of subgrade soil in exterior flatwork areas should be uniformly moisture-conditioned at least 2% above optimum moisture content and compacted to at least 90% relative compaction prior to placing AB.
- 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 offset could affect doorway operation.

6.10 Hot Mix Asphalt Pavement

- 6.10.1 We performed Resistance-Value (R-Value) testing on a representative bulk soil sample from the proposed pavement areas. Our testing resulted in an R-Value of less than 5 (Appendix B). Table 6.12.1 provides alternative pavement sections based on the design methods of Caltrans' *Highway Design Manual* using a design subgrade R-value of 5.

**TABLE 6.10.1
FLEXIBLE PAVEMENT SECTIONS**

	Parking Areas Traffic Index = 5.0	Driveways, Light Truck Traffic Traffic Index = 6.0	Fire Truck Areas Traffic Index = 7.0
HMA, inches	3.0	3.5	4.0
AB, inches	9.5	12.5	15.5
Total Section, inches	12.5	16.0	19.5

- 6.10.2 The recommended pavement section is based on the following assumptions:

1. Pavement subgrade soil has an R-Value of at least 5.
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.

- 6.10.3 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.
- 6.10.4 Asphalt pavement section recommendations for driveways and parking areas are based on the design procedures of Caltrans' *Highway Design Manual* (Design Manual), Chapter 600. 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.

6.11 Rigid Concrete Pavement

- 6.11.1 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.
- 6.11.2 If rigid PCC pavement is used in fire truck traffic areas, we recommend that the concrete be at least 7 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.
- 6.11.3 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.

- 6.11.4 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.
- 6.11.5 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.
- 6.11.6 Adequate dowels should also be used at joints to facilitate load transfer and reduce vertical offset. In addition, the recommendations in Section 6.12.3 pertaining to deepened curbs, moisture cut-offs, and subsurface drainage apply to concrete pavements, sidewalks and flatwork, as well as asphalt pavements.
- 6.11.7 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.

6.12 Site Drainage and Moisture Protection

- 6.12.1 Adequate site drainage is critical to reduce the potential for differential soil movement, 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.
- 6.12.2 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.
- 6.12.3 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. We recommend use of area drains to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes. In addition, where landscaping is planned adjacent to the pavement or flatwork, we recommend construction of a cutoff wall (deepened curb) along the edge of the pavement/flatwork that extends at least 4 inches into the soil subgrade below the bottom of the base material.

- 6.12.4 The soil conditions at the site (low-permeability clays) are not conducive to water infiltration devices such as vegetated swales. However, Low Impact Development (LID) devices can be installed to reduce velocity and the amount of water entering the storm drain system. The LID devices should be properly constructed to prevent water infiltration into the surrounding soil. If water infiltrates the expansive soils, distress may be caused to adjacent pavements, flatwork, or structures. Vegetated swales and basin areas (if used) should be lined with an impermeable liner (e.g. high-density polyethylene, HDPE, with a thickness of about 12 mil or equivalent polyvinyl chloride liner) to reduce infiltration.
- 6.12.5 We recommend that roof drains be connected to water-tight subdrains that direct the water to the storm drain system. However, we understand that LID and Leadership in Engineering and Environmental Design (LEED) requests disconnecting the roof drains to help obtain certification. The water from the roof drains should be directed away from buildings. Consideration should be given to draining roofs to lined planter boxes or placing liners below the proposed landscape areas to prevent infiltration of the water. Geocon can be contacted for additional recommendations.
- 6.12.6 We recommend implementing measures to reduce infiltrating irrigation water near buildings, flatwork, or pavements. Such measures may include:
- Selecting drought-tolerant plants that require little or no irrigation, especially within 3 feet of buildings, slabs-on-grade, or pavements.
 - Using drip irrigation or low-output sprinklers.
 - Using automatic timers for irrigation systems.
 - Using appropriately spaced area drains.
- The project landscape architect should consider incorporating these measures into the landscaping plans.
- 6.12.7 Experience has shown that even with these provisions, subsurface seepage may develop in areas where no such water conditions existed prior to site development. This is particularly true where a substantial increase in surface water infiltration has resulted from an increase in landscape irrigation.

7.0 FURTHER GEOTECHNICAL SERVICES

7.1 Plan and Specification Review

- 7.1.1 We should review the 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.
- 7.1.2 Pedestrian bridge foundation design can be performed once preliminary information regarding the foundation loading conditions, dimensions, sizes, and depths are provided for our use/review.

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 are important in order 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 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.

