THE REPLACEMENT OF GUARDRAIL ON CROW CANYON ROAD AT VARIOUS LOCATIONS FROM SAN SIMEON PLACE TO NORRIS CANYON ROAD ALAMEDA COUNTY, CALIFORNIA SPECIFICATION NO. 2483 STATE AID PROJECT: HSIPL – 5933 (165)

This addendum is issued by the County of Alameda, Public Works Agency, Construction and Development Services Department, 399 Elmhurst Street, Hayward, CA 94544.

TO ALL PROSPECTIVE BIDDERS for the above project, notice is hereby given that the following changes, modifications, corrections, clarifications, and additions as hereinafter set forth shall apply to the plans and specifications described herein and shall be made part thereof and subject to all requirements as if originally specified or drawn.

Receipt of this Addendum No. 2 must be acknowledged on the form in the bid proposal in writing.

GENERAL

A. The latest responses to Bidders' inquiries are attached **(Attachment 1)** and also can be viewed at the following Public Works' website:

Additional Bidder Information | Doing Business with Us | ACPWA Alameda County Public Works Agency

This document will be continuously updated. It is the contractor's responsibility to check for updates.

CHANGES TO THE BID BOOK

1. Replace Bid Book pages BB-3, BB-8, BB-9 with the attached Bid Book pages BB-3 (Addendum 2), BB-3 (Addendum 2), and BB-9 (Addendum 2).

CHANGES TO THE SPECIAL PROVISIONS

1. Replace Special Provisions Table of Contents page i with the attached Special Provisions Table of Contents page i (Addendum 2).
2. Replace Special Provisions page 22 with the attached Special Provisions page 22 (Addendum 2).
3. Replace Special Provisions page 72 with the attached Special Provisions page 72 (Addendum 2).
4. Replace Special Provisions page 75 with the attached Special Provisions page 75 (Addendum 2).
5. Add Informational Handout J: Geotechnical Engineering Study Memorandum – Crow Canyon Road Guardrail Replacement

END OF ADDENDUM NO. 2
OFFICE OF THE COUNTY ENGINEER

CONTRACTOR'S INQUIRY RESPONSES

THE REPLACEMENT OF GUARDRAILS ON CROW CANYON ROAD AT VARIOUS LOCATIONS FROM SAN SIMON PLACE TO NORRIS CANYON ROAD EDEN TOWNSHIP, ALAMEDA COUNTY, CALIFORNIA HSIPL-5933 (165)

The responses to contractors' inquiries, unless incorporated into a formal addendum to the contract, are not a part of the contract and are provided for the contractor's convenience only. In some instances, the question and answer may represent a summary of the matters discussed rather than a word-for-word recitation. The responses may be considered along with all other information furnished to prospective bidders for the purpose of bidding on the project. The availability or use of information provided in the responses to contractors' inquiries is not to be construed in any way as a waiver of the provisions of section 2-1.07 of the Standard Specifications or any other provision of the contract, the plans, Standard Specifications or Special Provisions, nor to excuse the contractor from full compliance with those contract requirements. Bidders are cautioned that subsequent responses or contract addenda may affect or vary a response previously given and any such subsequent response or addenda should be taken into consideration when submitting a bid for the project. Inquiries must be submitted by the deadline specified in the project Special Provisions.

This document will be continuously updated. It is the contractor's responsibility to check for updates.

UPDATED (2-14-2024): *(Legend: T = telephone; PBM = pre-bid meeting; E = email)*

Inquiry No.	Inquiry	Response
1PBM	Are there any DBE or SLEB goals?	No
2PBM	Can you confirm the project's estimate?	$810,000
3PBM	With respect to Traffic Control, will we be allowed to close one lane?	Refer to the Project's Staging Plans (plans sheets 10 thru 12)
4PBM	When do you expect construction to start?	tentatively April 2024
5PBM (2-6-24)	Is the first pre-bid meeting attendee information available?	Yes; it is available on our ADDITIONAL BIDDER INFORMATION SHEET (website): https://www.acpwa.org/business/add-bidder-info.page and in our online Plan Room.
6PBM (2-6-24)	Bid Item #25 on the bid schedule looks to have the wrong unit. Should this item be per lineal foot?	Yes; refer to Addendum 2

7E	1. There is no additional bid item for the asphalt for Bid Item 18 – Place Hot Mix Asphalt Dike (Type C), is the intent for the asphalt materials to be incidental to the lineal foot price? 2. Plan Sheet 7 of 12 shows the existing asphalt dike is to remain where all the CIDH piles are being installed. This is highly unlikely due to the size of the CIDH piles going in. Would the county consider adding the removal of the existing dike and installation of new dike to Bid Items 18 & 19 to reduce contractor risk in this area? 3. What is Bid Item 31 Finishing Roadway to be used for? There are not items where we are building new road sections. 4. Special Provisions Section 12-4.01A states that Traffic Control Plans are to be Wet Stamped by and Engineer. If we are using the Traffic Control plans provided in the Plan set is this still required? 5. Is there any geotechnical information available for the area where the CIDH piles are being installed? 6. Special Provisions Section 14-11.14 states this section only applies if there is a Bid Item for Treated Wood Waste. Are contractors required to still abide by this spec for the Treated Wood Waste from the guardrail removal since there is no bid item for the disposal? 7. What does the County see the Contractor providing for Bid Item 2 Construction Surveys? The only reference I see is to a Grade Setter and we are not building any road grade on this project. 8. Bid Item 16 – Spoils Stockpile & Offhaul – Does the County have a site available for stockpiling?	1. A bid item for Asphalt Concrete, Type A (HMA-LV) is added to the Bid List. Refer to Addendum 2. 2. Yes; Refer to Addendum 2 for increase quantities for Bid Items 18 and 19 should this existing AC dike is removed as a consequence of unavoidable construction activities. 3. Debris removal, cleanup,…etc. Refer to Section 22 of the Standard Specifications. 4. Yes 5. Yes; Refer to Addendum 2 6. A bid item for Treated Wood Waste is added to the Bid List. Refer to Addendum 2. 7. Construction Survey work includes all work to construct the proposed guardrail in its proper locations as shown in the plans, including staking out the proposed guardrail alignment based on the centerline stationing and offsets provided. 8. Yes. This site is located in proximity of Crow Canyon Road Milepost 2.05.

Inquiry No.	Inquiry	Response
	9. Bid Item 16 – Spoils Stockpile & Offhaul – Is this item intended for Treated Wood Waste or for the Spoils associated with the CIDH installation? 10. Bid Item 16 – Spoils Stockpile & Offhaul – If this item is intended for the CIDH spoils, can the county provide the Concentration Data and sample location maps per 14-11.08C Site Conditions? 11. Bid Item 25 – MGS CRT Wood Post – Asked in the prebid meeting, please correct the unit for this bid item. 12. The General Instruction on Page BB-3 of the General Instructions Item 8 states that the responsible bidder must perform work equally at least 50% of the value of the total bid. This is also listed in Section 5-1.13A of the special provisions. Can this be reduced to 30% to match the 2022 Caltrans Standard Specification book? I think this will provide more flexibility to the contractors to not only get DBE Subcontract support but also get qualified contractors for the other items of work on this project. 13. Bid Items 22, 23 & 24 call out for Wood Post Midwest Guardrail System's. Would the County allow Steel Posts with composite blocks instead? Cal Trans allows for the use of Steel Posts and composite blocks and other new guardrail installation's in the area have steel posts and composite blocks.	9. For the Spoils associated with the CIDH installation. 10. Concentration Data and sample location maps are not available. Refer to Addendum 2. 11. Correct Unit is LINEAR FEET; refer to Addendum 2 12. Yes; refer to Addendum 2. 13. Galvanized W6x15 steel posts that have 6 inch flange width can be used instead of 6x8 wood posts. If steel posts are used, the length of steel posts need to match the length of wood posts shown on sheet 08 of 12. As per plan, posts need to be placed in the soil and not connected to CIDH piles. (NOTE: There will be no bid item added to the bid proposal reflecting the use of steel posts; substitution of wood posts to steel posts will be made at no change in cost to the project)
8E		
9E		
10E		

Inquiry No.	Inquiry	Response
11E		
12E		
13E		
14E		
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49		
50		

GENERAL INSTRUCTIONS

A. Confirm your qualifications as a responsible bidder.

☐ 1. Did not already provide architectural or engineering services for the contract (§2-1.02).

☐ 2. Can certify compliance with the Iran Contracting Act of 2010 if bid is to be over $1M (§2-1.02).

☐ 3. Did or will attend a mandatory pre-bid outreach meeting as scheduled in the Notice to Bidders (§2-1.04).

☐ 4. Registered with the Department of Industrial Relations if bid is to be over $25,000 (§3-1.03).

☐ 5. Licensed California contractor of the classification specified in the Notice to Bidders (§3-1.06).

☐ 6. Party to, or intend to become a party to, the Alameda County Project Stabilization/Community Benefits Agreement for Non-Federal-Aid projects (§3-1.09).

☐ 7. Not currently sanctioned as ineligible by the Alameda County Board of Supervisors for non-conformance with the requirements of another contract or under suspension, debarment, voluntary exclusion, or determination of ineligibility by any federal agency. (§3-1.10D).

☐ 8. Can perform work equaling at least ~~50~~ 30 percent of the value of the total bid with own employees and owned/rented equipment (§5-1.13A).

B. Familiarize yourself with the Contract documents and requirements.

Section 3-1.18, "Contract Execution," provides a sample contract.

Upon execution of the Contract, your Bid Proposal, the *Special Provisions*, Project Plans, *Standard Specifications*, Standard Details, Revised Standard Plans, Standard Plans, and any supplemental project information all become components of the Contract. Section 5-1.02, "Contract Components," describes the governing ranking of Contract parts.

The Contract's *Special Provisions* are based upon Caltrans 2022 construction standards. As such, they are organized in a similar manner and are to be interpreted in a similar way as if they were issued under a State transportation contract.

If unfamiliar with Caltrans construction standards, it may be beneficial to review the State's training webpage: http://www.dot.ca.gov/hq/construc/training-page.html

C. Submit a responsive bid.

Provisions pertaining to the bidding process are in section 2.

In summary:

☐ 1. Attend the mandatory pre-bid outreach meeting and sign the attendance sheet.

☐ 2. Submit a sealed bid that includes a bidder's security as described under section 2-1.34, "Bidder's Security," to the location and by the deadline specified in the Notice to Bidders.

D. Be Prepared to Submit Prerequisite Documents for Contract Award

If you are determined to be the lowest responsible bidder, you will need to submit a:

☐ Payment bond (§3-1.05, sample bond form provided under §3-1.18)

☐ Performance bond (§3-1.05, sample bond form provided under §3-1.18)

☐ Commercial general liability insurance policy and an excess policy (§3-1.07)

☐ Certificate of Insurance showing all other required coverages (§3-1.07)

☐ CPA Certification of sufficient resources for self-insured retentions—if applicable (§3-1.07)

No.	Sec/Code	Bid Item Description	Qty	Unit	Unit Cost	Total Cost
LANDSCAPE						
17*	§21-2.03D 202028-A	Hydroseed	5,600	SF		
SURFACINGS AND PAVEMENTS						
18*	**§39-2.09 390132-LV**	**Hot Mix Asphalt, Type A (HMA-LV)**	**30**	**TN**		
19*	§39-2.01 394073	Place Hot Mix Asphalt Dike (Type C)	**405**	LF		
20*	§39-3.03 398100	Remove Asphalt Concrete Dike	**350**	LF		
ROADSIDE SIGNS						
21*	§82	Relocate Roadside Sign and Post	1	EA		
GUARDRAIL SYSTEM						
22*	§83-11.02B 839752	Remove Guardrail	1,211	LF		
23*	§83-2.02 832005	Midwest Guardrail System (MGS) – 6' Wood Post	1,080	LF		
24*	§83-2.02 832005	Midwest Guardrail System (MGS) – 8' Wood Post	110	LF		
25*	§83-2.02 832005	Midwest Guardrail System (MGS) – 9' Wood Post for Narrow Road Installation	180	LF		
26*	§83-2.02 832007	Midwest Guardrail System (MGS) Controlled Releasing Terminal (CRT) Wood Post	125	**LF**		
27*	§83-2.02 839581	End Anchor Assembly (Type SFT)	2	EA		
28*	§83-2.04 839539	Caltrans Approved 31" In-Line Terminal System	4	EA		
29*	49-3	Cast-in-Drilled-Hole (CIDH) Concrete Piling	450	LF		
30*	81-1	MGS Delineator (A77N4)	270	EA		
31	**§14-11.14 141120**	**Treated Wood Waste (Disposal)**	**1**	**LS**		
PROJECT WRAP-UP						
32	§5-1.23B(3)	Record Drawings	1	LS		
33	§22 220101	Finishing Roadway	1	LS		

*Contingent item under section 2-1.09B

*Contingent item under section 2-1.09B

Total Bid: _____ **Dollars $** _____
(in words)

The prices bid include all State, Federal, and other taxes applicable to the project.

The prices bid include furnishing the resources and activities required to complete the work. Payment is full compensation for furnishing the resources and activities as described under section 9-1.03.

Specifications found under the referenced sections are not the only specification that apply to the Bid Item as described under section 1-1.01.

Most bid Item codes (without the hyphenated suffix) and descriptions are similar to, but not necessarily the same as, Caltrans Standard Bid Item codes and descriptions. This information when queried at the following webpage may be useful for estimating costs: http://sv08data.dot.ca.gov/contractcost.

*Contingent item under section 2-1.09B

Table of Contents

5 CONTROL OF WORK

Replace last paragraph in section 5-1.01 with

Use contract administration forms available at the Elations Systems website or that are otherwise provided by the Agency.

Replace section 5-1.02 with:

5-1.02 CONTRACT COMPONENTS

A component in one Contract part applies as if appearing in each. The parts are complementary and describe and provide for a complete work.

If a discrepancy exists:

1. Governing ranking of Contract parts in descending order is:
    1.1. Project plans
    1.2. Special provisions and Information Handouts
    1.3. Standard specifications
    1.4. (County) Standard Details/Design Guidelines
    1.5. Revised standard plans
    1.6. Standard plans
    1.7. Supplemental project information
2. Written numbers and notes on a drawing govern over graphics
3. Detail drawing governs over a general drawing
4. Specific specification governs over a general specification
5. Specification in a section governs over a specification referenced by that section

Use proper caution and care to verify dimensions. You are responsible for any discrepancies or errors or omissions that might have otherwise been avoided.

If a discrepancy, apparent error or omission is found or confusion arises, submit an RFI immediately upon discovery

Delete section 5-1.09 – Partnering

Replace the 1st sentence in section 5-1.12 with:

The performance of the Contract or any Contract part may be assigned only with prior written consent from the Agency upon authorization granted by the Board.

Delete the 2nd sentence in section 5-1.13A

Replace the 5th sentence in section 5-1.13A with:

Except for a building-construction non-federal-aid contract, perform work equaling at least ~~50~~ 30 percent of the value of the original total bid with your employees and with equipment you own or rent, with or without operators.

14-11.08C Site Conditions

Concentration data and sample location maps for ADL are ~~included in the Information Handout~~ not available.

14-11.08D Submittals

14-11.08D(1) General

Reserved

14-11.08D(2) Excavation and Transportation Plan

Within 15 days of Contract approval, submit 3 copies of an excavation and transportation plan for material containing hazardous waste concentrations of ADL.

If the plan requires revisions, the Agency provides comments. Submit a revised plan within 7 days of receiving comments. The Engineer may allow construction to proceed while minor revisions or amendments are being completed.

The excavation and transportation plan must comply with:

1. DTSC regulations
2. Variance regarding the use of material containing ADL
3. Cal/OSHA regulations
4. Requirements for the design and development of a sampling plan, statistical analysis, and reporting of test results under US EPA, SW 846, "Test Methods for Evaluating Solid Waste," Volume II: Field Manual Physical/Chemical, Chapter 9, section 9.1

14-11.08D(3) Burial Location Report

Reserved

14-11.08D(4) Bill of Lading

Submit copies of the bills of lading as an informational submittal upon placement of Type Y-1 or Y-2 material in its final location.

14-11.08E Dust Control

Prevent visible dust migration during excavation, transportation, placement, and handling of material containing hazardous waste concentrations of ADL under section 14-11.04.

14-11.08F Air Monitoring

Reserved

14-11.08G Material Management

Reserved

14-11.08H Surveying Type Y-1 or Y-2 Material Burial Locations

Survey the bottom and top perimeters of each location where you bury Type Y-1 or Type Y-2 material.

The survey must be performed by or under the direction of one of the following:

1. Land surveyor licensed under the Bus & Prof Code Ch 15, starting with § 8700
2. Civil engineer licensed before January 1, 1982 under the Bus & Prof Code Ch 7, starting with § 6700

Survey 10 points to identify each burial location horizontally and vertically within the specified accuracies and to create closed polygons of the bottom and top perimeters of the burial location. If needed to adequately define the polygon, survey additional points. Establish the position of the bottom and top perimeters before placing subsequent layers of material that obstruct the location.

Report each burial location in California state plane coordinates in US survey feet within the appropriate zone of the California Coordinate System of 1983 (CCS83) and in latitude and longitude. Reference horizontal positions to CCS83 (epoch 2007.00 or later National Geodetic Survey [NGS] or California Spatial Reference Center [CSRC] published epoch) to an accuracy of 3 feet horizontally. Identify the survey points to an accuracy of 1 foot

Identify treated wood waste and accumulation areas using water-resistant labels that comply with 22 CA Code of Regs, Div 4.5 Ch 34 § 67386.5. Labels must include:

1. The words Alameda County Public Works Agency
2. The words Specification No. and the specification number
3. Agency office address
4. Engineer's name, address, and telephone number
5. Contractor's contact name, address, and telephone number
6. Date placed in storage

14-11.14E Transport and Disposal of Treated Wood Waste

Transport treated wood waste directly to the CA permitted disposal site after leaving the jobsite. Do not mix treated wood waste from the job site with waste from any other generator.

Dispose of treated wood waste within:

1. 90 days of generation if stored on blocks
2. 180 days of generation if stored on a containment surface or pad
3. 1 year of generation if stored in a water-resistant container or within 90 days after the container is full, whichever is shorter
4. 1 year of generation if stored in a storage building as defined in 22 CA Code of Regs, Div 4.5, Ch 34, § 67386.6(a)(2)(C)

The contractor must remove all treated wood waste and any project's spoils and waste material from all County stockpile site(s) by the end of the project's construction. The County will not accept the contract until the Engineer approves the treated wood waste and spoils removal, cleanup and restoration of the County's stockpile site(s).