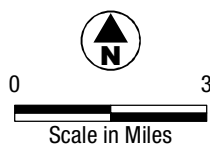
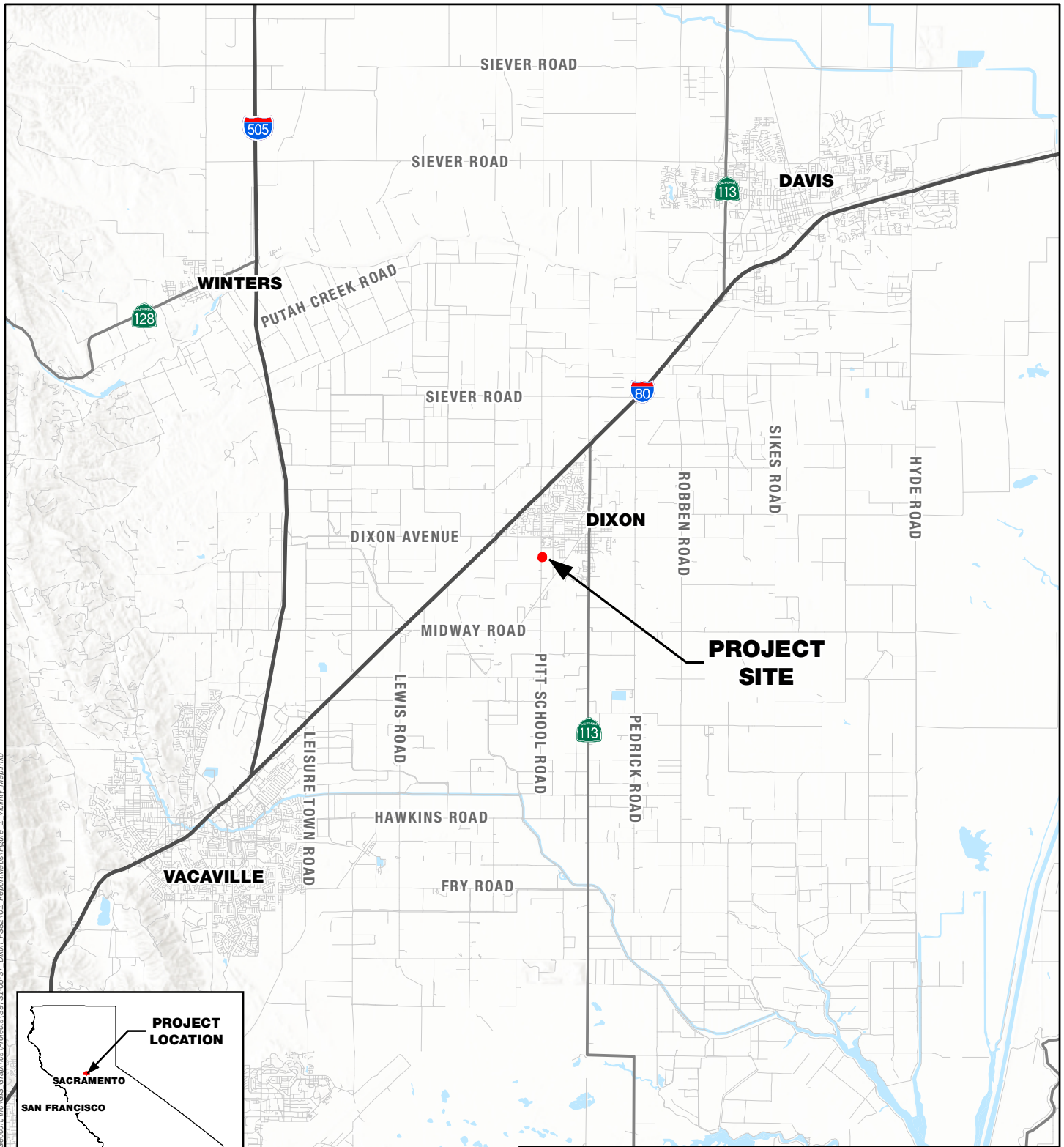
This report is issued with the understanding that it is the responsibility of the owner or their representative to ensure that the information and recommendations contained herein are brought to the attention of the design team for the project and incorporated into the plans and specifications and the 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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6. Caltrans, *Standard Specifications, Section 26*, 2022.
7. Department of Water Resources, *Groundwater Information Center Interactive Map Application* (<https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#gwlevels>), accessed March 7, 2023.
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11. Structural Engineers Association of California (SEAOC) and Office of Statewide Health Planning and Development (OSHPD), *Seismic Design Maps*, <https://seismicmaps.org/>, accessed March 8, 2023.
12. United States Geological Survey (USGS), *Unified Hazard Tool* <https://earthquake.usgs.gov/hazards/interactive/>.
13. Unpublished reports, aerial photographs, and maps on file with Geocon.
14. Warren Consulting Engineers, *City of Dixon Fire Station 82 Grading Plan*, June 15, 2022.