Before transporting treated wood waste, obtain agreement from the receiving facility that it will accept the waste. Protect shipments of the waste from loss and exposure to precipitation. For projects generating 10,000 lb or more of treated wood waste, request a generator's EPA Identification Number from the Engineer at least 5 business days before the 1st shipment. Each shipment must be accompanied by a shipping record such as a bill of lading or invoice that includes:

1. The words Alameda County Public Works Agency
2. The words Specification No. and the specification number
3. Agency office address
4. Engineer's name, address, and telephone number
5. Contractor's name, contact person, and telephone number
6. Receiving facility's name and address
7. Description of the waste (e.g., treated wood waste with preservative type if known or unknown/mixture)
8. Project location
9. Estimated weight or volume of the shipment
10. Date of transport
11. Date of receipt by the treated wood waste facility
12. Weight of shipment measured by the receiving facility
13. Generator's US EPA Identification Number for projects generating 10,000 lb or more of treated wood waste

The shipping record must be 8-1/2 by 11 inches and a 4-part carbon or carbonless form to provide copies for the Engineer, transporter, and treated wood waste facility.

Dispose of treated wood waste at an approved California disposal site operating under a RWQCB permit that includes acceptance of treated wood waste.

15 EXISTING FACILITIES

March 12, 2024

Bong Ng, P.E.
Alameda County Public Works Agency
399 Elmhurst Street

Subject: **Geotechnical Engineering Study Memorandum**
Crow Canyon Road Guardrail Replacement Phase IV
Project Alameda County, California
WRECO Project No. P16066

Dear Mr. Ng:

This letter report presents WRECO's *Geotechnical Engineering Study Memorandum* for selected Crow Canyon Road guardrail replacement segments (Project) for the County of Alameda (County) Public Works Agency (PWA). Our understanding of the Project site, scope of work performed for this study, and engineering recommendations are detailed below.

BACKGROUND

The Project consists of eight existing guardrail segments along Crow Canyon Road in unincorporated Alameda County, California. Five of these segments, Guardrail No. 3 through 7, are located adjacent to slopes that may require stabilization; these segments are located between the Cold Water Drive and Norris Canyon Road intersections. The Project is located in a suburban area in the northwest portion of the County. The affected guardrail locations are as listed below in Table 1.

Table 1. Proposed Guardrail Locations, Crow Canyon Road, Alameda County, California

Guardrail Number	Offset (Left or Right)	Proposed Guardrail Locations				Approximate Length (feet)
		Project Stationing		Latitude, Longitude (decimal degrees)		
		Begin	End	Begin	End	
3	Left	78+19.9	82+22.7	37.7070, -122.0415	37.7080, -122.0409	405
4	Right	90+76.4	102+96.3	37.7104, -122.0405	37.7138, -122.0401	1,220
5	Left	106+11.5	124+54.1	37.7145, -122.0400	37.7189, -122.0383	1,845
6	Left	126+42.3	128+71.2	37.7193, -122.0384	37.7200, -122.0382	230
7	Right	174+60.0	175+25.0	37.7317, -122.0334	37.7319, -122.0333	65

The Project area is shown on Figure 1, Project Location Map, and the site locations are shown on Figure 2, Project Vicinity Map, as attachments to this report.

SCOPE OF WORK

For the Project, WRECO performed the following scope of work:

- Submitted a boring plan, showing the location of the planned borings.
- Prepared a Safety, Health & Environmental (SH&E) Plan for the field work activities.
- Performed a literature search for published geologic and geohazard information for the Project site and adjacent areas.
- Visited the sites and marked in white paint and/or wooden stakes the proposed boring locations and contacted Underground Service Alert (USA) a minimum of 72-hours prior to the start of field investigation work to identify on-site underground utilities.
- Obtained an encroachment permit from the County PWA (Permit No. R23LD23029).
- Obtained a well permit from the County PWA – Water Resources (Permit No. W2023-0084).
- Advanced eight exploratory borings to evaluate soil and rock types and groundwater conditions at the site and observed the adjacent slopes.
- Visually classified samples and cuttings at the time of drilling using the California Department of Transportation's (Caltrans) *Soil and Rock Logging, Classification, and Presentation Manual*, 2010 Edition (Caltrans. 2010.).
- Obtained samples of subsurface materials in general conformance with conducting the Standard Penetration Test (SPT) (ASTM D1586), and Modified California Penetration Test (Cal Mod; ASTM D3550).
- Backfilled each boring with neat cement grout to within 2 feet of the existing ground surface then backfilled the remaining interval with previously excavated aggregate base with a 6-inch concrete cap flush with the existing asphalt surface upon completion.
- Performed laboratory testing for the determination of grain size distribution, Atterberg Limits, soil moisture and density on representative recovered soil samples.

After completing the field work and laboratory testing, WRECO has prepared this *Geotechnical Engineering Study Memorandum* to provide an evaluation of the storm damage and provide potential repair options. This report includes the following information:

- A Project summary and description of the geotechnical work performed.
- A discussion of the regional and local geology as it pertains to the Project.
- A summary of the identified soil and groundwater conditions observed at the Project site, and a summary of the laboratory testing results.
- A discussion of the existing slope conditions and earth materials encountered along the Project alignment.
- Recommendations for guardrail support including piles and spread footings.
- Evaluation for the need for slope stabilization and provide potential stabilization methods that are suitable for each location.
- Evaluation of the need for additional geotechnical/geologic investigation needed to complete design.

FIELD EXPLORATION

The field exploration involved the completion of eight borings, A-23-001 through A-23-008 (approximately north to south, in order of increasing numbering), drilled on February 14 and 15, 2023, by Geo-Ex Subsurface Exploration under the supervision of a WRECO representative. Where possible,

the borings were located on the outboard side of the road using a 4.3-inch diameter solid-stem auger drill rig.

A WRECO field geologist visually classified soil and rock samples and cuttings at the time of drilling per the requirements of the Caltrans *Soil and Rock Logging, Classification, and Presentation Manual* (2010 Edition with 2022 Errata). Soil sampling was performed using drive samplers that were advanced/driven using a 140-pound auto-trip hammer, falling 30-inches, in general conformance with conducting the SPT, ASTM D1586.

Soil samples were collected from the borings at selected intervals using an unlined 1.4-inch inside diameter (ID) split spoon sampler for SPT. In addition, one sample was collected from Boring A-23-001 using a 3.0-inch outer diameter sampler with 2.5-inch ID stainless steel liners for Cal Mod. Field blow counts were recorded as the number of hammer blows required to drive the SPT or Cal Mod sampler the final 12 inches of an 18-inch drive.

Detailed visual descriptions of the recovered soil and rock samples, SPT/Cal Mod results, and boring information is shown on the boring records as an attachment to this report. The boring information is also summarized in Table 2. The boring locations are shown on Figures 3a, 3b, 3c, and 3d in the attachments.

Table 2. Summary of Subsurface Investigation

Boring ID	Latitude, Longitude (decimal degrees)	Guardrail Number	Estimated Top of Hole Elevation[1] (feet)	Drilled Depth (feet)	Drill Rig/ Hammer Type	Hammer Efficiency Ratio (Average)[2] (%)
A-23-001	37.7074, -122.0413	3	294	22.3±	Central Mine Equipment (CME) 75/Automatic 140-pound hammer with 30-inch drop	82.2
A-23-002	37.7118, -122.0406	4	307	6.5±		
A-23-003	37.7129, -122.0403	4	318	6.5±		
A-23-004	37.7155, -122.0401	5	338	16.5±		
A-23-005	37.7169, -122.0386	5	344	20.2±		
A-23-006	37.7186, -122.0380	5	351	21.5±		
A-23-007	37.7197, -122.0383	6	367	11.5±		
A-23-008	37.7320, -122.0332	7	414	11.5±		

[1] Derived from Google Earth application and checked using USGS topographic map (USGS, 2023).
[2] As reported as overall average value, from Pile Dynamics, Inc SPT Analyzer result report, dated December 27, 2018 and provided by Geo-Ex Subsurface Exploration.

Upon completion of drilling, each boring was backfilled with neat cement grout to within 2 to 3 feet of the existing ground surface. Depending on the location, the remaining interval was filled with either native soil to match the existing ground surface or previously removed base aggregate, then capped with approximately 6 inches of a quick setting, high-strength concrete to match the existing roadway grade. Black paint was applied to the concrete patch to match existing roadway surface.

LABORATORY TESTING

Laboratory soil testing for this study included the determination of grain size distribution, Atterberg Limits, soil moisture and density, and corrosive potential (minimum resistivity, pH, and chloride; and sulfate content). A summary of the laboratory testing is shown in Table 3. Lab test results are provided in the attachments.

Table 3. Summary of Laboratory Testing

Boring ID	Sample Depth (feet)	Test	Standard (ASTM/CT)*
A-23-001	5.0 – 6.5	Sieve Analysis	ASTM D6913 / CT 202
		Atterberg Limits	ASTM D4318 / CT 204
	16.0 – 16.5	Unconfined Compression	ASTM D2166
A-23-002	5.0 – 6.5	Sieve Analysis	ASTM D6913 / CT 202
A-23-003	5.0 – 6.5	Sieve Analysis	ASTM D6913 / CT 202
		Atterberg Limits	ASTM D4318 / CT 204
A-23-004	5.0 – 6.5	Sieve Analysis	ASTM D6913 / CT 202
	15.0 – 16.5	Sieve Analysis	ASTM D6913 / CT 202
		Atterberg Limits	ASTM D4318 / CT 204
A-23-005	5.0 – 6.5	Sieve Analysis	ASTM D6913 / CT 202
		Atterberg Limits	ASTM D4318 / CT 204
	10.0 – 11.5	Sieve Analysis	ASTM D6913 / CT 202
		Atterberg Limits	ASTM D4318 / CT 204
A-23-006	5.0 – 6.5	Sieve Analysis	ASTM D6913 / CT 202
	10.0 – 11.5	Sieve Analysis	ASTM D6913 / CT 202
		Atterberg Limits	ASTM D4318 / CT 204
	15.0 – 16.5	Sieve Analysis	ASTM D6913 / CT 202
	20.0 – 21.5	Sieve Analysis	ASTM D6913 / CT 202
A-23-007	5.0 – 6.5	Sieve Analysis	ASTM D6913 / CT 202
		Atterberg Limits	ASTM D4318 / CT 204
	10.0 – 11.5	Sieve Analysis	ASTM D6913 / CT 202
		Atterberg Limits	ASTM D4318 / CT 204
A-23-008	10.0 – 11.5	Sieve Analysis	ASTM D6913 / CT 202
		Atterberg Limits	ASTM D4318 / CT 204
*ASTM: American Society for Testing and Materials; CTM: California Test Methods			

GEOTECHNICAL CONDITIONS

Project Area Topography

The Project area is located in Crow Creek Canyon. The canyon is characterized by relatively steep slopes along the creek and Crow Canyon Road. Exposed bedrock is present along the canyon slopes and within the creek bed. Surface elevations at the level of Crow Canyon Road range from approximately 430 feet at the Norris Canyon Road intersection to about 295 feet at the Cold Water Drive intersection (U.S. Geological Survey, 2021). Approximately 10,055 feet separate the two points.

Regional and Project Area Geology

The Project area is located within the southern portion of the Coast Ranges Geomorphic Province of California (California Geologic Survey [CGS], 2002). This province extends along the majority of the California coast and is bounded by the Great Valley to the east, the Pacific Ocean to the west, the Transverse Range Mountains to the south, and the Klamath Mountains to the north. The Coast Ranges are northwest-trending mountain ranges and valleys subparallel to the various fault systems, including the Calaveras Fault. The northern and southern ranges are separated by a depression containing the San Francisco Bay, located west of the Project area.

Based on published literature, the Crow Creek valley bottom is mapped as alluvial gravel, sand, and clay of valley areas, includes gravel and sand of major stream channels (Qa). The side slopes with exposed bedrock consist of Late Cretaceous Panoche Formation clay shale or claystone (Kp) and sandstone (Kps), or, further northeast along the canyon, Miocene Briones Sandstone (Tbr) (Dibble, T.W. and Minch, J.A.. 2005.).

The bedrock has been folded to present a number of northwest-southeast trending synclinal and anticlinal structures along the Project area. The Project area is bisected by the Quaternary-age Miller Creek Fault, which is located north of the Station 128+94.97 location. The fault is part of the Pinole-Moraga-Miller Creek-Palomares Fault complex, which originates at the Calaveras Fault in the vicinity of Sunol Regional Park and trends northwest, running east of Upper San Leandro Reservoir, between San Pablo and Briones Reservoirs (CGS. 2023.).

The Project site can be seen in relation to the published geology in the Geologic Map, as shown on Figure 4 in the attachments.

Guardrail Number 3 Segment

Surface Observations

Guardrail Number 3 will replace and extend an existing, approximately 160-foot-long guardrail that is along the northwest, outboard road edge, located approximately 300 feet north-northeast of the Cold Water Road intersection. The road edge overlooks Crow Creek to the north and is on top of a terrace that is approximately 20- to 25-feet-high. The terrace is approximately 15-feet-wide near the intersection and narrows to approximately 1- to 2-feet-wide, just south of the existing guardrail (Photographs attachment, Photograph 1). An asphalt curb defines the road edge from Cold Water Road to the northern end of the guardrail and directs roadway surface flows to a 24-inch diameter corrugated

pipe, located at the approximate mid-point of the guardrail. The pipe follows the slope down to the creek.

At the boring site (A-23-001), the ground slopes down from 20 degrees at the top of the terrace with localized steeper sections immediately above the creek. Large boulders and cobbles were observed in the stream bed. No slope instabilities were observed on the slopes. Some minor sloughing and sliding of surficial soils have occurred on some portions of the slope, as indicated by tilted tree trucks below the existing guardrail, but these appear related to ongoing erosional processes and surficial soil creep within the creek channel (Photographs attachment, Photograph 2). The roadway near the slope edge exhibit no cracking or other features that indicate movement. The slopes are vegetated with young tree growth and underbrush with older trees on the terrace edge.

Local Geology

Based on published literature, the Crow Creek valley bottom is mapped as alluvial gravel, sand, and clay of valley areas (Qa). The side slopes with exposed bedrock consist of Late Cretaceous Panoche Formation (Kp), consisting of dark gray, micaceous, bedded clay shale or claystone (Dibble, T.W. and Minch, J.A., 2005). Bedding is reported to have north-northwest strikes with 70 degree dips towards the west-southwest.

Subsurface Conditions

Boring A-23-001 is located on an unpaved terrace approximately 10 feet north of the asphalt curb that defines the road edge and approximately 180 feet north-northwest of the Cold Water Road-Crow Canyon Road intersection (Photographs attachment, Photograph 3). This location was chosen due to the presence of several telecommunication lines near the road edge and heavy tree cover and a relatively narrow roadway further to the north-northeast of the boring location. Table 4 summarizes the subsurface conditions in Boring A-23-001.

Table 4. Subsurface Conditions, Boring A-23-001

Boring	A-23-001
Top of Hole Elevation (ft)	294
Unit 1	Embankment fill – Clay with Gravel and lean Clay with Sand, brown grading to reddish brown, medium stiff, moist
Top of Unit 2 Elevation (ft)	278.5
Unit 2	Alluvial deposit – fat Clay with Gravel, dark yellowish brown, hard, moist
Top of Unit 3 Elevation (ft)	276
Unit 3	Weathered bedrock – well graded Sand with Gravel, variable light brown to light gray, dry
Bottom of Hole Elevation (ft)	271.7
Groundwater Surface Elevation (ft)	Not encountered
Date	2/14/2023

Based on the recorded blow counts and observed soils, the boring location is underlain by fill materials consisting of clay with gravel overlying a lean clay with fine sand. Fill material is estimated to be approximately 15.5-feet-thick.

The fill material was observed to overlie a hard clay with coarse sand and gravel consisting of angular to subangular rock. Bedrock is estimated to be 18 feet below the surface when drilling was noted to become difficult. Soil samples obtained from below 20 feet consisted a fine grained, light brown to light gray weathered bedrock. This is consistent with the bedrock geology at this location, which is mapped as a clay shale.

No groundwater was encountered in this boring. Groundwater elevation can vary with the amount of precipitation, irrigation, and other factors. Infiltrated water may accumulate along the top of bedrock surface and perched groundwater conditions may be seasonally common.

Guardrail Number 4 Segment

Surface Observations

Guardrail Number 4 will replace two existing guardrails on the east edge of Crow Canyon Road. The first existing guardrail is approximately 480-feet-long and extends from south of the large concrete double box culvert that directs Crow Creek from the east side of Crow Canyon Road to the west side. The second guardrail starts at a point 450 feet north-northeast of the north end of the first guardrail and extends along the east edge of the roadway for approximately 220 feet before deviating from the road towards the northeast for another 35 to 40 feet behind a chain-link fence, which is part of an enclosed compound used by the County. A road sign stating “ICY” with a fog marker with “1.96” is located

immediately south of the chain-link fence and on the outboard side of the guardrail. The northern portion of the guardrail also extends across the top of another large concrete double box culvert that directs Crow Creek from the west side of Crow Canyon Road to the east side.

Between the two box culvert concrete side walls, the roadway is supported by a cemented rock retaining wall that extends between the culverts and above Crow Creek, which had large boulders, cobbles, and miscellaneous debris in the stream bed (Photographs attachment, Photographs 4 and 5). The retaining wall is approximately 12-feet-high. The face is continuous in sections with a two-level configuration in other section. Where present, the two-level configuration consists of a lower level that is wider than the top portion and is approximately 5-feet-high. The upper level is approximately 7.5-feet-high. The exposed portion of the retaining wall on the roadway side ranges from 0.5- to 2-feet-high. The horizontal portion of the top and lower levels consist of cemented overlays. Corrugated pipes, estimated to be 24-inches-wide, were observed to extend from the wall adjacent to the northern end of the southern guardrail and north of this point. The spacing between the pipes is approximately 200 feet. These are likely stormwater outlets for the roadway but recent soil buildups due to storm events have covered the inlets. No retaining wall instabilities or vertical displacements were observed and no visible distresses were observed in the roadway surface adjacent to the wall. One tree was observed growing from the wall adjacent to the southern end of the north guardrail.