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Dixon Fire Station 82 - Pitt School Road and Lavender Lane

Dixon,
California

VICINITY MAP

S9731-05-37

June 2023

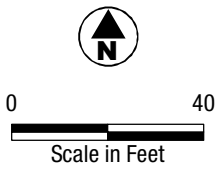
Figure 1



Aerial Image: Google Earth 02/06/2022

Legend

- B5  Approximate Boring Location
-  Approximate Site Boundary





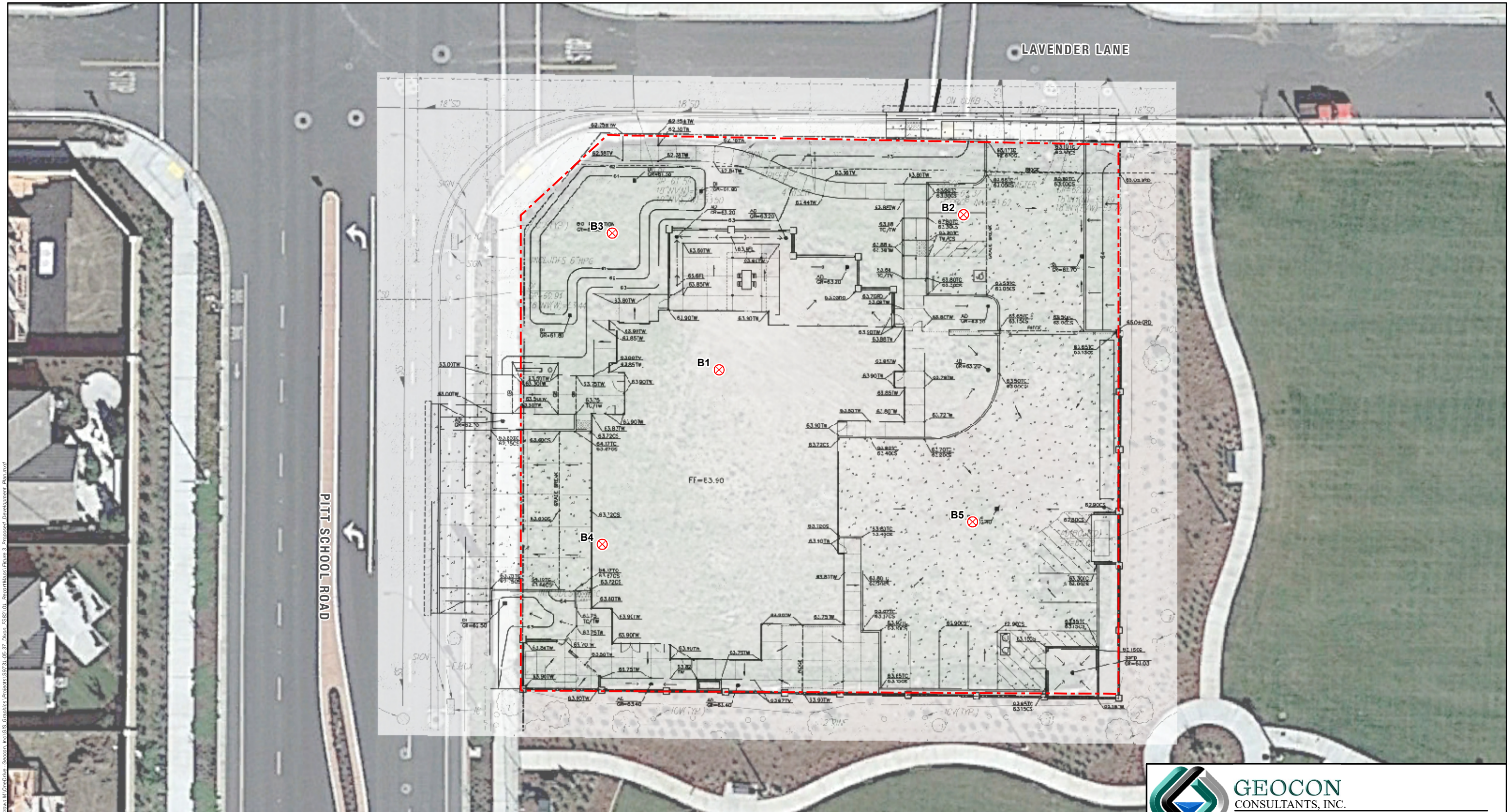
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Dixon,
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SITE PLAN

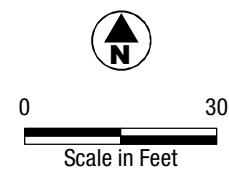
S9731-05-37	June 2023	Figure 2
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Development Plan: Warren Consulting Engineers, Inc. 06/15/2022
Aerial Image: Google Earth 02/06/2022

Legend

- B5 Approximate Boring Location
- Approximate Site Boundary





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Dixon Fire Station 82 - Pitt School Road and Lavender Lane

Dixon,
California

PROPOSED DEVELOPMENT PLAN

S9731-05-37

June 2023

Figure 3

APPENDIX

A

APPENDIX A

FIELD EXPLORATION

We performed our geotechnical field exploration on February 9, 2023. Our field exploration program consisted of drilling five (5) exploratory borings (B1 through B5) at the approximate locations depicted on the Site Plan, Figure 2 and Proposed Development Plan, Figure 3.

Borings were performed using a track-mounted limited access rig equipped with 8-inch outside diameter (OD) hollow-stem 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 and 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 neat cement grout or 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. Logs of exploratory borings are presented herein.