At the inlet of the downstream box culvert, the ground east of the road consist of a wide, unpaved, vegetated terrace, approximately 20-feet-wide between the inner side of the retaining wall and the guardrail, which then narrows to approximately 2.8 feet of an unpaved surface between the roadway side of the retaining wall and the edge of the roadway pavement at the north end of the existing southern guardrail. The unpaved portion narrows towards the north. The ground widens at a fog marker labeled “1.88,” located approximately 225 feet south of the north end of the northern existing guardrail. The width of the terrace is approximately 16 feet between the inboard fog line and the inner side of the retaining wall before narrowing to a broad shoulder approximately 12 feet. The slope of the surface from the inboard fog line to the retaining wall has a 5 to 10 degree slope toward the east; the surface is paved, but has a broken edge short of the wall and is covered with soil and organic debris between the broken edges and the wall.

Local Geology

The location is withing a relatively narrow portion of the Crow Creek valley with steep banks along Crow Creek and numerous bedrock exposures along the east bank. Based on published literature, Crow Creek has eroded the valley downwards along a fracture zone, which defines an axis of a tight anticline (Woodward-Clyde and Associates, 1969). The bottom of the valley is mapped as alluvial gravel, sand, and clay of valley areas (Qa).

At the Boring A-23-002 location, the side slopes consist of Late Cretaceous Panoche Formation sandstone (Kps), described as light gray to light brown to tan, hard, bedded, fine to medium grained, arkosic composition, with large (up to 1.5 feet in diameter) hard dark brown concretions (Dibble, T.W. and Minch, J.A., 2005). Bedding is reported to have north to north-northwest strikes with 60 to 85 degree dips towards the west and west-southwest.

At the Boring A-23-003 location, the side slopes consist of Kp clay shale or claystone, similar to the bedrock at the Boring A-23-001 location (Dibble, T.W. and Minch, J.A. 2005.). Bedding is reported to have similar strike and dips as the bedrock adjacent to Boring A-23-002.

Subsurface Conditions

Two borings were located adjacent to the retaining wall to determine the subsurface conditions for the placement of the proposed guardrail. Table 5 summarizes the subsurface conditions at Borings A-23-002 and A-23-003.

Table 5. Subsurface Conditions, Borings A-23-002 and A-23-003

Boring	A-23-002	A-23-003
Top of Hole Elevation (ft)	307	318
Unit 1	Pavement Section – 3.5 inches of asphaltic concrete over 21.5 inches of aggregate base	Pavement Section – 1 inch of asphaltic concrete over 16 inches of aggregate base
Top of Unit 2 Elevation (ft)	304.9	316.7
Unit 2	Retaining wall backfill – 2 feet of poorly graded sand overlying a clayey sand with broken, angular rock	Retaining wall backfill – 3.7 feet of clayey sand with gravel overlying a sandy lean clay
Bottom of Hole Elevation (ft)	300.5	311.5
Groundwater Surface Elevation (ft)	Not encountered	Not encountered
Date	2/14/2023	2/14/2023

Boring A-23-002 was located north of the north end of the southern existing guardrail at a point 3.5 feet inboard of the retaining wall and approximately 26 feet north of the north end of the guardrail. At this location, the pavement consists of 3.5 inches of asphalt with 21.5 inches of aggregate base, consisting of light brown, dry silty sand with subangular to subrounded fine gravel. The aggregate base overlies fill material consisting of interbedded poorly-graded sand and clayey sand with broken angular fine gravel. This material was found to be medium dense between 5 and 6.5 feet. The boring was terminated at a depth of 6.5 feet within a poorly graded sand.

Boring A-23-003 was located 3 feet south of south end of the northern existing guardrail and 5.8 feet east of the visible fog line. Placement of the boring was constrained by overhead tree canopies and a noticeable shoulder slope south of the boring location. At this location, the pavement consists of 1-inch of asphalt with 16 inches of aggregate base, consisting of light brown, dry sand with angular fine gravel. The aggregate base overlies fill material consisting of interbedded dark brown, moist clayey sand and sandy lean clay. The boring was terminated at a depth of 6.5 feet within a dark brown sandy lean clay.

No groundwater was encountered in these borings. It is likely the borings were located within the retaining wall backfill and may be well-drained.

Guardrail Number 5 Segment

Surface Observations

Guardrail Number 5 will replace an existing 1,850-foot-long guardrail on the west edge of Crow Canyon Road. The south end of the existing guardrail is approximately 585 feet north-northwest of Boring A-23-003. Between the southern and northern guardrail ends, the ground from the west edge of the roadway slopes down to the west to Crow Creek, approximately 20 to 25 feet below the road edge, with varying steepness and configurations.

At the south end of the existing guardrail, the northern inlet of the concrete double box culvert structure is adjacent to and west of this location. The outlet to this culvert is northeast of Boring A-23-003. North of this point, the slope has been modified by the placement of a mechanical stabilized earthen (MSE) retaining wall (Photographs attachment, Photograph 6). This wall is approximately 100-feet-long. Further north, the slope from the roadway edge to Crow Creek exhibits a terraced configuration. The upper portion, sloped between 20 to 30 degrees and approximately 15- to 20-feet-high, slopes down to a relatively flat bench, approximately 10 feet above the creek, before sloping down 20 to 25 degrees to the water edge (Photographs attachment, Photograph 7). No slope instabilities were observed on the slopes. Some minor sloughing and sliding of surficial soils have occurred on the upper portions of the slope, as indicated by tilted tree trucks below the existing guardrail, but these appear related to ongoing surficial soil creep on the slope. The lower slope appear to be scoured. Similar to downstream locations, Crow Creek was observed to have large boulders, cobbles, and miscellaneous debris in the stream bed.

Further north, approximately between Project Station 110+50 and 111+00, the slopes appear to steepen with noticeable prior movements in the guardrail concrete foundations (Photographs attachment, Photograph 8). Also, some tension cracking was noted in the shoulder area between the fog line and the asphalt curb. The flatter lower terrace is not present. Also, one slope failure in the upper soils was noted near Project Station 117+00 (Photographs attachment, Photograph 9). The slopes along this section are heavily vegetated. A fence was noted on the lower slopes. No exposed bedrock was noted on the slopes. An asphalt curb defines the road edge from approximately Station 114+00 to Station 122+00. The asphalt curb directs surface flows to a 24-inch diameter corrugated pipe, located at approximately Station 116+00. The pipe outlet directs flows onto the slope down to the creek (Photographs attachment, Photograph 10).

Along the northern portion of the existing guardrail, the slopes appear to have a configuration similar to the southern end of the affected segment. The upper portion, sloped between 20 to 30 degrees and approximately 15-feet-high, slopes down to a relatively flat bench, approximately 10 feet above the creek, before sloping down 20 to 25 degrees to the water edge (Photographs attachment, Photographs 11, 12, and 13). Some minor sloughing and sliding of surficial soils have occurred and appear related to ongoing surficial soil creep on the slope. No noted distresses to the pavement were observed in this segment.

Local Geology

Along this segment of Crow Canyon Road, the valley bottom is mapped as Qa. The side slopes have been mapped as Kp, described as dark gray, micaceous, and bedded (Dibble, T.W. and Minch, J.A.,

2005). Bedding is reported to have north-northwest strikes and 80 to 85 degree dips to the east-northeast. One orientation is reported as overturned.

Subsurface Conditions

Three borings were advanced to determine the subsurface conditions for the placement of the proposed Guardrail Number 5. Table 6 summarizes the subsurface conditions at Borings A-23-004, A-23-005, and A-23-006.

Table 6. Subsurface Conditions, Borings A-23-004, A-23-005, and A-23-006

Boring	A-23-004	A-23-005	A-23-006
Top of Hole Elevation (feet)	338	344	351
Unit 1	Pavement section – 6.0 inches of asphaltic concrete	Pavement section – 7.0 inches of asphaltic concrete over 18 inches of aggregate base, dry	Pavement section – 6.0 inches of asphaltic concrete over 18 inches of aggregate base, dry
Top of Unit 2 Elevation (feet)	337.5	341.9	349
Unit 2	Roadway/embankment fill – silty sand with gravel, dry becoming moist below 3-foot depth; below 5 feet, sandy lean clay, medium stiff becoming stiff with depth, moist	Embankment fill – clayey sand with gravel, moist	Embankment fill – silty sand with gravel then below 5 feet depth, clayey sand with gravel grading to a clayey silt
Top of Unit 3 Elevation (feet)	325	339	338
Unit 3	Alluvium – clayey sand with gravel (broken, weathered sedimentary rock fragments), dense to very dense	Alluvium – lean clay, dry, hard	Alluvium – silty sand, wet below 336 feet, loose becoming medium dense with depth
Top of Unit 4 Elevation (feet)	xx	336	xx
Unit 4	xx	Weathered sedimentary bedrock – clayey gravel with sand, dense to very dense	xx
Bottom of Hole Elevation (feet)	321.5	323.8	329.5
Groundwater Surface Elevation (feet)	Not encountered	Not encountered	335
Date	2/14/2023	2/15/2023	2/15/2023

Boring A-23-004 was located approximately 380 feet north of the south end of the existing guardrail and 5.3 feet east of the edge of pavement. At this location, the pavement consists of 6 inches of asphalt overlying fill material. The fill material consisting of a dry silty sand with subangular to subrounded

fine gravel, which becomes moist below a depth of 3 feet and grades into a yellowish brown, moist, poorly-graded fine to medium sand with trace fine gravel at a depth of approximately 5 feet. The latter fill material was found to be loose between a depth of 5 and 6.5 feet. Underlying the poorly graded sand at an approximate depth of 8 feet is a brown, moist silty to clayey sand. This material is medium dense at a depth interval of 10 to 11.5 feet and appears to be fill. Below approximately 13 feet is a grayish brown, moist silty sand with about 25 percent of the volume consisting of broken, weathered sedimentary rock up to 0.75 inches in diameter and 20 percent fines. This material was found to be very dense at a depth of 15 to 16.5 feet. The boring was terminated at a depth of 16.5 feet.

Boring A-23-005 was located 660 feet northeast of Boring A-23-005, 5.8 feet east of the visible fog line, and adjacent to the noted slope failure. At this location, the pavement consists of 7 inches of asphalt overlying 18 inches of an aggregate base, consisting of light brown, dry silty to clayey sand with subrounded to rounded fine gravel. Below the dry material, the soil was observed to be moist and was found to be medium plastic to a depth of 5 feet. At this depth, the recovered sample was found to be a dry, light brown clay. This material was found to be hard between 5 and 6.5 feet with a consistency of 15 blows per foot. Below the clay, the soil appears to grade into weathered bedrock below 8 feet depth. The bedrock was observed to be light brown, dry with visible laminations. The material was friable, breaking down to a sandy silt with rock fragments with hand pressure. Below this, the drilling became more difficult with very dense soils at 15 to 16.5 feet. The boring was terminated at a depth of 20.2 feet within a gray, very dense, weathered sedimentary rock.

Boring A-23-006 was located approximately 230 feet south of the north end of the existing guardrail at a point 1.5 feet inboard of the fog line within the southbound travel lane and approximately 8.3 feet from the edge of pavement. At this location, the pavement consists of 6 inches of asphalt. The asphalt overlies 4.5 feet of a silty sand with fine gravel. This material was observed to be dry and light brown to a depth of 2 feet then moist and brown below this depth. At a depth of 5 feet, the observed soil was found to be a medium dense tan brown clayey sand with up to 20 to 25 percent coarse sand and fine gravel and broken bedrock fragments. At approximately at 343 feet elevation, the clayey sand grades into a clayey silt. These soils were found to be loose between 10 and 11.5 feet and soft and wet between 15 and 16.5 feet. At depths between 20 and 21.5 feet, the soil was observed to be a loose to medium dense, light grayish brown, wet, silty fine sand with a trace of coarse sand and fines. The boring was terminated at a depth of 21.5 feet within the silty sand.

Groundwater was encountered at a depth of 16 feet in Boring A-23-006. No groundwater was encountered in Borings A-23-004 and A-23-005.

Guardrail Number 6 Segment

Surface Observations

The proposed Guardrail Number 6 will replace an existing 240-foot-long guardrail on the west edge of Crow Canyon Road. The south end of the existing guardrail is approximately 415 feet north-northwest of Boring A-23-006. Between the southern and northern guardrail ends, the ground from the west edge of the roadway slopes down to the west to a relative flat area with a residential property (6270 Crow Canyon Road) on the south end and an open field adjacent to the remaining length of this segment. The field has a slight slope to the south (Photographs attachment, Photograph 14). A fence is located on the slope along the entire segment, except for a small section near the midpoint. Where the fence is not

present, an unnamed Crow Creek tributary channel crosses the road via a 48-inch corrugated culvert from the northwest. Both the inlet and outlet have stacked rock walls protecting the roadway embankment (Photographs attachment, Photograph 15).

Local Geology

As with the previous road segment associated with proposed Guardrail Number 5, the valley bottom is mapped as Qa. Along this segment, the side slopes to the east have been mapped as Kp with north-northwest strikes and 80 to 85 degree dips to the east-northeast (Dibble, T.W. and Minch, J.A. 2005.).

Subsurface Conditions

One boring was advanced to determine the subsurface conditions for the placement of the proposed Guardrail Number 6. Due to high voltage overhead lines, the boring location was located to the east into the southbound travel lane of Crow Canyon Road. The resulting boring is located 12 feet east of the edge of the outboard pavement and 5.8 feet east of the fog line. Table 7 summarizes the subsurface conditions found at Boring A-23-007.

Table 7. Subsurface Conditions, Boring A-23-007

Boring	A-23-007
Top of Hole Elevation (ft)	367
Unit 1	Pavement section – 9.5 inches of asphaltic concrete
Top of Unit 2 Elevation (ft)	349
Unit 2	Embankment fill – lean clay with sand, hard, dry becoming moist below 6 foot depth
Top of Unit 3 Elevation (ft)	359
Unit 3	Alluvium – fat clay with sand, stiff
Bottom of Hole Elevation (ft)	355.5
Groundwater Surface Elevation (ft)	Not encountered
Date	2/15/2023

Approximately 9.5 inches of asphalt was observed overlying a dry, light gray lean clay with sand. Due to hard drilling, water was introduced into the hole below a depth of 2 feet. When wetted, this material was found to be highly plastic. At a depth of 5 to 6.5 feet, a hard clay with sand and trace gravel with numerous broken rock fragments was observed. The top portion was found to be dry then became moist with depth. Between 10 and 11.5 foot depths, a grayish brown, moist fat clay with trace amount of medium sand was encountered. This soil was found to be highly plastic and easily indented with a thumb. The boring was terminated at a depth of 11.5 feet. No groundwater was encountered.

Guardrail Number 7 Segment

Surface Observations

Guardrail Number 7 will replace two existing, guardrails that are above the Norris Creek culvert inlet on the east-southeast side of Crow Canyon Road. Norris Creek flows from the northeast to the southwest and is a tributary to Crow Creek, located approximately 240 feet downstream. The first, southern guardrail is approximately 35-feet-long. The south end is located on the north side of the driveway to the residential driveway at 7825 Crow Canyon and ends at a wooden utility pole located above the culvert. The second guardrail, approximately 25-feet-long, starts near the same pole and curves to the northeast, serving to protect the stream bank upstream from the culvert inlet. The northeast end of the second guardrail is located approximately 500 feet from the off-ramp roadway to Norris Canyon Road.

At the utility pole, the road edge is approximately 12 feet below the creek bed. The culvert is a concrete open bottom arch structure and has a near-vertical, stacked, uncemented rock wall on the top portion (Photographs attachment, Photograph 16). The sides have boulder-sized rocks stacked along the slope face. Three corrugated pipes, ranging from 6 to 24 inches serve as stormwater drains and direct water flows from edge of Crow Canyon Road to the south side. One 24-inch corrugated pipe directs water flows from the edge of the Crow Canyon Road to the north side of the culvert. The stream channel consists of coarse sands with cobbles.

To the southwest, the stream bank is a highly vegetated ground that slopes down approximately 20-25 degrees from the existing driveway approximately 15 to 20 feet above the stream channel. Upstream, tree growth on the southeast slopes have noticeable tilts and curves, indicating some soil creep. To the northeast, the stream bank is approximately 12-feet-high and has a shallower slope; no slope instabilities were noted. The top of the northeast stream bank flattens out to a broad terrace relatively clear of tree growth.

Local Geology

At this location, the stream channel and the flat terrace to the northeast is mapped as Qa (alluvial gravel, sand, and clay of valley areas, includes gravel and sand of major stream channels). The side slope to the southwest is mapped as Miocene Briones Sandstone (Tbr), described as a marine clastic sandstone, light gray to tan in color, thick bedded, medium grained to locally pebbly, arkosic, fossiliferous, and locally includes thin layers of gray siltstone (Dibble, T.W. and Minch, J.A. 2005.). Bedding is reported to have a northwest-southeast strike with dips 60 to 70 degrees towards the northeast.

Subsurface Conditions

One boring was advanced to determine the subsurface conditions for the placement of the proposed Guardrail Number 7. Due to the presence of the culvert and the buried culverts, the boring location was located to north of the second, existing guardrail and approximately 25.5 feet from the slope edge down to Norris Creek (Photographs attachment, Photograph 17). The resulting boring, A-23-008, is located on relatively flat ground 11.4 feet southeast of the northbound travel lane fog line and 3 feet from the edge of pavement. Table 8 summarizes the subsurface conditions found at Boring A-23-008.

Table 8. Subsurface Conditions, Boring A-23-008

Boring	A-23-008
Top of Hole Elevation (ft)	414
Unit 1	Roadway fill – 24 inches of aggregate base
Top of Unit 2 Elevation (ft)	412
Unit 2	Embankment fill – interbedded sandy clay, silty sand with fine gravel, and poor-graded fine sand
Top of Unit 3 Elevation (ft)	409.9
Unit 3	Alluvium – sandy lean clay, stiff, moist
Bottom of Hole Elevation (ft)	402.5
Groundwater Surface Elevation (ft)	Not encountered
Date	2/15/2023

The boring was advanced through a variety of soils that are likely fill material. The upper 5 feet encountered moist silty sands, sandy clays, and poorly graded sand. Below a depth of 5 feet, a dark grayish brown, moist, nonplastic sandy lean clay was observed with a SPT blow count of 5 per foot. Between a depth of 10 and 11.5 feet, a highly plastic sandy lean clay was found. The boring was terminated at a depth of 11.5 feet. No groundwater was encountered.