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
	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
FINE-GRAINED SOILS MORE THAN HALF IS FINER THAN NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50%		OL	ORGANIC SILTS OR CLAYS OF LOW PLASTICITY
			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

BEDDING SPACING DESCRIPTIONS

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

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			COMPRESSIVE STRENGTH (tsf)
	RELATIVE DENSITY	BLOWS PER FOOT (SPT)*	BLOWS PER FOOT (MOD-CAL)*	CONSISTENCY	BLOWS PER FOOT (SPT)	BLOWS PER FOOT (MOD-CAL)*	
	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)	R – R-VALUE (CTM 301)
CR – CORROSION ANALYSIS (CTM 422, 643, 417)	SE – SAND EQUIVALENT (CTM 217)
DS – DIRECT SHEAR (ASTM D3080)	TXCU – CONSOLIDATED UNDRAINED TRIAXIAL (ASTM D4767)
EI – EXPANSION INDEX (ASTM D4829)	TXUU – UNCONSOLIDATED UNDRAINED TRIAXIAL (ASTM D2850)
GSA – GRAIN SIZE ANALYSIS (ASTM D422)	UC – UNCONFINED COMPRESSIVE STRENGTH (ASTM D2166)
MC – MOISTURE CONTENT (ASTM D2216)	
PI – PLASTICITY INDEX (ASTM D4318)	



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KEY TO LOGS

Figure A1

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B1		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
					ELEV. (MSL.) <u>~65'</u>	DATE COMPLETED <u>2/9/23</u>				
					ENG./GEO. <u>K. Williams</u>	DRILLER <u>Cuesta Geo</u>				
					EQUIPMENT <u>MPP Limited Access Drill</u>	HAMMER TYPE <u>140 lb. Automatic</u>				
					MATERIAL DESCRIPTION					
0	BT Bulk			CL	FILL					ET
1	B1-0.5				Stiff, moist, dark yellowish brown Lean CLAY, medium plasticity, PP=1 tsf					10
2	B1-1			CL	Stiff, dark yellowish brown, Lean CLAY with fine sand					
3	B1-3			CL	ALLUVIUM					PI, GSA
4	B1-3.5				Medium stiff, moist, dark yellowish brown Lean CLAY with fine sand, PP=0.5 tsf					17
5					- PP=0.5 tsf					106.3
6	B1-5.5			CH	Very stiff, moist, dark yellowish brown, Fat CLAY, trace medium sand, PP=3.5 tsf					21.1
7	B1-6									20
8	B1-8			ML	Medium stiff, dry, dark yellowish brown SILT with fine sand, low plasticity					23.0
9	B1-8.5				- very stiff, PP=2.5 tsf					PI, GSA
10				CL	Very stiff, moist, dark yellowish brown, Lean CLAY, few fine sand, medium plasticity					9
11	B1-10.5				- PP=3.5 tsf					25
12	B1-11									
13										
14										
15	B1-15.5			ML	Hard, dry, yellowish brown, SILT with fine sand, medium plasticity					55
16	B1-16				- PP>4.5 tsf					
17										
18										
19										
20	B1-20.5				- few medium sand					87
21	B1-21				- PP>4.5 tsf					
22										
23										
24										
25	B1-25			ML	Very stiff, moist, dark yellowish brown, Sandy SILT					17
26										
27										

Figure A2, Log of Boring, page 1 of 2

IN PROGRESS S9731-05-37 BORING LOGS - KW.GPJ 03/08/23



SAMPLE SYMBOLS

□ ... SAMPLING UNSUCCESSFUL

▤ ... DISTURBED OR BAG SAMPLE

■ ... STANDARD PENETRATION TEST

▣ ... CHUNK SAMPLE

■ ... DRIVE SAMPLE (UNDISTURBED)

▼ ... WATER TABLE OR SEEPAGE

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

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B1		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
					ELEV. (MSL.) ~65'	DATE COMPLETED 2/9/23				
					ENG./GEO. K. Williams	DRILLER Cuesta Geo				
					EQUIPMENT MPP Limited Access Drill	HAMMER TYPE 140 lb. Automatic				
MATERIAL DESCRIPTION										
28					- hard, PP>4.5 tsf					
29										
30	B1-30									
31										
32										
33					Very stiff, moist, yellow brown Lean CLAY with fine and medium sand - stiff, PP=1.5 tsf					
34										
35										
36										
37										
38										
39										
40	B1-40			CL						
41										
42										
43										
44										
45										
46										
47										
48										
49										
50	B1-50			ML	Hard, moist, yellowish brown with grayish brown mottling, Sandy SILT					
51										
BORING TERMINATED AT 51.5 FEET GROUNDWATER ENCOUNTERED AT 30 FEET; STABIILIZED AT 29 FEET BACKFILLED WITH NEAT CEMENT GROUT							39			