CONCLUSIONS

Proposed Guardrail Numbers 4, 6, and 7 are located in areas that are either level to gently sloping or next to an existing retaining wall. Soil conditions at these sites were found to be favorable for construction without high groundwater or shallow rock. Shallow pile or spread footing type support appears suitable at these sites.

Proposed Guardrail Numbers 3 and 5 are located next to a steep slopes with evidence of slope creep and/or other slope instabilities. Guardrails along these segments are subject to tilting or lateral movement of the guardrail due to this slope movement. Therefore, pile support of the guardrails is prudent to reduce the potential for distress and provide some increase in slope support.

Proposed Guardrail Number 5 has areas with possible erosion along the base of slope and some existing guardrail supports are tilted and displaced downward. During the site review, the area with the greatest erosion was between Station 110+50 and Station 117+00. Continued erosion would be expected to undermine the embankment slope and eventually lead to roadway failure.

RECOMMENDATIONS

Guardrail Support

Guardrail Numbers 4, 6, and 7

Caltrans' *Standard Plan* pile and footings are acceptable for support of proposed guardrail.

Guardrail Numbers 3 and 5

Due to proximity top of slope, height of slope, and evidence of slope movement along the alignment, deepened foundations are recommended. Foundations are recommended to consist of cast-in-drilled-hole piles of 12 inch or greater diameter extending 15 feet below existing grade. Steel reinforcement cages or a steel W6x15 post section extending to within 1 foot of the bottom of pile are recommended to provide reinforcement.

Slope Stabilization

Portions of the proposed Guardrail Number 5 from Station 110+50 to Station 117+00 are recommended to have erosion/slope stabilization improvements. At a minimum, rock slope protection (RSP) is recommended along the base of slope in this area to reduce erosion and help stabilize the slope. The RSP should be keyed into competent soils a minimum of 5 feet below the creek bottom elevation. Completed RSP should not be steeper than 1.5H:1V (horizontal:vertical). Vegetated RSP can be considered to reduce visual impacts of the stabilization.

CONSTRUCTION CONSIDERATIONS

Site soils are generally considered rippable with heavy construction equipment, but cobble to boulder size rock and concrete debris was observed within most segments. The contractor should be prepared to remove these materials during excavation.

Existing guardrail installations include wood, steel, and concrete components that will likely need to be removed or cutoff to install the proposed new guardrails. It is recommended to cutoff existing guardrail supports 6 inches below the planned final grade if not in conflict with new guardrail support locations. If existing supports must be removed, care should be taken to minimize disturbance of site soils and to remove and replace disturbed soils with compacted fill, flowable fill, or other suitable materials to provide support for planned new guardrails. Any fill placed should be compacted to 95% of maximum compaction per ASTM D1557.

Retaining walls, culverts, and multiple overhead and underground utilities exist in the vicinity of the proposed guardrails. The contractor should identify all existing structures and utilities prior to beginning excavation or installation of guardrail supports and take appropriate measures to protect these improvements.

LIMITATIONS

This report was performed in accordance with generally accepted geotechnical engineering principles and practices. No other warranty, expressed or implied, is made as to the conclusions and professional recommendations made in this report.

This report is intended for use for Alameda County Public Works Agency for the replacement of the existing guardrails. Any changes in the design or location of the proposed new improvements,

however slight, should be brought to our attention so that we may determine how they may affect our conclusions and recommendations. The conclusions and recommendations contained in this report are based upon the data relating only to this specific project and locations discussed herein.

REFERENCES

Caltrans (California Department of Transportation). 2010. *Soil and Rock Logging, Classification, and Presentation Manual*, 2010 Edition, and Errata, 2022. Caltrans Division of Engineering Services, Geotechnical Services.

CGS (California Geologic Survey). 2002. *California Geomorphic Provinces, Note 36*. Revised 2002.

CGS. 2023. *Fault Activity Map of California*, <https://maps.conservation.ca.gov/cgs/fam/app/ >.

Dibble, T.W. and Minch, J.A., 2005. *Geologic Map of the Hayward Quadrangle, Contra Costa and Alameda Counties, California*, Dibblee Geological Foundation Map DF-163, 1:24,000.

U.S. Geological Survey, 2021. U.S. Topographic 7.5-minute Map for Hayward, California. < https://www.usgs.gov/core-science-systems/national-geospatial-program/us-topo-maps-america>

Woodward-Clyde and Associates, 1969. *Soil and Geologic Investigation for the Proposed Culverts at Mile 1.7 and Mile 2.0, Crow Canyon Road, Castro Valley, California*, Project S-11924, September 16.

CONCLUDING REMARKS

WRECO would like to thank the County for the opportunity to prepare this letter report for the subject Project. If you would like to discuss any of the recommendations provided, please feel free to contact WRECO at (916) 897-5705.

Respectfully submitted,

WRECO

David Kitzmann, PE, CEG
Senior Engineering Geologist

Attachments: *Figure 1 – Project Location Map*
Figure 2 – Project Vicinity Map
Figures 3A, 3B, 3C, and 3D – Boring Locations
Figure 4 – Geologic Map

Photographs
Boring Records
Laboratory Test Reports

FIGURES

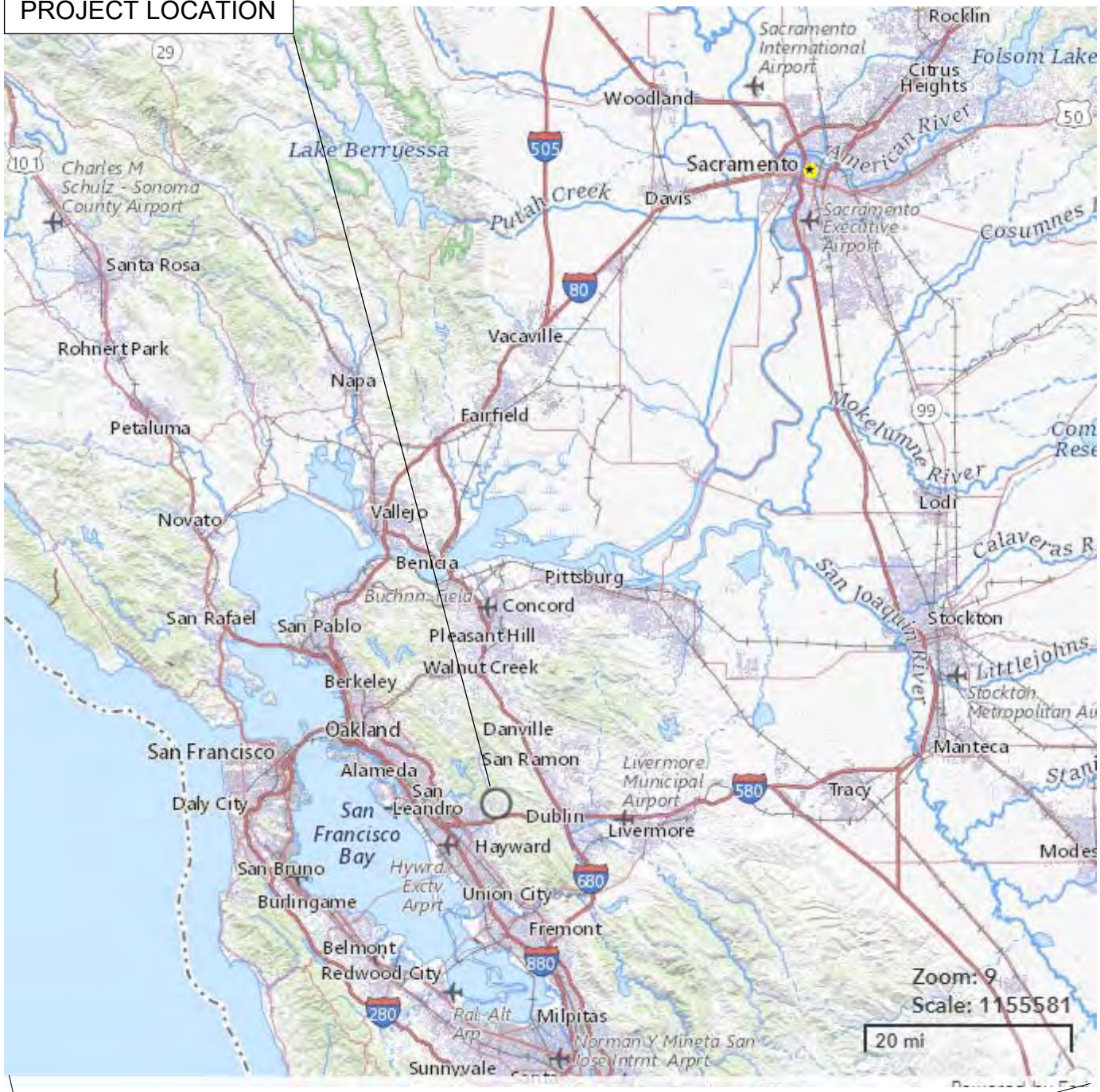
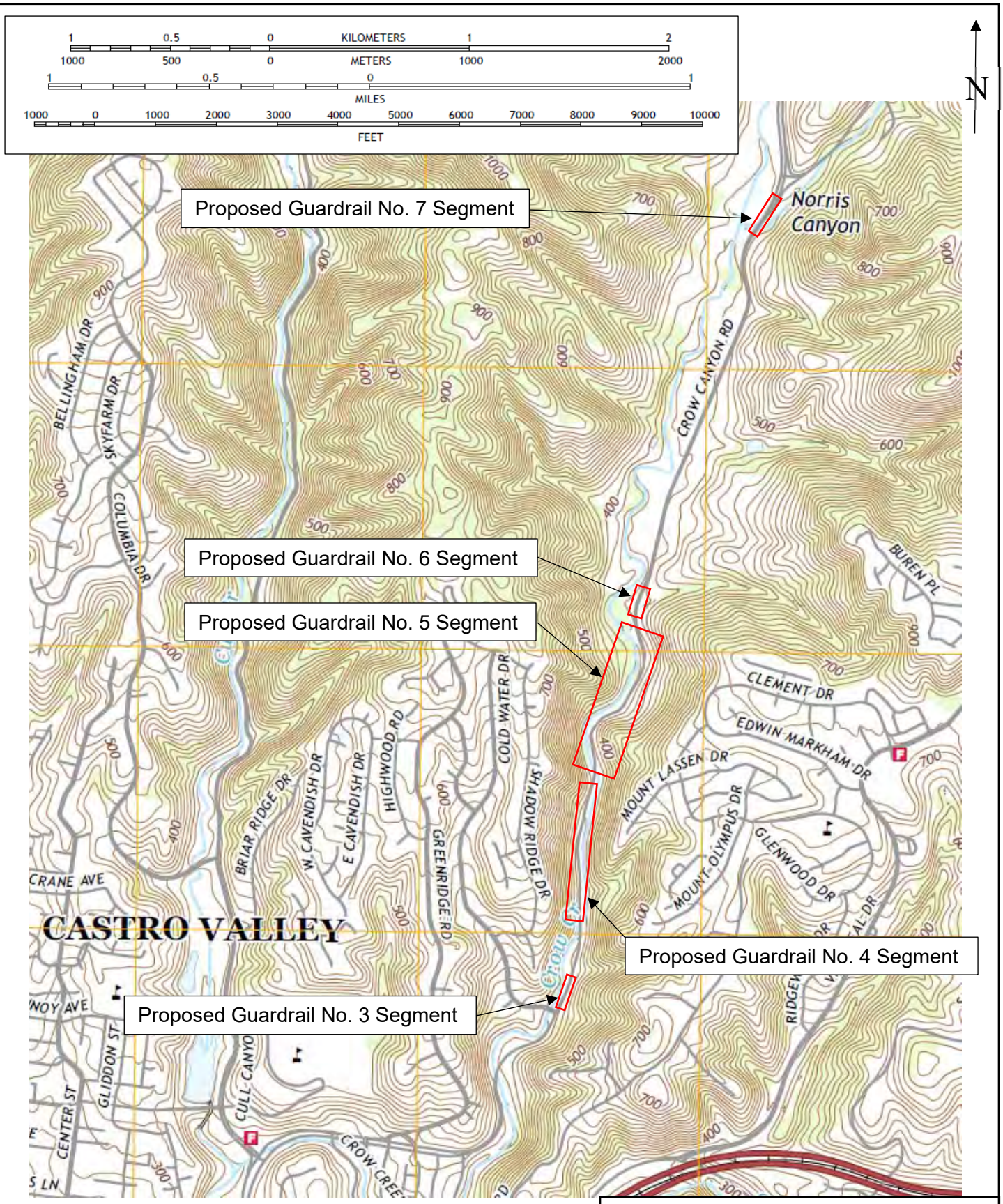


Figure 1. Project Location Map

Crow Canyon Road Guardrail Replacement Phase IV Project
Alameda County, California

WRECO Project No. P16066



Derived from U.S. Geological Survey, Topographic 7.5-minutes map for Walnut Creek, CA, 2021, USGS – National Geospatial Technical Operations Center

Contour Interval: 20 feet

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Figure 2. Project Vicinity Map

Crow Canyon Road Guardrail Replacement Phase IV Project

Alameda County, California

WRECO Project No. 16066

LEGEND:

C–# EXIST MONUMENT / SURVEY CONTROL POINT

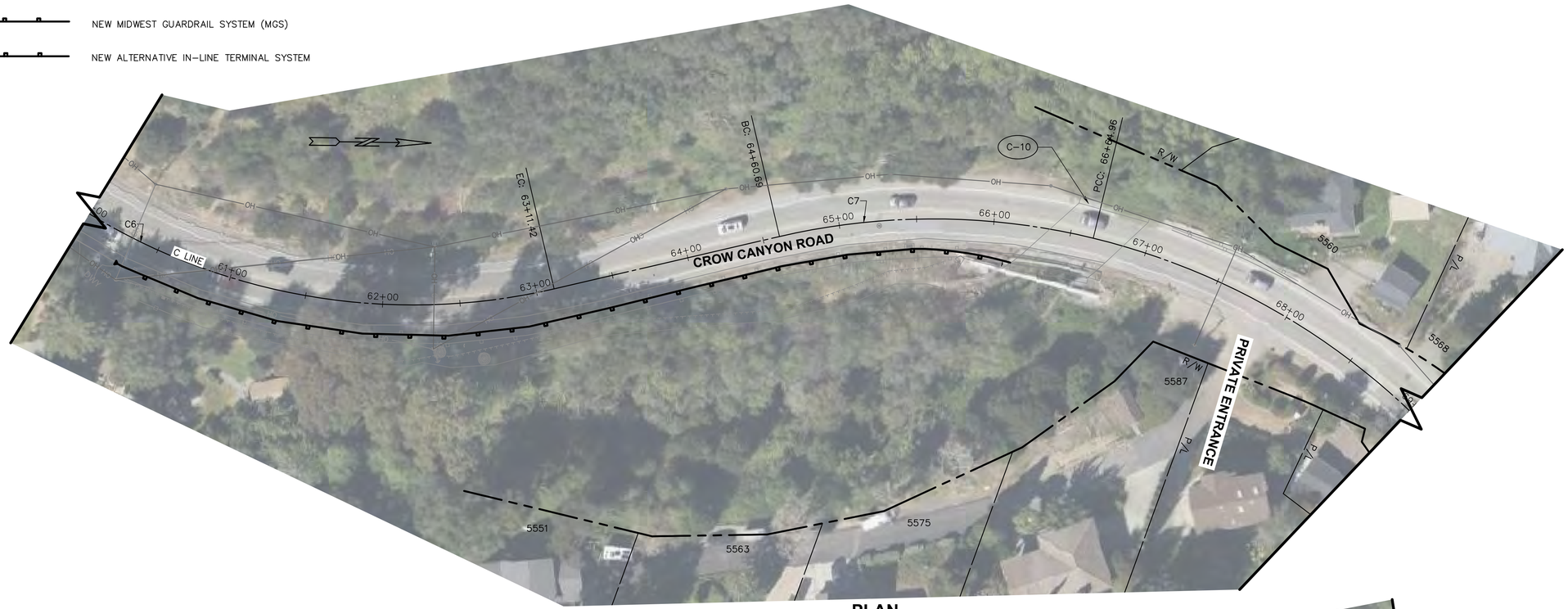
BORING

EXIST MBGR

NEW MIDWEST GUARDRAIL SYSTEM (MGS)

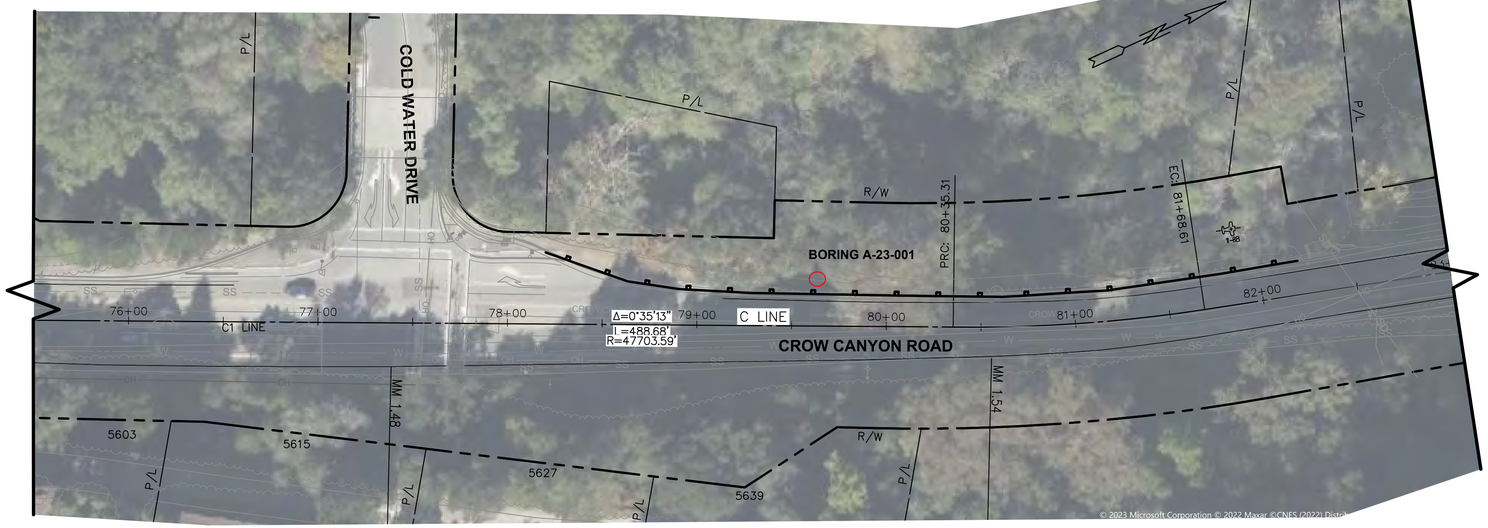
NEW ALTERNATIVE IN–LINE TERMINAL SYSTEM

MATCH LINE STA 65+50
SEE LOWER LEFT



PLAN

SCALE: 1"=40'