Figure A2, Log of Boring, page 2 of 2

IN PROGRESS S9731-05-37 BORING LOGS - KW.GPJ 03/08/23



SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ☒ ... DISTURBED OR BAG SAMPLE

- ☐ ... STANDARD PENETRATION TEST
- ☒ ... CHUNK SAMPLE

- ☐ ... DRIVE SAMPLE (UNDISTURBED)
- ☒ ... WATER TABLE OR SEEPAGE

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

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B2 ELEV. (MSL.) <u>~65'</u> ENG./GEO. <u>K. Williams</u> EQUIPMENT <u>MPP Limited Access Drill</u> DATE COMPLETED <u>2/9/23</u> DRILLER <u>Cuesta Geo</u> HAMMER TYPE <u>140 lb. Automatic</u>	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	B2 Bulk				MATERIAL DESCRIPTION				
1	B2-0.5			CL-ML	FILL Medium stiff, moist, very dark brown, SILTY CLAY	9			PI, R
2	B2-1				- stiff, PP=1.5 tsf - few fine sand				
3	B2-3			CL	ALLUVIUM				
4	B2-3.5				Hard, moist, Lean CLAY, few fine sand, PP=4.5 tsf	17			
5	B2-5.5								
6	B2-6				- very stiff, PP=2.5 tsf	15			
BORING TERMINATED AT 6.5 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED WITH NEAT CEMENT GROUT									

Figure A3, Log of Boring, page 1 of 1

IN PROGRESS S9731-05-37 BORING LOGS - KW.GPJ 03/08/23



SAMPLE SYMBOLS

□ ... SAMPLING UNSUCCESSFUL

▣ ... DISTURBED OR BAG SAMPLE

■ ... STANDARD PENETRATION TEST

▤ ... CHUNK SAMPLE

■ ... DRIVE SAMPLE (UNDISTURBED)

▼ ... WATER TABLE OR SEEPAGE

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

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B3 ELEV. (MSL.) ~65' ENG./GEO. K. Williams EQUIPMENT MPP Limited Access Drill DATE COMPLETED 2/9/23 DRILLER Cuesta Geo HAMMER TYPE 140 lb. Automatic	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
0	B3 Bulk				MATERIAL DESCRIPTION				
1	B3-0.5			CL	FILL Medium stiff, moist, dark yellowish brown, Lean CLAY, trace medium sand	9			PI
2	B3-1				- stiff to very stiff, PP=2 tsf				
3					- trace asphalt trimmings				
4	B3-3			CL	ALLUVIUM Stiff, moist, dark yellowish brown Lean CLAY, trace medium sand, medium plasticity	17			Corr
5	B3-3.5				- very stiff, PP=3.5 tsf				
6	B3-5.5				- PP=3 tsf	24			
	B3-6				BORING TERMINATED AT 6.5 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED WITH NEAT CEMENT GROUT				

Figure A4, Log of Boring, page 1 of 1

IN PROGRESS S9731-05-37 BORING LOGS - KW.GPJ 03/08/23



SAMPLE SYMBOLS

□ ... SAMPLING UNSUCCESSFUL

■ ... STANDARD PENETRATION TEST

■ ... DRIVE SAMPLE (UNDISTURBED)

▨ ... DISTURBED OR BAG SAMPLE

■ ... CHUNK SAMPLE

▼ ... WATER TABLE OR SEEPAGE

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

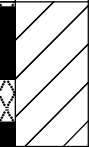
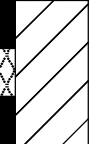
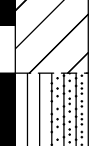
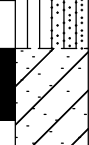
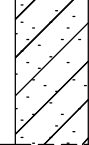
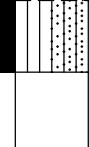
DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B4		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
					ELEV. (MSL.) ~65'	DATE COMPLETED 2/9/23				
					ENG./GEO.	DRILLER				
					MPP Limited Access Drill <td>Cuesta Geo<td></td><td></td><td></td><td></td></td>	Cuesta Geo <td></td> <td></td> <td></td> <td></td>				
					EQUIPMENT	HAMMER TYPE				
						140 lb. Automatic				
MATERIAL DESCRIPTION										
0	B4 Bulk			CL	FILL		16			
1	B4-0.5			Stiff, moist, very dark grayish brown, Lean CLAY, medium to high plasticity						
2	B4-1			- hard, PP=4.5 tsf						
3	B4-3			CL	- trace medium sand		16	85.2	22.0	
4	B4-3.5			ALLUVIUM						
5				Stiff, moist, very dark grayish brown, Lean CLAY, trace medium sand, medium to high plasticity						
6	B4-5.5				- hard, PP>4.5 tsf		17			
7	B4-6				- very stiff, PP=3.5 tsf					
8	B4-8				Soft, moist, dark yellowish brown, Sandy SILT, fine sand, low plasticity					
9	B4-8.5			ML	- stiff to very stiff, PP=2 tsf		6			
10				Stiff, moist, very dark grayish brown, Lean CLAY, trace fine sand, medium plasticity						
11	B4-10.5			- very stiff, PP=4 tsf						
12	B4-11			CL			23			
13										
14										
15	B4-15.5			ML	Very stiff, dry, yellowish brown, Sandy SILT, fine sand, trace medium sand		31			
16	B4-16			- hard, PP>4.5 tsf						
BORING TERMINATED AT 16.5 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED WITH NEAT CEMENT GROUT										

Figure A5, Log of Boring, page 1 of 1

IN PROGRESS S9731-05-37 BORING LOGS - KW.GPJ 03/08/23



SAMPLE SYMBOLS

□ ... SAMPLING UNSUCCESSFUL

▣ ... DISTURBED OR BAG SAMPLE

■ ... STANDARD PENETRATION TEST

■ ... CHUNK SAMPLE

■ ... DRIVE SAMPLE (UNDISTURBED)

▼ ... WATER TABLE OR SEEPAGE

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

DEPTH IN FEET	SAMPLE INTERVAL & RECOVERY	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B5		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	ADDITIONAL TESTS
					ELEV. (MSL.) ~65'	DATE COMPLETED 2/9/23				
					ENG./GEO. K. Williams	DRILLER Cuesta Geo				
					EQUIPMENT MPP Limited Access Drill	HAMMER TYPE 140 lb. Automatic				
MATERIAL DESCRIPTION										
0	B5 Bulk			CL	FILL Medium stiff, moist, very dark brown, Lean CLAY, trace fine sand - very stiff, PP=2.5 tsf - stiff, very dark grayish brown, few fine sand, trace asphalt trimmings		10			
1	B5-0.5 B5-1									
2				CL	ALLUVIUM Stiff, very dark grayish brown, Lean CLAY, few fine sand, medium plasticity - PP=1 tsf - very stiff, PP=2.75 tsf		15	108.5	19.9	
3	B5-3 B5-3.5									
4				CL			17	97.7	23.0	
5	B5-5.5 B5-6									
6				ML	Soft, moist, dark yellowish brown, SILT with fine sand, low to medium plasticity - very stiff, PP=2.25 tsf		5			
7	B5-8 B5-8.5									
8				CL	Stiff, dry, dark grayish brown, Lean CLAY, few fine sand - very stiff, PP=3.5 tsf - dark yellowish brown - hard, PP>4.5 tsf		23			
9	B5-10.5 B5-11									
10				CL			39			
11	B5-15.5 B5-16									
12				CL			71			
13	B5-20.5 B5-21									
14					- PP>4.5					
BORING TERMINATED AT 21.5 FEET GROUNDWATER NOT ENCOUNTERED BACKFILLED WITH NEAT CEMENT GROUT										

Figure A6, Log of Boring, page 1 of 1

IN PROGRESS S9731-05-37 BORING LOGS - KW.GPJ 03/08/23



SAMPLE SYMBOLS

□ ... SAMPLING UNSUCCESSFUL

▣ ... DISTURBED OR BAG SAMPLE

■ ... STANDARD PENETRATION TEST

▤ ... CHUNK SAMPLE

■ ... DRIVE SAMPLE (UNDISTURBED)

▼ ... WATER TABLE OR SEEPAGE

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

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, fines content, corrosion potential, expansion potential, 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		
B1-Bulk	0 – 5	14.3	29.1	66	Medium

**Expansion Potential Classification per ASTM D4829.*

**TABLE B2
R-VALUE TEST RESULTS
ASTM D2844**

Sample Number	Depth (feet)	Soil Classification	R-Value
B2-Bulk	0 – 5	Lean Clay	<5

Sample ID	Depth (feet)	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Water Content (%)	Dry Density (pcf)
B1-3	3	41	17	24	---	70.1		
B1-3.5					---		21.1	106.3
B1-6	6	51	20	31	---	94.5	23.0	101.9
B2-Bulk		21	14	7	---			
B3-Bulk	0-5	25	15	10	---			
B4-3.5	3.5				---		22.0	85.2
B5-3.5	3.5				---		19.9	108.5
B5-6	6				---		23.0	97.7



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Summary of Laboratory Results