PLAN

SCALE: 1"=40'

40 0 20 40 80 1600

(IN FEET)
1"=40'

FOR REDUCED ENGLISH PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2 3

REVIEWED BY:	DATE:	REVIEWED BY:	DATE:
CONSTRUCTION		SURVEY	
MAINTENANCE		TRAFFIC	
REAL ESTATE		ENVIRONMENTAL	

NO.	DESCRIPTION	BY	DATE	APPV'D
1				
2				
3				
4				

REVISIONS

wreeo
1000 Broadway, Suite 475
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(510) 836-5188

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CHECKED: ANDREW SEKIOKA
DESIGNED: HORACIO URIAS
APPROVED: GARRETT LOW

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

THE REPLACEMENT OF GUARDRAILS ON CROW CANYON ROAD FROM SAN SIMEON TO NORRIS CANYON ROAD

FIGURE 3A - BORING LOCATION

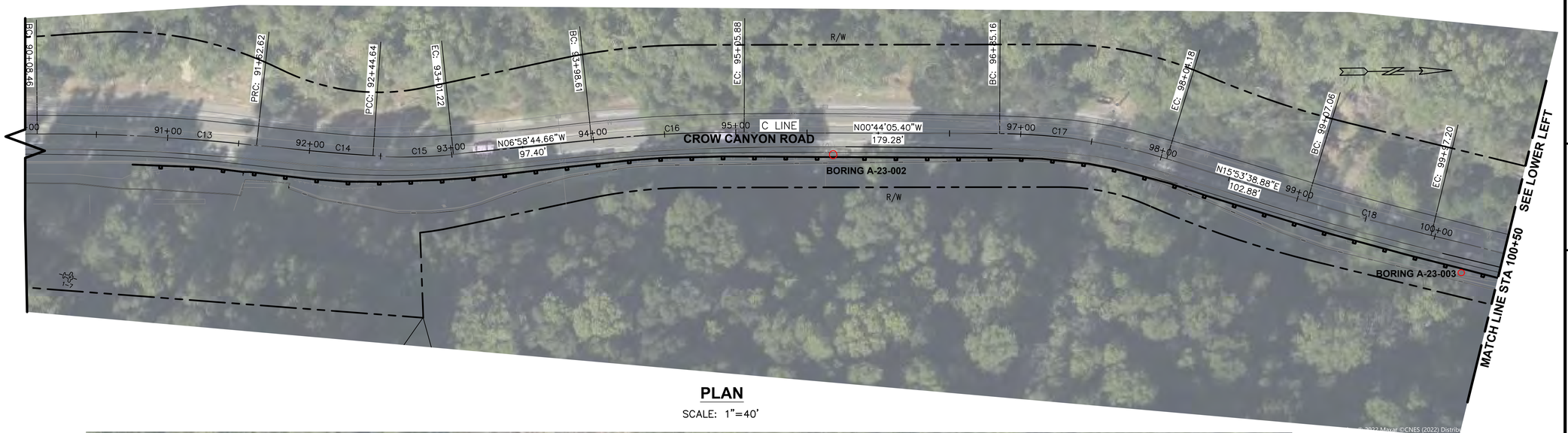
REVIEWED:
BOND NG
REVIEWED:
JAMES CHU
APPROVAL RECOMMENDED::
ARTHUR CARRERA

DATE	JAN 2023
SCALE	1"=40'
WORK ORDER NO.	R23476
SPECIFICATION NO.	2410
SHEET NO.	1 OF 4
FILE NO.	U-132-27

G:\Projects\Y2016\P16066 AlaCo CivEnvRW Oncall\TO 03 Crow Canyon Pvmt Rehab\Dwg\Sheets\Phase 4\Exhibit\01.dwg 1-26-23 05:04:19 PM MBAJADA

LEGEND:

- EXIST FENCE
- EXIST MBGR
- NEW MIDWEST GUARDRAIL SYSTEM (MGS)
- NEW ALTERNATIVE IN-LINE TERMINAL SYSTEM
- BORING



PLAN

SCALE: 1"=40'

PLAN

SCALE: 1"=40'

40 0 20 40 80 1600

(IN FEET)
1"=40'

FOR REDUCED ENGLISH PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2 3

REVIEWED BY:	DATE:	REVIEWED BY:	DATE:
CONSTRUCTION		SURVEY	
MAINTENANCE		TRAFFIC	
REAL ESTATE		ENVIRONMENTAL	

NO.	DESCRIPTION	BY	DATE	APPV'D
1				
2				
3				
4				

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APPROVED: GARRETT LOW

APPROVAL RECOMMENDED:
ARTHUR CARRERA

REVIEWED:
BOND NG

REVIEWED:
JAMES CHU

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

THE REPLACEMENT OF GUARDRAILS ON
CROW CANYON ROAD
FROM SAN SIMEON TO
NORRIS CANYON ROAD

FIGURE 3B - BORING LOCATIONS

DATE	SCALE
JAN 2023	1"=40'

WORK ORDER NO.
R23476

SPECIFICATION NO.
2410

SHEET NO.
1 OF 4

FILE NO.
U-132-27

LEGEND:

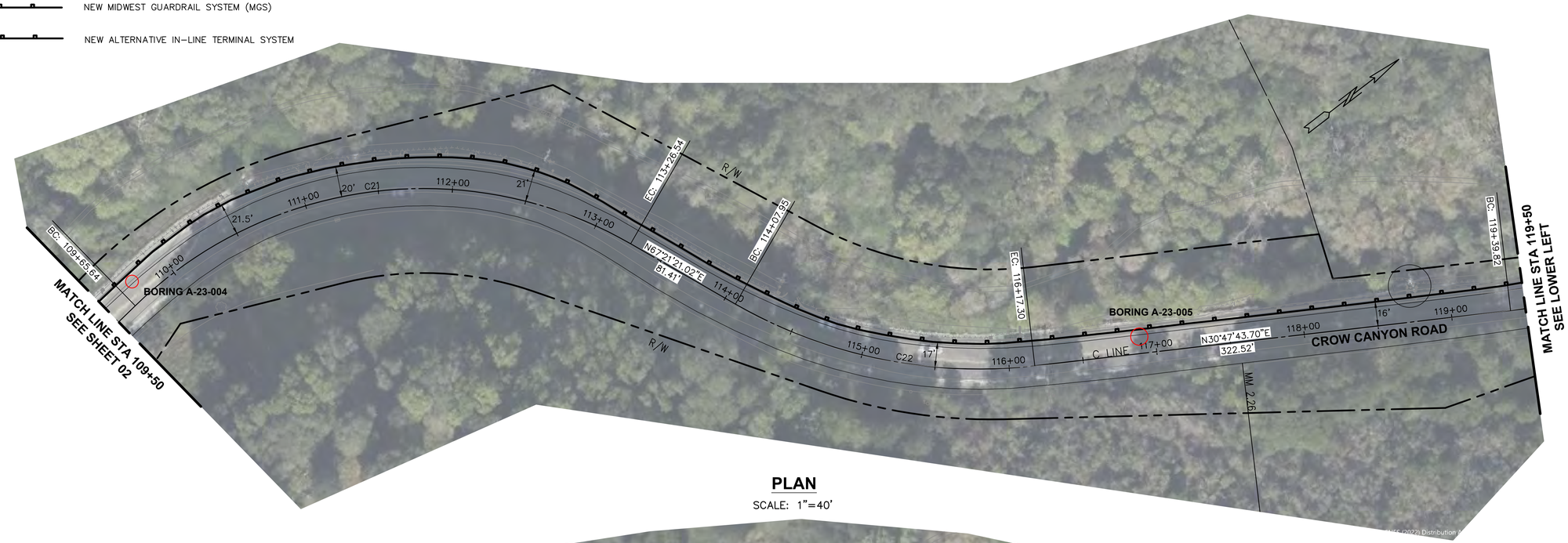
EXIST FENCE

EXIST MBGR

NEW MIDWEST GUARDRAIL SYSTEM (MGS)

NEW ALTERNATIVE IN-LINE TERMINAL SYSTEM

BORING



PLAN

SCALE: 1"=40'

PLAN

SCALE: 1"=40'

40 0 20 40 80 1600

(IN FEET)
1"=40'

FOR REDUCED ENGLISH PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2 3

REVIEWED BY:	DATE:		REVIEWED BY:	DATE:
CONSTRUCTION		SURVEY		
MAINTENANCE		TRAFFIC		
REAL ESTATE		ENVIRONMENTAL		

REVISIONS

NO.	DESCRIPTION	BY	DATE	APPV'D
1				
2				
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5				

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DESIGNED: HORACIO URIAS
CHECKED: ANDREW ISKOKA
APPROVED: GARRETT LOW

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

REVIEWED: BOND NG
REVIEWED: JAMES CHU
APPROVAL RECOMMENDED:: ARTHUR CARRERA

THE REPLACEMENT OF GUARDRAILS ON CROW CANYON ROAD FROM SAN SIMEON TO NORRIS CANYON ROAD

FIGURE 3C - BORING LOCATIONS

DATE: JAN 2023
SCALE: 1"=40'
WORK ORDER NO.: R23476
SPECIFICATION NO.: 2410
SHEET NO.: 3 OF 4
FILE NO.: U-132-27

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LEGEND:

EXIST MBGR

NEW MIDWEST GUARDRAIL SYSTEM (MGS)

NEW ALTERNATIVE IN-LINE TERMINAL SYSTEM

BORING

PLAN

SCALE: 1"=40'

40 0 20 40 80 1600

(IN FEET)
1"=40'

FOR REDUCED ENGLISH PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2 3

	REVIEWED BY:	DATE:
CONSTRUCTION		
MAINTENANCE		
REAL ESTATE		

	REVIEWED BY:	DATE:
SURVEY		
TRAFFIC		
ENVIRONMENTAL		

NO.	DESCRIPTION	BY	DATE	APPV'D
5				
4				
3				
2				
1				

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CHECKED: ANDREW SISKOKA
DESIGNED: HORACIO URIAS
APPROVED: GARRETT LUM

REVIEWED: RONG NG
REVIEWED: JAMES CHU
APPROVAL RECOMMENDED:: ARTHUR CABRERA

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

THE REPLACEMENT OF GUARDRAILS ON CROW CANYON ROAD FROM SAN SIMEON TO NORRIS CANYON ROAD

FIGURE 3D - BORING LOCATION

DATE: JAN 2023
SCALE: 1"=40'
WORK ORDER NO.: R23476
SPECIFICATION NO.: 2410
SHEET NO.: 4 OF 4
FILE NO.: U-132-27

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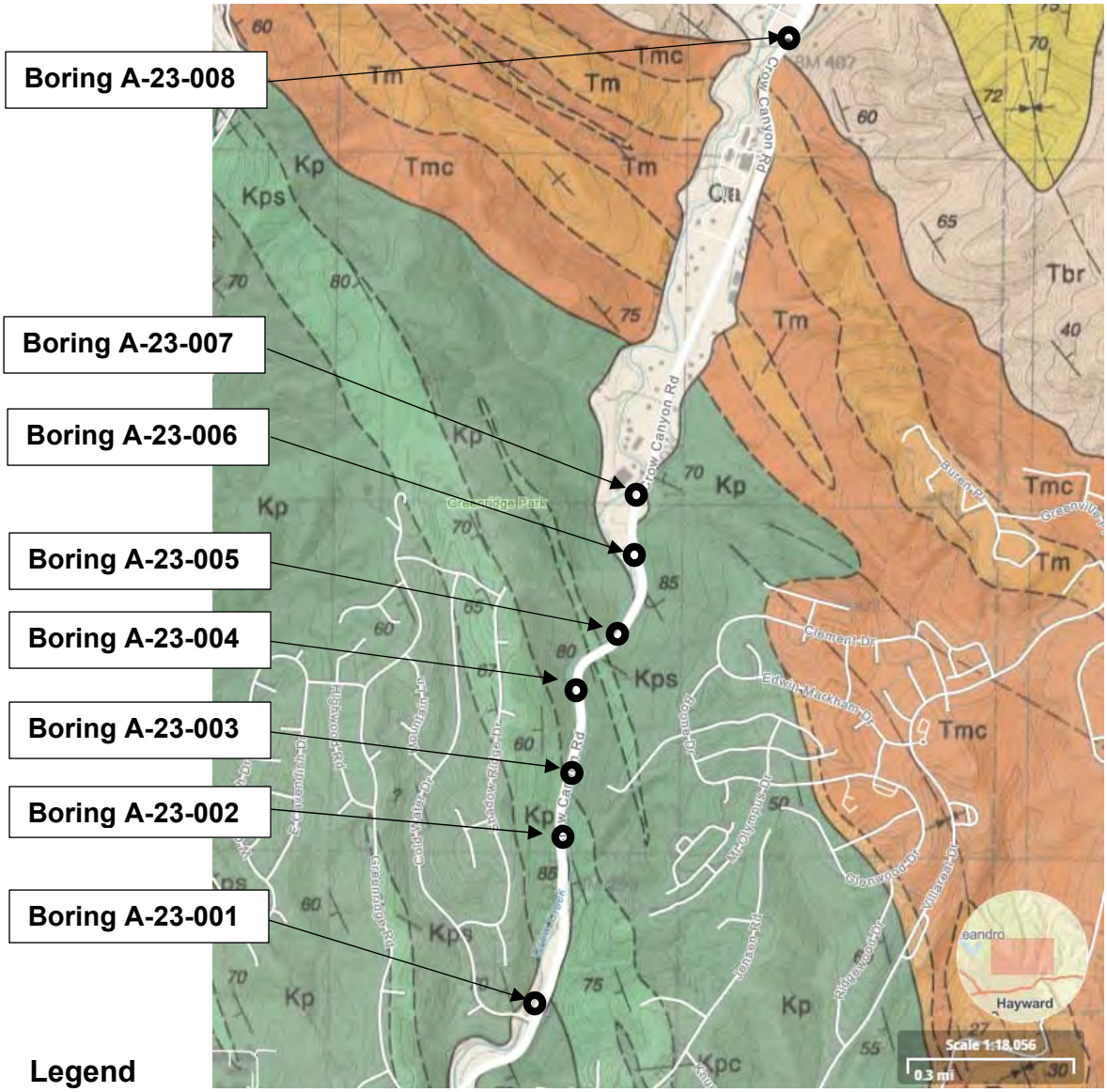

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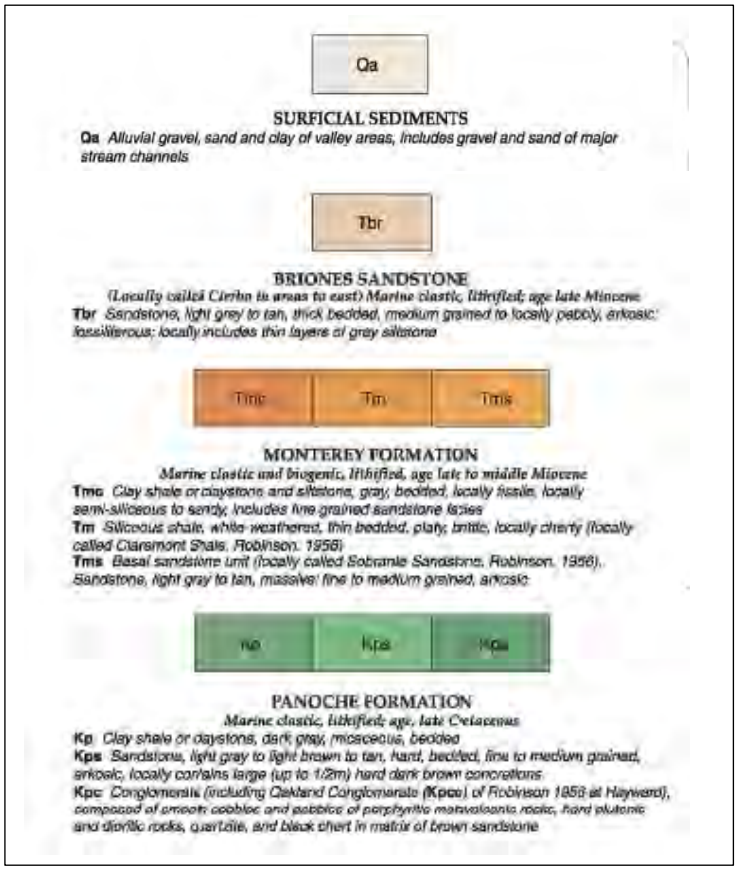

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Figure 4. Geologic Map

Crow Canyon Road Guardrail Replacement Phase IV Project

Alameda County, California

WRECO Project No. 16066

PHOTOGRAPHS

Photograph 1. Boring A-23-001 Location, Looking North

Photograph 2. Slope Below Boring A-23-001 Location

Photograph 3. Boring A-23-001

Photograph 4. Inlet of South Concrete Double Box Culvert and Retaining Wall, Looking South-Southwest

Photograph 5. Retaining Wall Adjacent to Northern End of South Guardrail, Looking South

Photograph 6. Mechanical Stabilized Earthen Wall West of Existing Guardrail, Looking North

Photograph 7. Slope with Flat Bench Below Boring A-23-004 Looking North

Photograph 8. Guardrail North of Boring A-23-004 Looking North-Northeast

Photograph 9. Slope Below Boring A-23-005, Looking South-Southeast

Photograph 10. Storm Culvert South of Boring A-23-005, Looking North-Northeast

Photographs 11, 12, and 13. Slope Below Boring A-23-006 Location, Looking North

Photograph 14. Slope Below Boring A-23-007 Location, Looking South

Photograph 15. Culvert Inlet Adjacent to Guardrail No. 6 Segment Looking Southwest

Photograph 16. Culvert Inlet South of Boring A-23-008 Location

Photograph 17. Boring A-23-008 Location, Looking Northwest

Boring Records

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Olsson	**2-14-23**	**2-14-23**	**37° 42' 26.46" / -122° 2' 28.54" Crow Canyon Rd**	**A-23-001**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geo-Ex Subsurface Exploration				**294 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4.3 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, SPT, CalMod			**Automatic**	**82.2 (average)**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement grout, native soil cap			**No free groundwater encountered**	**22.3 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	Gravel (%)	Sand (%)	Fines (%)	Drilling Method	Casing Depth	Remarks
	0		Lean to fat CLAY with GRAVEL (CL/CH); brown; moist; some coarse, subangular GRAVEL ; (Fill).		S1			100						
	1													
292.0	2		Lean CLAY with SAND (CL); reddish brown; moist; high plasticity fines ; (Fill).											
	3													
290.0	4		PP = 1.5 tsf.											
	5		Dark reddish brown; trace fine GRAVEL ; little fine SAND.		S2	5 7 10	17	67	0	26	74			PA, PI
288.0	6													
	7													
286.0	8													
	9													
	10													

(continued)

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Elk Grove, CA 95758
(916) 513-7428

REPORT TITLE				HOLE ID
BORING RECORD				**A-23-001**
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
04	**Alameda**			**P16066**
PROJECT OR BRIDGE NAME				
Crow Canyon Road Phase IV Guardrail Project				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	J. Olsson	**2-14-23**	**1 of 3**	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	Gravel (%)	Sand (%)	Fines (%)	Drilling Method	Casing Depth	Remarks
	10		Few fine SAND ; PP = 2.4 tsf. Lean CLAY with SAND (CL) *(continued)*.		S3	4 4 5	9	100						
	11													
282.0	12													
	13													
280.0	14													
	15		PP = 1.5 tsf.		S4	12 18	43	100						
			Fat CLAY with GRAVEL (CH); dark yellowish brown; moist; few fine, angular GRAVEL ; PP = 4.5 tsf.			25								
278.0	16													
	17													
276.0	18		Well-graded SAND with GRAVEL (SW); (Weathered sedimentary rock).											Hard drilling
	19													
274.0	20		Variable light brown to light gray; dry.		S5	30 50/2"		100						
	21													
	22													

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				**A-23-001**
DIST. **04**	COUNTY **Alameda**	ROUTE	POSTMILE	PROJECT NO. **P16066**
PROJECT OR BRIDGE NAME **Crow Canyon Road Phase IV Guardrail Project**				
BRIDGE NUMBER	PREPARED BY **J. Olsson**	DATE **2-14-23**	SHEET **2 of 3**	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	Gravel (%)	Sand (%)	Fines (%)	Drilling Method	Casing Depth	Remarks
	22		Gray.		S6	50/3"		100						Auger refusal
			Bottom of borehole at 22.3 ft bgs											
			This Boring Record was developed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010) and Errata (April 2022).											
	23													
270.0	24													
	25													
268.0	26													
	27													
266.0	28													
	29													
264.0	30													
	31													
262.0	32													
	33													
	34													

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(916) 513-7428

REPORT TITLE **BORING RECORD**				HOLE ID **A-23-001**
DIST. **04**	COUNTY **Alameda**	ROUTE	POSTMILE	PROJECT NO. **P16066**
PROJECT OR BRIDGE NAME **Crow Canyon Road Phase IV Guardrail Project**				
BRIDGE NUMBER	PREPARED BY **J. Olsson**		DATE **2-14-23**	SHEET **3 of 3**

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Olsson	2-14-23	2-14-23	37° 42' 42.419" / -122° 2' 26.063" Crow Canyon Rd	A-23-002
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geo-Ex Subsurface Exploration				307 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			CME 75	4.3 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
SPT			Automatic	82.2 (average)
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement grout, aggregate base, concrete cap			No free groundwater encountered	6.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	Gravel (%)	Sand (%)	Fines (%)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE (3.5 in).											
			AGGREGATE BASE (21.5 in); light brown; dry.											
	1													
305.0	2		Poorly-graded SAND (SP); brown; moist; few fines ; (Fill).		S1			100						
	3													
303.0	4		CLAYEY SAND (SC); brown; moist; with broken, angular rock up to 3/4" diameter at base (Fill); PP = 0.6 tsf.											
	5		Dusky red; moist; trace fine, angular GRAVEL ; mostly fine SAND ; some fines ; (Fill).		S2	4 4 11	15	67	2	67	30			PA
301.0	6													
			Bottom of borehole at 6.5 ft bgs											
	7		This Boring Record was developed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010) and Errata (April 2022).											
299.0	8													
	9													
	10													

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REPORT TITLE				HOLE ID
BORING RECORD				A-23-002
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
04	Alameda			P16066
PROJECT OR BRIDGE NAME				
Crow Canyon Road Phase IV Guardrail Project				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	J. Olsson		2-14-23	1 of 1

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Olsson	**2-14-23**	**2-14-23**	**37° 42' 46.444" / -122° 2' 25.242" Crow Canyon Rd**	**A-23-003**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geo-Ex Subsurface Exploration				**318 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4.3 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, SPT			**Automatic**	**82.2 (average)**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement grout, aggregate base, concrete cap			**No free groundwater encountered**	**6.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	Gravel (%)	Sand (%)	Fines (%)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE (1 in).											
			AGGREGATE BASE (16 in); light brown; dry.											
	1													
			CLAYEY SAND with GRAVEL (SC); dark brown; moist; little fine GRAVEL ; (fill).		S1			100						
316.0	2													
	3													
314.0	4													
	5		SANDY lean CLAY (CL); very dark grayish brown; moist; trace fine GRAVEL ; some SAND ; mostly nonplastic fines ; (fill); PP = 1.7 tsf.		S2	2	7	100	0	39	61			PA, PI
						3								
312.0	6					4								
			Bottom of borehole at 6.5 ft bgs											
	7		This Boring Record was developed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010) and Errata (April 2022).											
310.0	8													
	9													
	10													

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REPORT TITLE				HOLE ID
BORING RECORD				**A-23-003**
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
04	**Alameda**			**P16066**
PROJECT OR BRIDGE NAME				
Crow Canyon Road Phase IV Guardrail Project				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	J. Olsson	**2-14-23**	**1 of 1**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Olsson	**2-14-23**	**2-14-23**	**37° 42' 55.933" / -122° 2' 24.428" Crow Canyon Rd**	**A-23-004**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geo-Ex Subsurface Exploration				**338 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4.3 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
SPT			**Automatic**	**82.2 (average)**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement grout, concrete cap			**No free groundwater encountered**	**16.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	Gravel (%)	Sand (%)	Fines (%)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE (6 in).											
	1		SILTY SAND with GRAVEL (SM); , becoming moist below 3' depth; little fine, subangular to subrounded GRAVEL ; (fill).											
336.0	2													
	3													
334.0	4													
	5		SANDY lean CLAY (CL); light yellowish brown; moist; some fine SAND ; mostly fines ; (fill).		S2	4 2 4	6	61	0	31	69			PA
332.0	6													
	7													
330.0	8													
	9													
	10													

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				**A-23-004**
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
04	**Alameda**			**P16066**
PROJECT OR BRIDGE NAME				
Crow Canyon Road Phase IV Guardrail Project				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	J. Olsson	**2-14-23**	**1 of 2**	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	Gravel (%)	Sand (%)	Fines (%)	Drilling Method	Casing Depth	Remarks
	10		Brown. SANDY lean CLAY (CL) *(continued)*.		S3	7 11 14	25	72						
	11													
326.0	12													
	13		CLAYEY SAND with GRAVEL (SC).											
324.0	14													
	15		Dark yellowish brown; moist; some fine GRAVEL ; some fine to coarse SAND ; little fines ; 25% broken, weathered sedimentary rock.		S4	14 22 30	52	83	37	44	20			PA, PI
322.0	16													
			Bottom of borehole at 16.5 ft bgs											
	17		This Boring Record was developed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010) and Errata (April 2022).											
320.0	18													
	19													
318.0	20													
	21													
	22													

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(916) 513-7428

REPORT TITLE				HOLE ID
BORING RECORD				**A-23-004**
DIST. **04**	COUNTY **Alameda**	ROUTE	POSTMILE	PROJECT NO. **P16066**
PROJECT OR BRIDGE NAME **Crow Canyon Road Phase IV Guardrail Project**				
BRIDGE NUMBER	PREPARED BY **J. Olsson**		DATE **2-14-23**	SHEET **2 of 2**

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Olsson	**2-15-23**	**2-15-23**	**37° 43' 0.854" / -122° 2' 19.043" Crow Canyon Rd**	**A-23-005**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geo-Ex Subsurface Exploration				**344 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4.3 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
SPT			**Automatic**	**82.2 (average)**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement grout, concrete cap			**No free groundwater encountered**	**20.2 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	Gravel (%)	Sand (%)	Fines (%)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE (7 in).											
			AGGREGATE BASE (18 in); dry.											
	1													
342.0	2		CLAYEY SAND with GRAVEL (SC); moist; medium plasticity fines.											
	3													
340.0	4													
	5		Lean CLAY (CL); dark yellowish brown; dry; trace fine GRAVEL ; few fine SAND ; mostly fines.		S2	7	15	61	0	12	88			PA, PI
			PP = 4.5 tsf.			7								
338.0	6					8								
	7													
336.0	8		CLAYEY GRAVEL with SAND (GC); (weathered sedimentary rock).											
	9													
	10													

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				**A-23-005**
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
04	**Alameda**			**P16066**
PROJECT OR BRIDGE NAME				
Crow Canyon Road Phase IV Guardrail Project				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	J. Olsson		**2-14-23**	**1 of 2**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	Gravel (%)	Sand (%)	Fines (%)	Drilling Method	Casing Depth	Remarks
	10		Dark grayish brown; dry; some fine and coarse GRAVEL ; some fine to coarse SAND ; little fines. CLAYEY GRAVEL with SAND (GC) *(continued)*.		S3	15 24 20	44	89	47	34	19			PA, PI
	11													
332.0	12													
	13													
330.0	14													
	15		Gray to orangish brown.		S4	15 30 40	70	78						
328.0	16													
	17													
326.0	18													
	19													
324.0	20		Gray.		S5	50/2"		100						
			Bottom of borehole at 20.2 ft bgs											
	21		This Boring Record was developed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010) and Errata (April 2022).											
	22													

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REPORT TITLE				HOLE ID
BORING RECORD				**A-23-005**
DIST. **04**	COUNTY **Alameda**	ROUTE	POSTMILE	PROJECT NO. **P16066**
PROJECT OR BRIDGE NAME **Crow Canyon Road Phase IV Guardrail Project**				
BRIDGE NUMBER	PREPARED BY **J. Olsson**		DATE **2-14-23**	SHEET **2 of 2**

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Olsson	**2-15-23**	**2-15-23**	**37° 43' 5.711" / -122° 2' 16.811" Crow Canyon Rd**	**A-23-006**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geo-Ex Subsurface Exploration				**351 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**CME 75**	**4.3 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, SPT			**Automatic**	**82.2 (average)**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement grout, aggregate base, concrete cap			**16.0 ft**	**16.0 ft on2-16-23**	**21.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	Gravel (%)	Sand (%)	Fines (%)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE (6 in).		S1			100						
			AGGREGATE BASE (18 in); light brown; dry.											R
349.0	2		SILTY SAND with GRAVEL (SM); brown; moist; few fine GRAVEL ; (fill).											
347.0	4													
	5		CLAYEY SAND with GRAVEL (SC); dark grayish brown; moist; little fine GRAVEL ; some fine to coarse SAND ; some fines.		S2	6 17 10	27	100	18	40	42			PA
345.0	6													
343.0	8		CLAYEY SILT (ML/CL); brown; moist; low to medium plasticity fines ; (fill).											
	10													

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				**A-23-006**
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
04	**Alameda**			**P16066**
PROJECT OR BRIDGE NAME				
Crow Canyon Road Phase IV Guardrail Project				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	J. Olsson		**2-14-23**	**1 of 2**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	Gravel (%)	Sand (%)	Fines (%)	Drilling Method	Casing Depth	Remarks
	10		PP = 1.1 tsf. CLAYEY SILT (ML/CL) *(continued)*.		S3	2 2 3	5	100	0	29	71			PA, PI
	11													
339.0	12													
	13		SILTY SAND (SM); (fill).											
337.0	14													
	15		Brown; wet; PP = 0.6 tsf.		S4	0 3 3	6	89	0	57	43			PA
335.0	16													
	17													
333.0	18		Nonplastic fines ; (fill).											
	19													
331.0	20		Light brown; wet; few GRAVEL ; mostly fine SAND ; little fines.		S5	3 4 6	10	100						
	21													
			Bottom of borehole at 21.5 ft bgs											
	22													

This Boring Record was developed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010) and Errata (April 2022).

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REPORT TITLE				HOLE ID
BORING RECORD				**A-23-006**
DIST. **04**	COUNTY **Alameda**	ROUTE	POSTMILE	PROJECT NO. **P16066**
PROJECT OR BRIDGE NAME **Crow Canyon Road Phase IV Guardrail Project**				
BRIDGE NUMBER	PREPARED BY **J. Olsson**		DATE **2-14-23**	SHEET **2 of 2**

7 BR - CUSTOM COLUMNS 2023 0301_10339787_CROW CANYON GUARDRAILS_GINT LOGS_V0.2_JO.GPJ WRECO - NONCALTRANS.GLB 03/02/23

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Olsson	2-15-23	2-15-23	37° 43' 10.898" / -122° 2' 17.93" Crow Canyon Rd	A-23-007
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geo-Ex Subsurface Exploration				367 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			CME 75	4.3 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, SPT			Automatic	82.2 (average)
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement grout, aggregate base, concrete cap			No free groundwater encountered	11.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	Gravel (%)	Sand (%)	Fines (%)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE (9.5 in).											
	1		Lean CLAY with SAND (CL); dry; highly plastic when wet (fill).		S1			100						
365.0	2													
	3													
363.0	4													
	5		Dark grayish brown; dry becoming moist with depth; trace fine, angular GRAVEL ; little fine SAND ; mostly fines ; PP = 4.3 tsf.		S2	11 9 7	16	100	1	23	77			PA, PI
361.0	6													
	7													
359.0	8		Fat CLAY with SAND (CH).											
	9													
	10													

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				A-23-007
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
04	Alameda			P16066
PROJECT OR BRIDGE NAME				
Crow Canyon Road Phase IV Guardrail Project				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	J. Olsson		2-14-23	1 of 2

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	Gravel (%)	Sand (%)	Fines (%)	Drilling Method	Casing Depth	Remarks
	10		Very dark gray; moist; trace fine GRAVEL ; little fine SAND ; mostly high plasticity fines ; PP = 2.1 tsf. Fat CLAY with SAND (CH) *(continued)*.		S3	4 6 9	15	94	3	24	74			PA, PI
	11													
			Bottom of borehole at 11.5 ft bgs											
355.0	12		This Boring Record was developed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010) and Errata (April 2022).											
	13													
353.0	14													
	15													
351.0	16													
	17													
349.0	18													
	19													
347.0	20													
	21													
	22													

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REPORT TITLE				HOLE ID
BORING RECORD				**A-23-007**
DIST. **04**	COUNTY **Alameda**	ROUTE	POSTMILE	PROJECT NO. **P16066**
PROJECT OR BRIDGE NAME **Crow Canyon Road Phase IV Guardrail Project**				
BRIDGE NUMBER	PREPARED BY **J. Olsson**		DATE **2-14-23**	SHEET **2 of 2**

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Olsson	2-15-23	2-15-23	37° 43' 55.027" / -122° 1' 59.606" Crow Canyon Rd	A-23-008
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geo-Ex Subsurface Exploration				414 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			CME 75	4.3 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, SPT			Automatic	82.2 (average)
BORE HOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement grout, native soil cap			No free groundwater encountered	11.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	Gravel (%)	Sand (%)	Fines (%)	Drilling Method	Casing Depth	Remarks
	0		AGGREGATE BASE (24 in); (fill).		S1			100						
	1													
412.0	2		SANDY lean to fat CLAY (CL/CH); (fill).											
	3		SILTY SAND (SM); (fill).											
410.0	4		Poorly-graded SAND (SP); (fill).											
	5		SANDY lean CLAY (CL). Dark grayish brown; moist; nonplastic fines ; PP = 2.0 tsf.		S2	2 3 2	5	94						
408.0	6													
	7													
406.0	8													
	9													
	10													

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				A-23-008
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
04	Alameda			P16066
PROJECT OR BRIDGE NAME				
Crow Canyon Road Phase IV Guardrail Project				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	J. Olsson		2-14-23	1 of 2

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per ft	Recovery (%)	Gravel (%)	Sand (%)	Fines (%)	Drilling Method	Casing Depth	Remarks
	10		Gray; some fine SAND ; mostly high plasticity fines. SANDY lean CLAY (CL) *(continued)*.		S3	3 2 4	6	100	0	40	60			PA, PI
	11													
			Bottom of borehole at 11.5 ft bgs											
402.0	12		This Boring Record was developed in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010) and Errata (April 2022).											
	13													
400.0	14													
	15													
398.0	16													
	17													
396.0	18													
	19													
394.0	20													
	21													
	22													

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REPORT TITLE				HOLE ID
BORING RECORD				**A-23-008**
DIST. **04**	COUNTY **Alameda**	ROUTE	POSTMILE	PROJECT NO. **P16066**
PROJECT OR BRIDGE NAME **Crow Canyon Road Phase IV Guardrail Project**				
BRIDGE NUMBER	PREPARED BY **J. Olsson**		DATE **2-14-23**	SHEET **2 of 2**

Laboratory Test Reports

BLACKBURN CONSULTING

Unconfined Compression
ASTM D 2166

Project Name: Crow Canyon Road
Project Number: 4390.X002
Sample ID: A-23-001-4C
Type of Sample: CalMod
Sample Description: Fat CLAY with GRAVEL, dark yellowish brown
Depth: 16-16.5'

Sample Data

Sample Length:	5.01	in	Sample + Tube:	770	g
Diameter:	2.41	in	Tube:	0.00	g
Height-to-Diameter Ratio:	2.08		Sample Weight:	770	g
Sample Area:	4.55	in^2	Wet Density:	128.7	pcf
Sample Volume:	22.8	in^3	Moisture:	18.6	%
Specific Gravity:	2.65	(assumed)	Dry Density:	108.6	pcf
			Saturation:	94.0	%