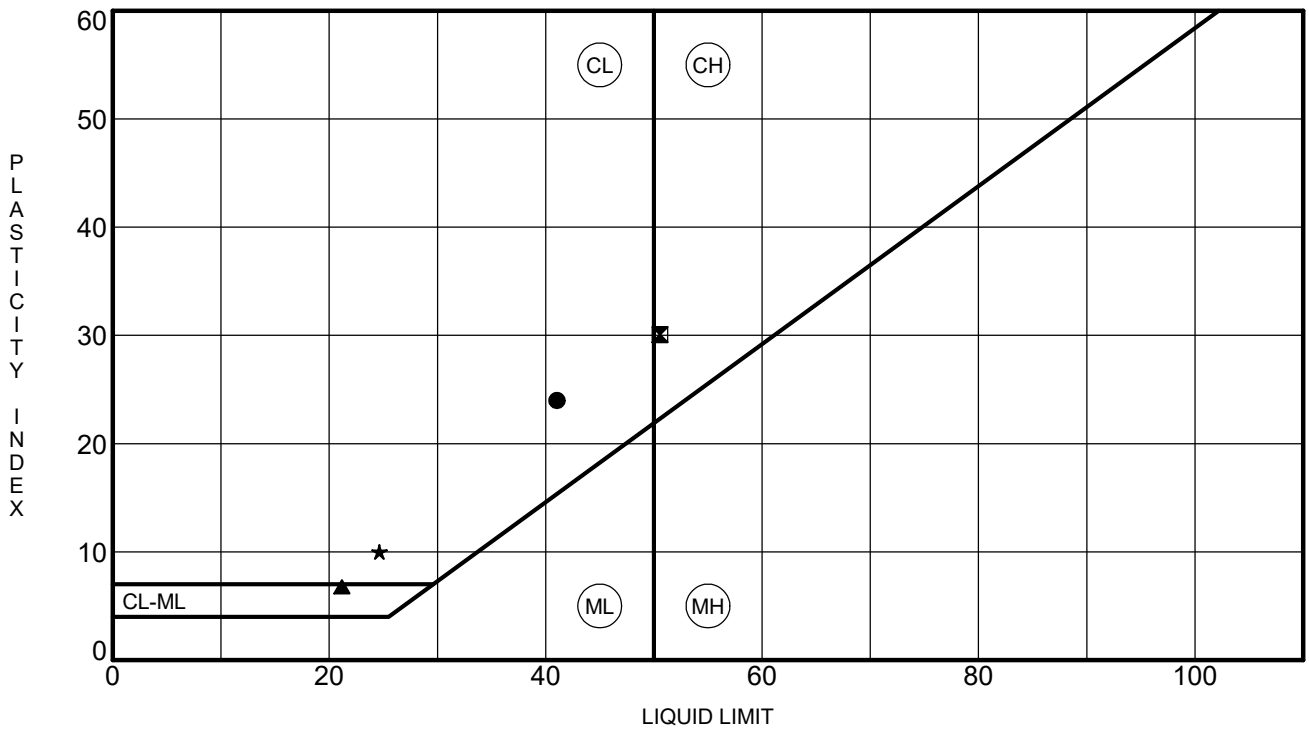
Project: Dixon Fire Station 82

Location: Dixon, California

Number: S9731-05-37

Figure: B1

Date:



	Sample No.	Liquid Limit	Plastic Limit	Plasticity Index	% Pass #200 Sieve	Unified Soil Classification Description	Preparation Method
●	B1-3	41	17	24	70.1	LEAN CLAY with SAND(CL)	dry
⊠	B1-6	51	20	31	94.5	FAT CLAY(CH)	dry
▲	B2-Bulk	21	14	7		SILTY CLAY(CL-ML)	dry
★	B3-Bulk	25	15	10		LEAN CLAY (CL)	dry



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ATTERBERG LIMITS (ASTM D4318)