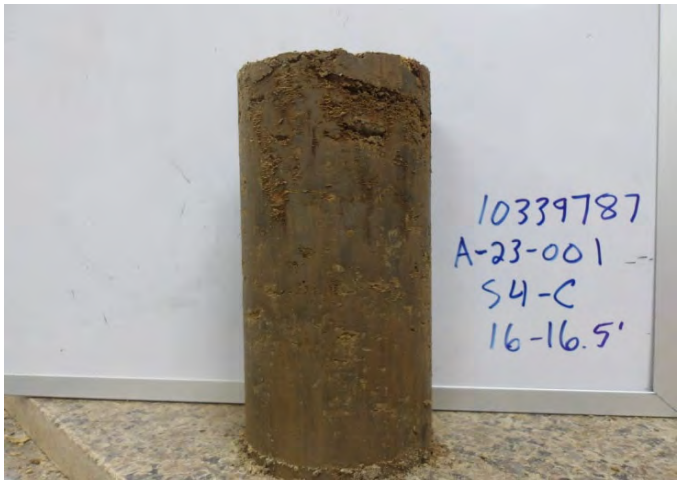
**Moisture content taken after test*

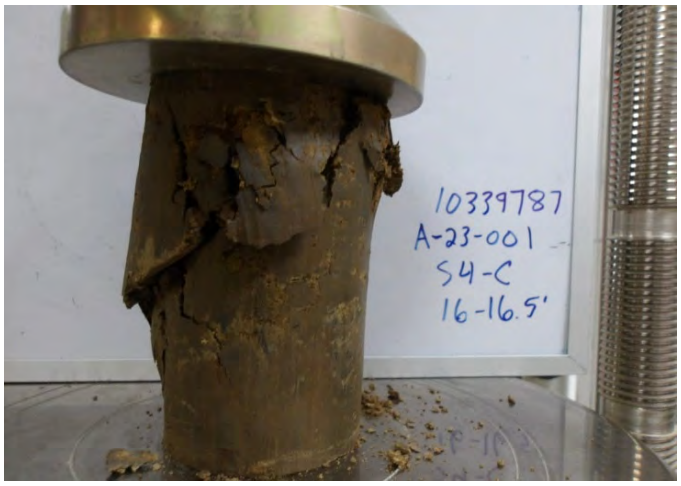
Test Results

Rate of Strain:	0.0501	in/min
Deflection at Max. Load:	0.107	in
Maximum Load:	123	lbs
Strain at Failure:	2.14	%
Average cross-sectional area at failure:	4.65	in^2
Compressive Strength:	**1.91**	**tsf**
	26.5	**psi**

Strain Information

Rate of Strain ½%:	0.025	in/min
Rate of Strain 2%:	0.100	in/min
Strain Rate:	0.050	in/min
15% Strain:	0.751	in



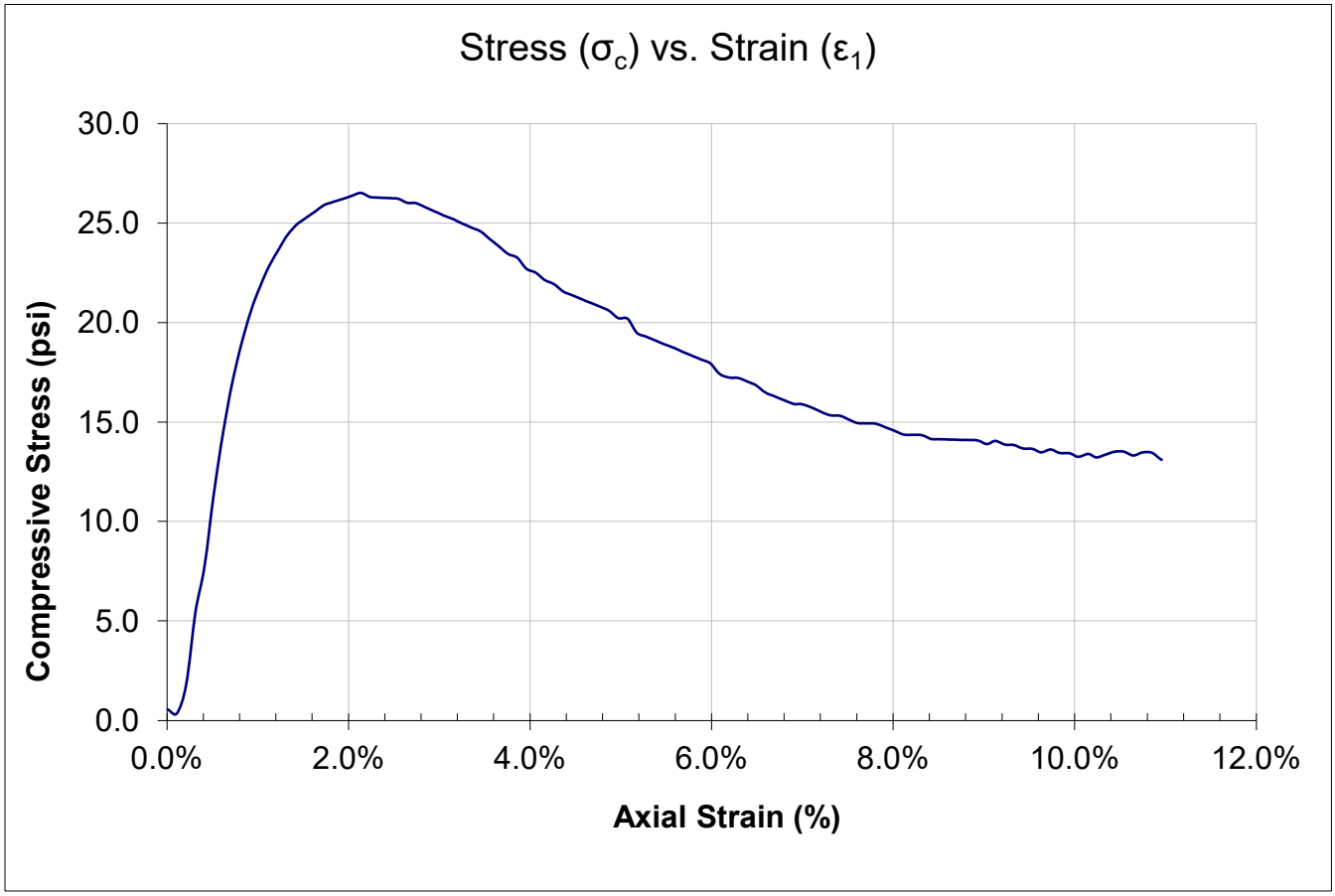


BLACKBURN CONSULTING

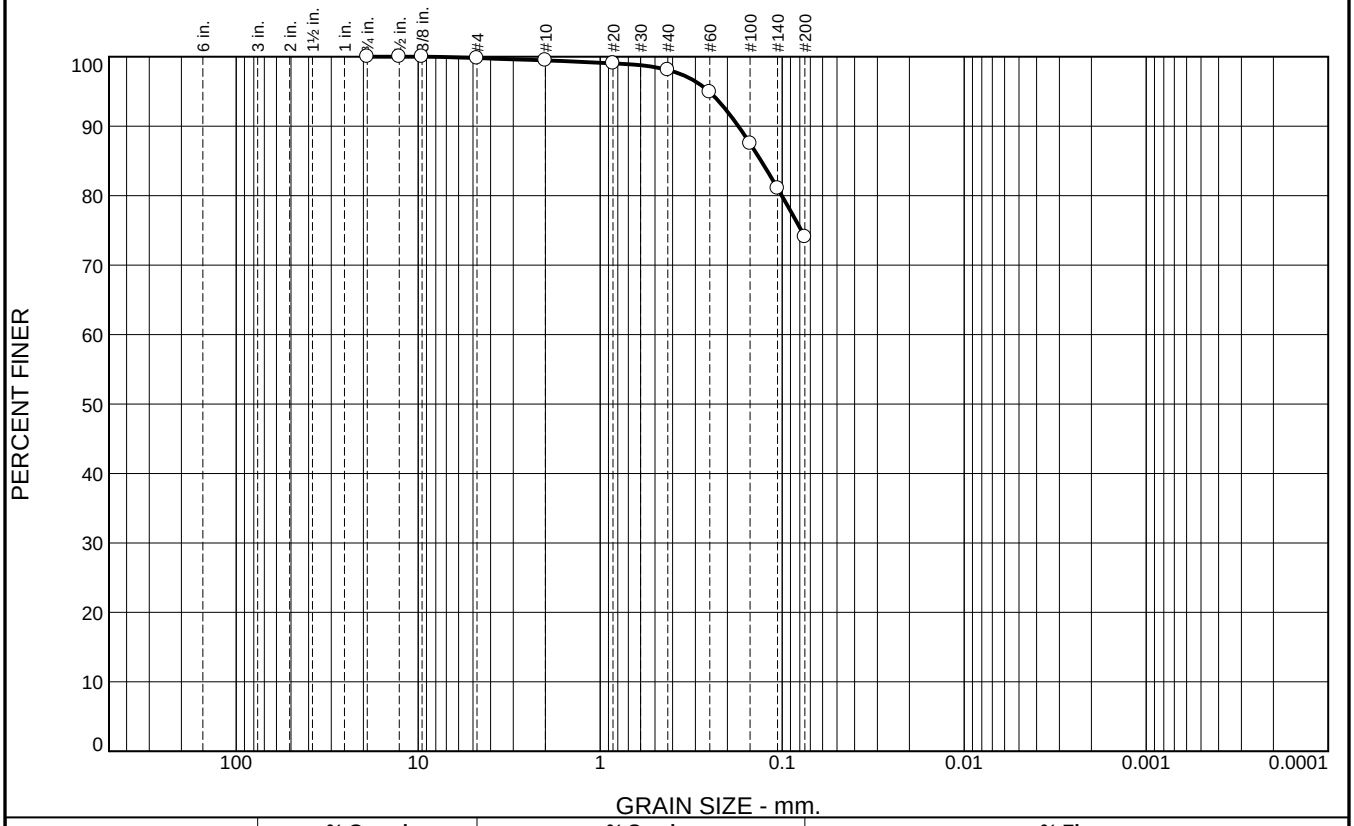
Unconfined Compression
ASTM D 2166

Project Name: Crow Canyon Road
Project Number: 4390.X002
Sample ID: A-23-001-4C
Type of Sample: CalMod
Sample Description: Fat CLAY with GRAVEL, dark yellowish brown
Depth: 16-16.5'

Compressive Strength: **1.91** **tsf**
26.5 **psi**



Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	0.3	1.4	24.0	74.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	99.8		
#10	99.5		
#20	99.0		
#40	98.1		
#60	94.9		
#100	87.5		
#140	81.0		
#200	74.1		

* (no specification provided)

Soil Description

Lean CLAY with SAND, dark reddish brown

Atterberg Limits

PL= 15 LL= 34 PI= 19

Coefficients

D_{90}= 0.1742 D_{85}= 0.1306 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(12)

Remarks

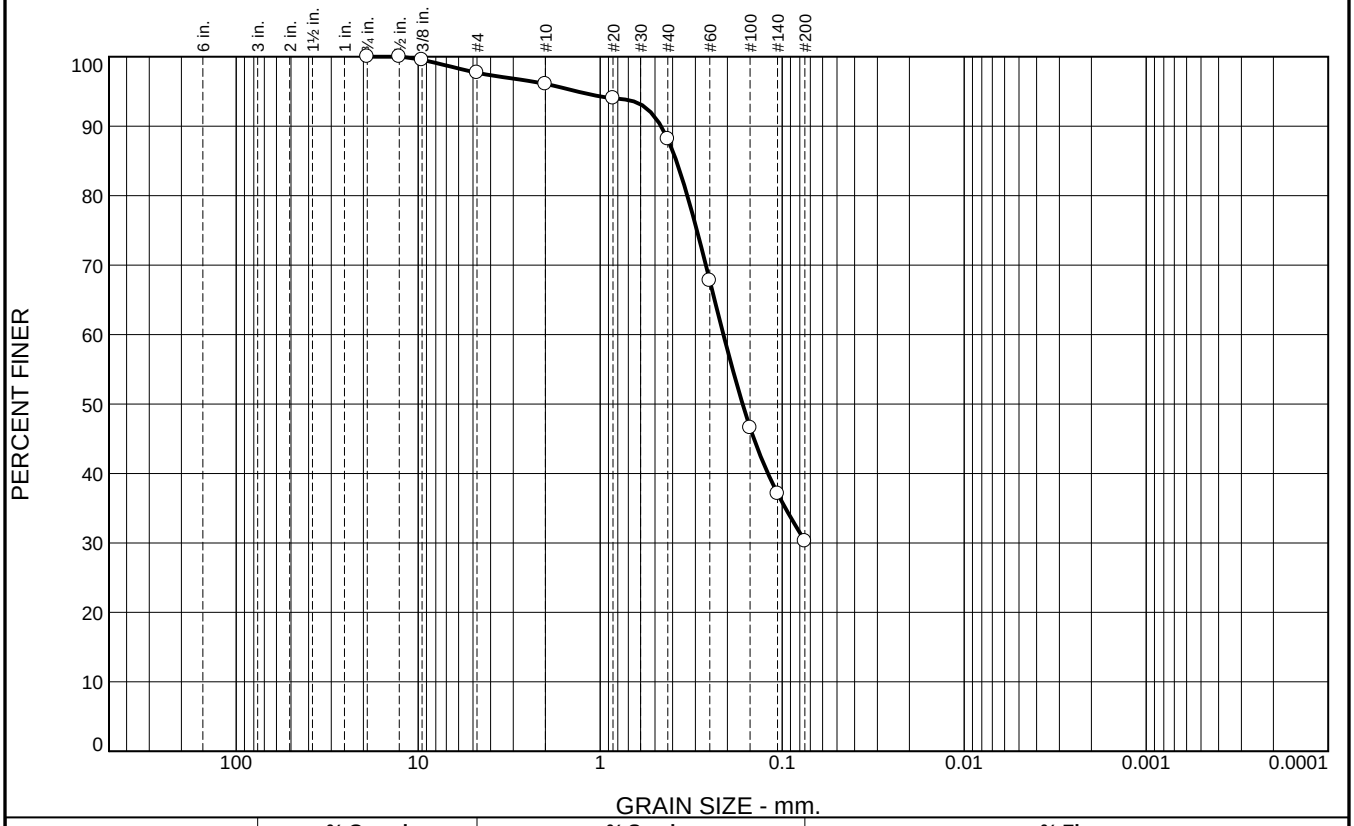
Source of Sample: A-23-001 **Depth:** 5-6.5'
Sample Number: S2 **Date:**

Blackburn Consulting

W. Sacramento, CA

Client: HDR/WRECO
Project: Crow Canyon Road Phase IV Guardrail Replacement Project, Alameda County Public Works Agency
Project No: 4390.X002 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.3	1.6	8.0	57.8	30.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	100.0		
3/8"	99.5		
#4	97.7		
#10	96.1		
#20	94.0		
#40	88.1		
#60	67.8		
#100	46.6		
#140	37.1		
#200	30.3		

* (no specification provided)

Soil Description

CLAYEY SAND, dusky red

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4622 D_{85}= 0.3811 D_{60}= 0.2103
D_{50}= 0.1651 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

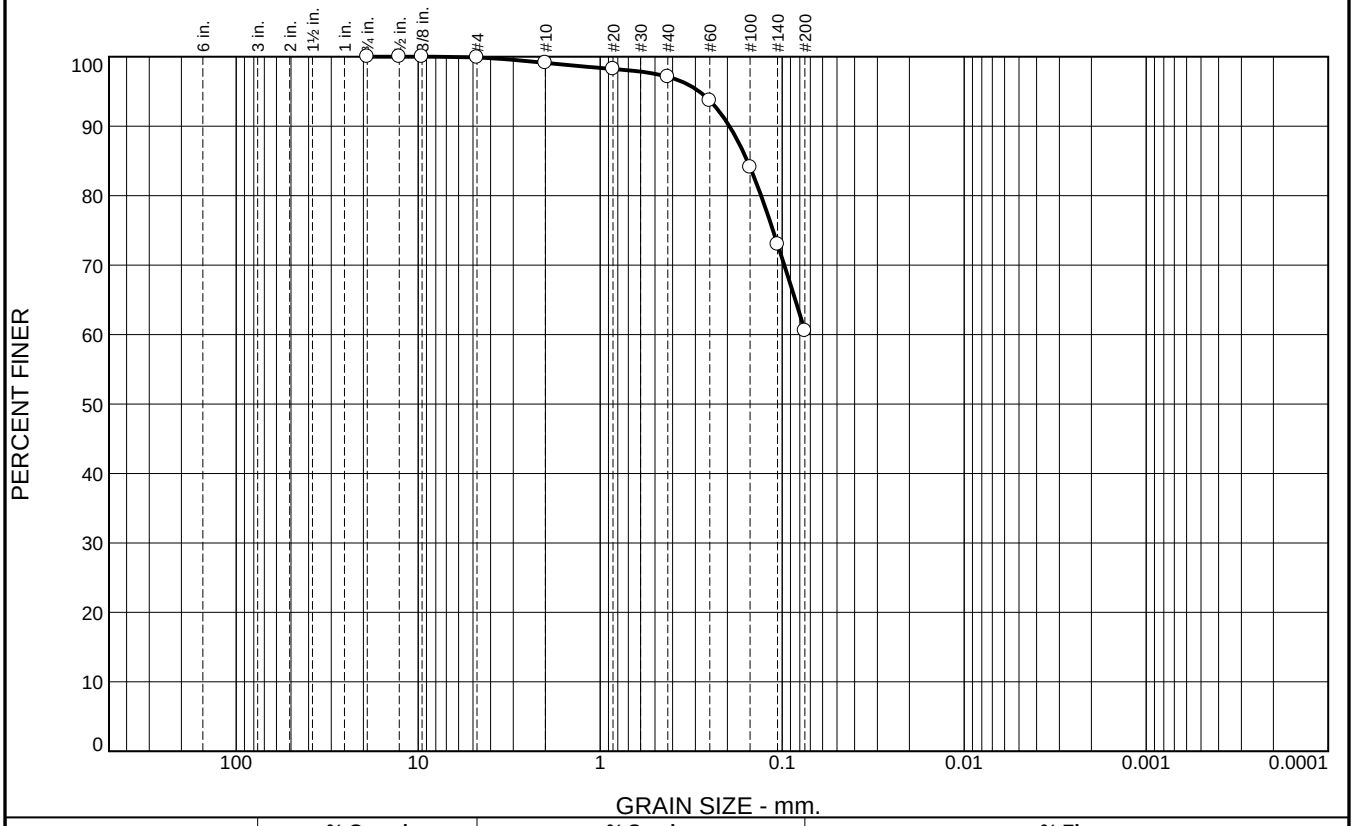
Source of Sample: A-23-002 **Depth:** 5-6.5'
Sample Number: S2 **Date:**