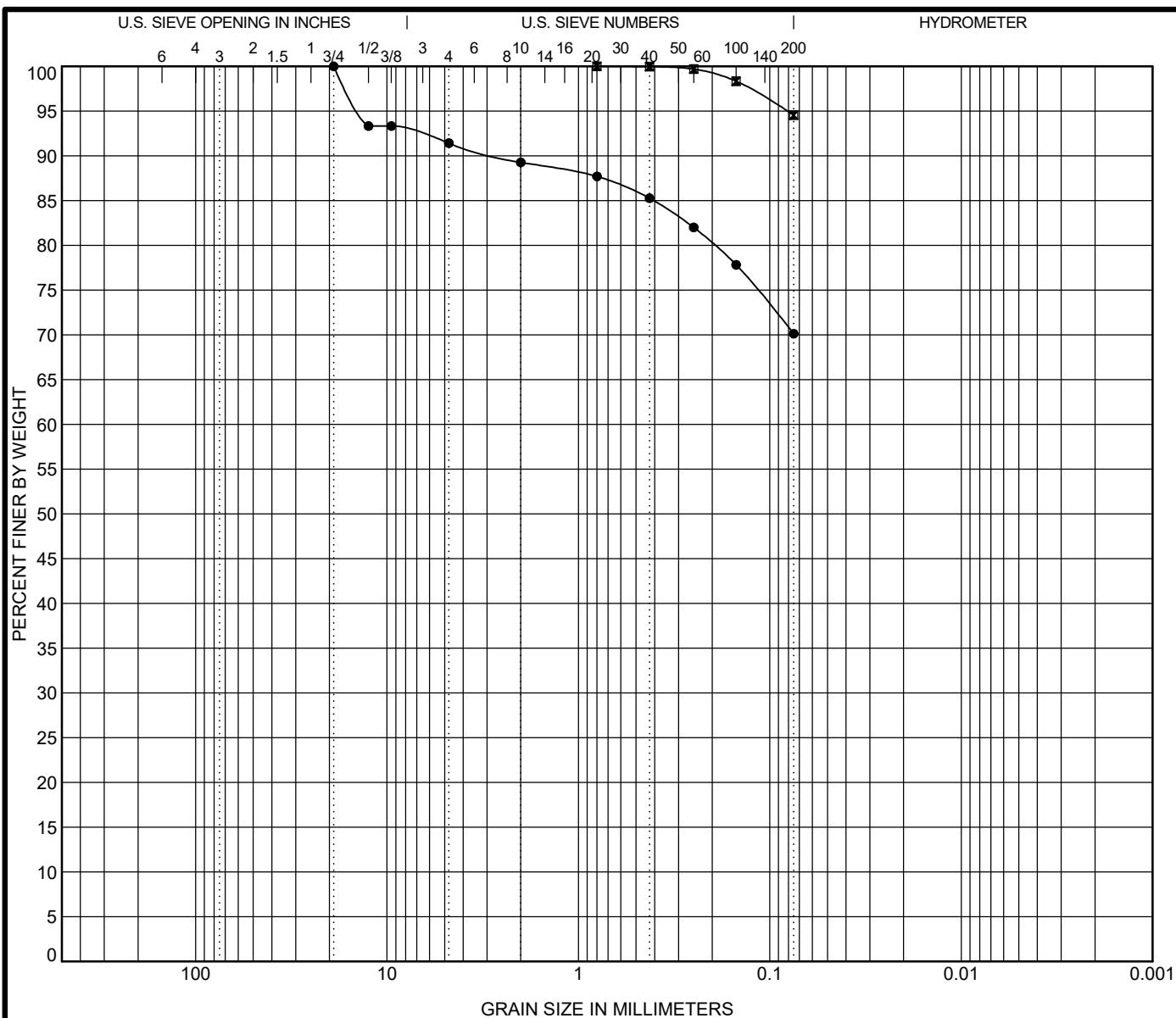
Project: Dixon Fire Station 82

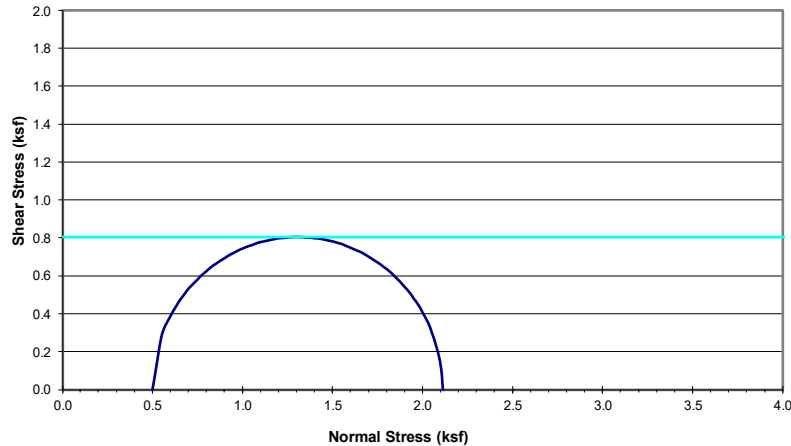
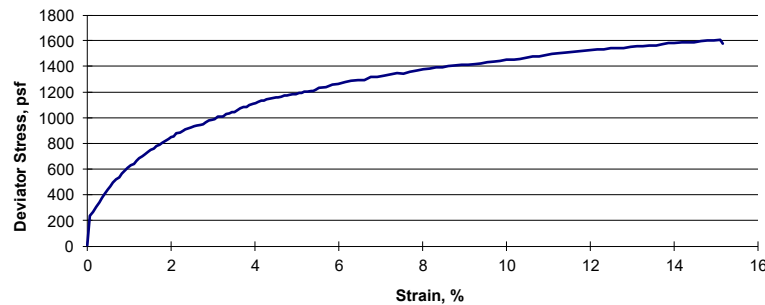
Location: Dixon, California

Number: S9731-05-37

Figure: B2

Date:



MOHR'S CIRCLES**STRESS-STRAIN****Failure Photo****Sample Description**

Sample Number	B1-3.5
Sample Depth (feet)	3.5
Material Description	Dark Brown lean CLAY

Initial Conditions at Start of Test

Height (inch)	4.800
Diameter (inch)	2.400
Moisture Content (%)	21.1
Dry Density (pcf)	106.3
Estimated Specific Gravity	2.7
Saturation (%)	97.5

Shear Test Conditions

Strain Rate (%/min)	1.0088
Major Principle Stress at Failure (psf)	2110
Minor Principle Stress, Cell Pressure (psf)	500
Deviator Stress at Fail (psf)	1610

Test Results

Friction Angle ϕ , (degrees)	0
Cohesion, (psf)	806

Note: Strength attributed to cohesion with no value of friction assigned



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Triaxial Shear Strength - UU Test (single)

Project: Dixon FS 82
Location: Dixon, CA
Number: S9731-05-37
Figure: B4