Blackburn Consulting

W. Sacramento, CA

Client: HDR/WRECO
Project: Crow Canyon Road Phase IV Guardrail Replacement Project, Alameda County Public Works Agency
Project No: 4390.X002 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	0.8	2.0	36.6	60.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	99.9		
#10	99.1		
#20	98.2		
#40	97.1		
#60	93.7		
#100	84.1		
#140	73.0		
#200	60.5		

* (no specification provided)

Soil Description

SANDY lean CLAY, very dark greyish brown

Atterberg Limits

PL= 16 LL= 32 PI= 16

Coefficients

D_{90}= 0.1949 D_{85}= 0.1553 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(7)

Remarks

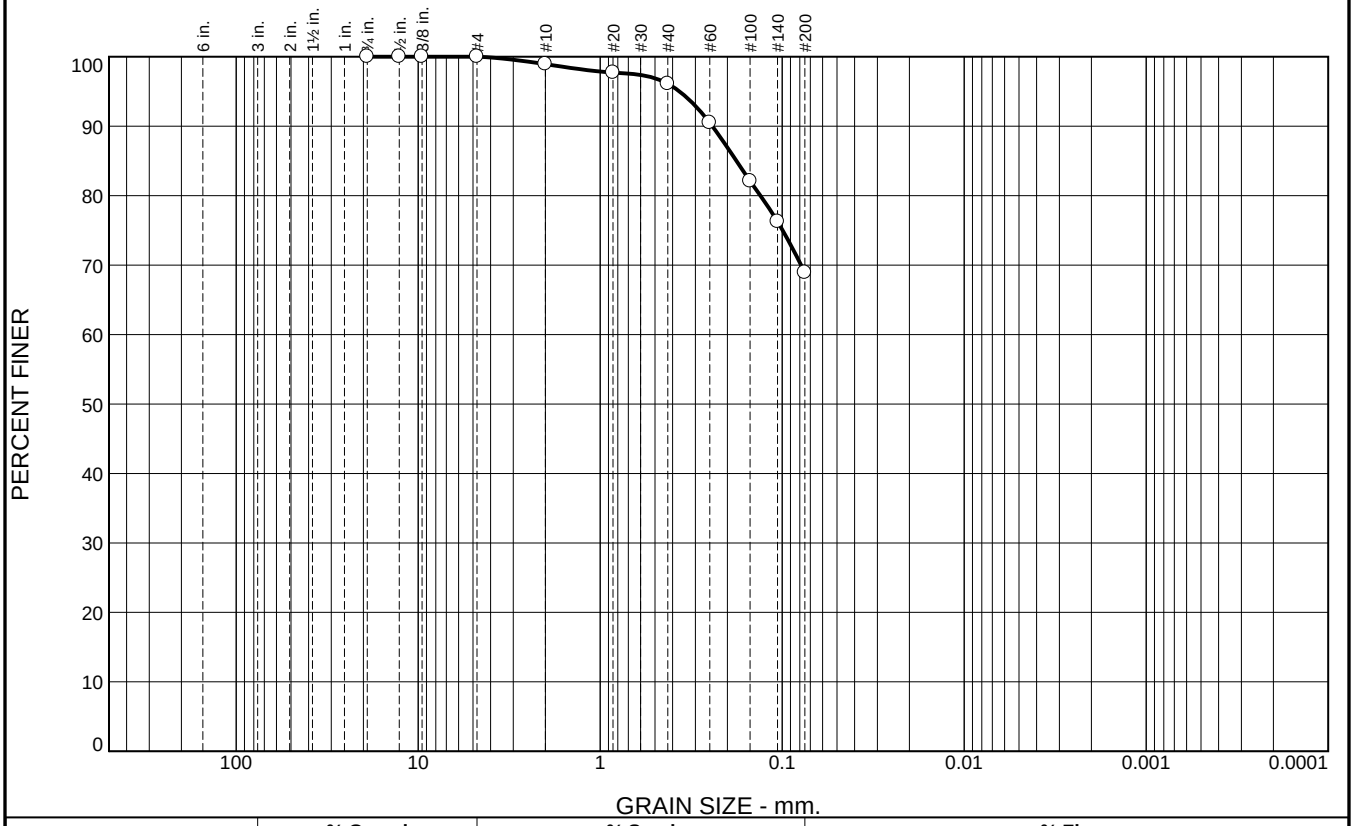
Source of Sample: A-23-003 **Depth:** 5-6.5'
Sample Number: S2 **Date:**

Blackburn Consulting

W. Sacramento, CA

Client: HDR/WRECO
Project: Crow Canyon Road Phase IV Guardrail Replacement Project, Alameda County Public Works Agency
Project No: 4390.X002 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.1	2.8	27.2	68.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	100.0		
#10	98.9		
#20	97.7		
#40	96.1		
#60	90.5		
#100	82.1		
#140	76.3		
#200	68.9		

* (no specification provided)

Soil Description

SANDY lean CLAY, light yellowish brown

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2420 D_{85}= 0.1784 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

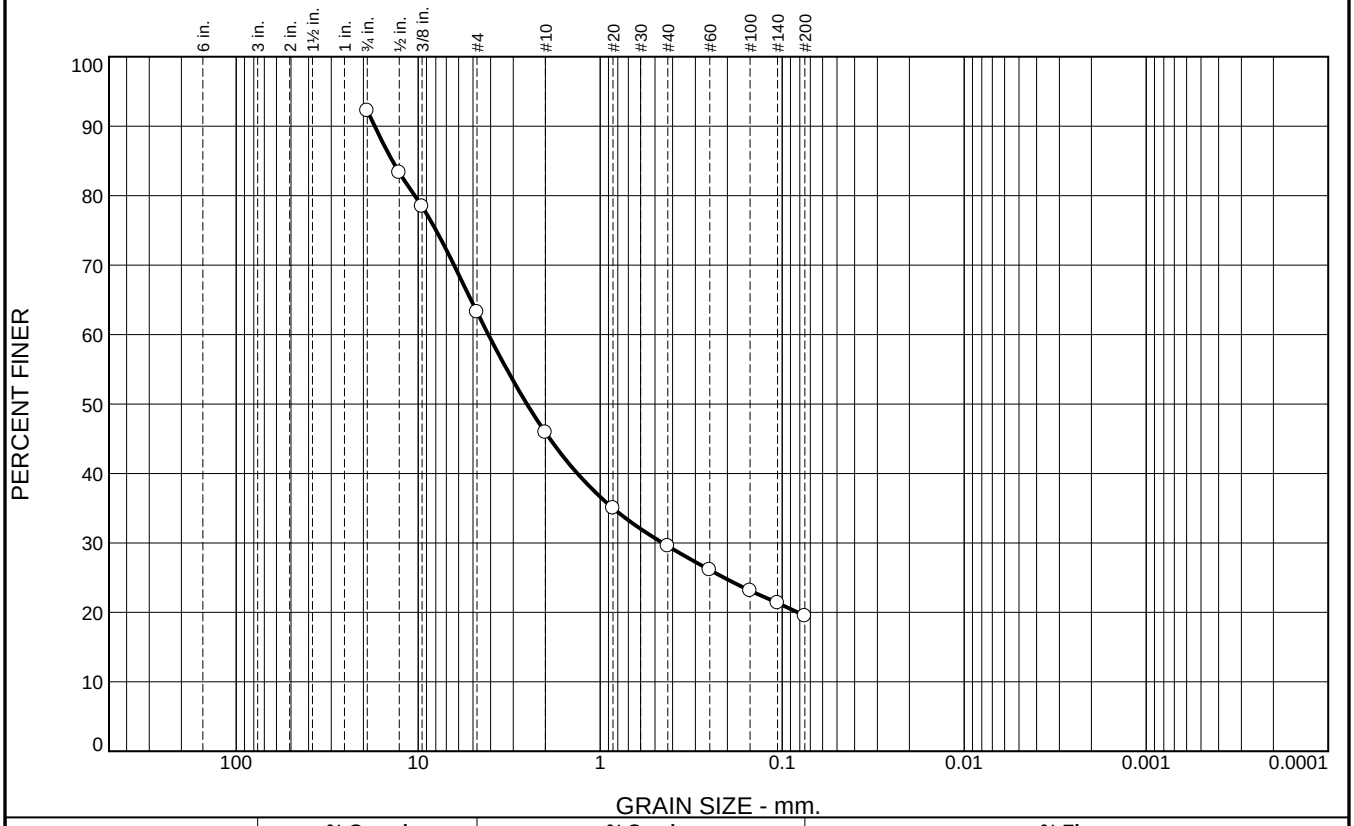
Source of Sample: A-23-004 **Depth:** 5-6.5'
Sample Number: S2 **Date:**

Blackburn Consulting

W. Sacramento, CA

Client: HDR/WRECO
Project: Crow Canyon Road Phase IV Guardrail Replacement Project, Alameda County Public Works Agency
Project No: 4390.X002 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		29.0	17.3	16.4	10.0	19.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	92.2		
1/2"	83.3		
3/8"	78.4		
#4	63.2		
#10	45.9		
#20	35.0		
#40	29.5		
#60	26.1		
#100	23.1		
#140	21.4		
#200	19.5		

* (no specification provided)

Soil Description

CLAYEY SAND with GRAVEL, dark yellowish brown

Atterberg Limits

PL= 19 LL= 33 PI= 14

Coefficients

D_{90}= 17.3374 D_{85}= 13.8442 D_{60}= 4.1152
D_{50}= 2.5259 D_{30}= 0.4539 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

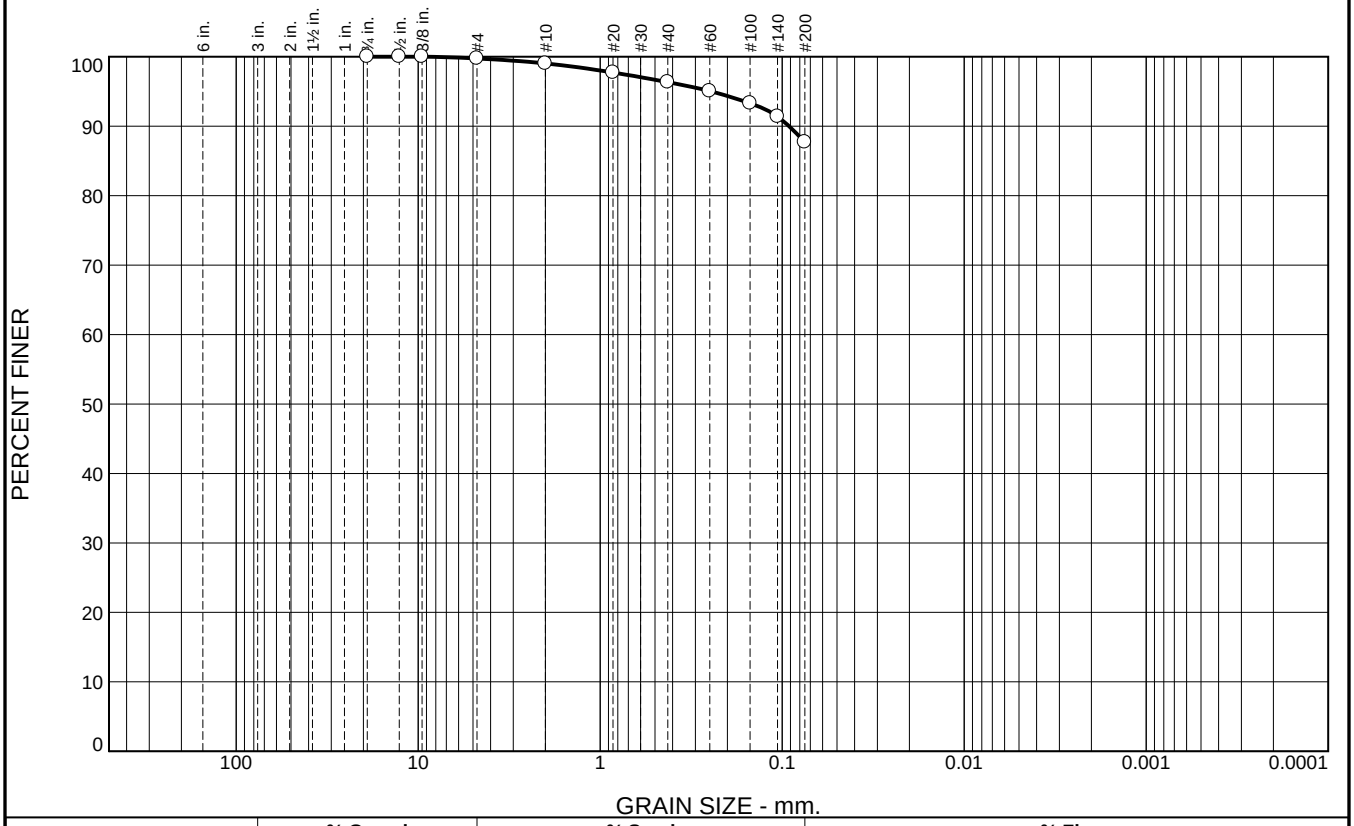
Source of Sample: A-23-004 **Depth:** 15-16.5'
Sample Number: S4 **Date:**

Blackburn Consulting

W. Sacramento, CA

Client: HDR/WRECO
Project: Crow Canyon Road Phase IV Guardrail Replacement Project, Alameda County Public Works Agency
Project No: 4390.X002 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	0.7	2.7	8.6	87.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	99.7		
#10	99.0		
#20	97.7		
#40	96.3		
#60	95.0		
#100	93.3		
#140	91.4		
#200	87.7		

* (no specification provided)

Soil Description

Lean CLAY, dark yellowish brown

Atterberg Limits

PL= 19 LL= 44 PI= 25

Coefficients

D_{90}= 0.0917 D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(23)

Remarks

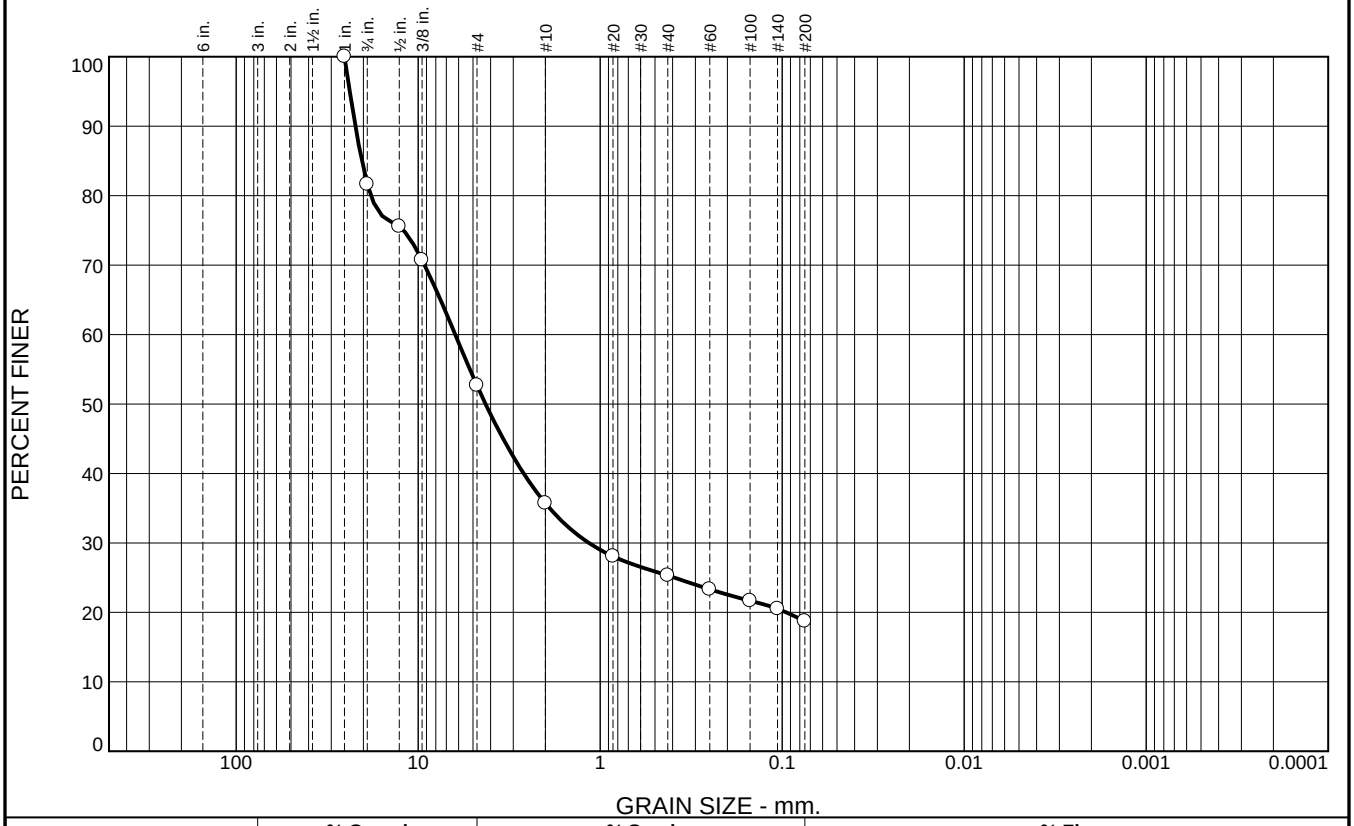
Source of Sample: A-23-005 **Depth:** 5-6.5'
Sample Number: S2 **Date:**

Blackburn Consulting

W. Sacramento, CA

Client: HDR/WRECO
Project: Crow Canyon Road Phase IV Guardrail Replacement Project, Alameda County Public Works Agency
Project No: 4390.X002 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	18.4	28.9	17.0	10.4	6.6	18.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	81.6		
1/2"	75.6		
3/8"	70.7		
#4	52.7		
#10	35.7		
#20	28.1		
#40	25.3		
#60	23.3		
#100	21.7		
#140	20.5		
#200	18.7		

* (no specification provided)

Soil Description

CLAYEY GRAVEL with SAND, dark grayish brown

Atterberg Limits

PL= 19 LL= 37 PI= 18

Coefficients

D_{90}= 22.1228 D_{85}= 20.4052 D_{60}= 6.2564
D_{50}= 4.2637 D_{30}= 1.1542 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= GC AASHTO= A-2-6(0)

Remarks

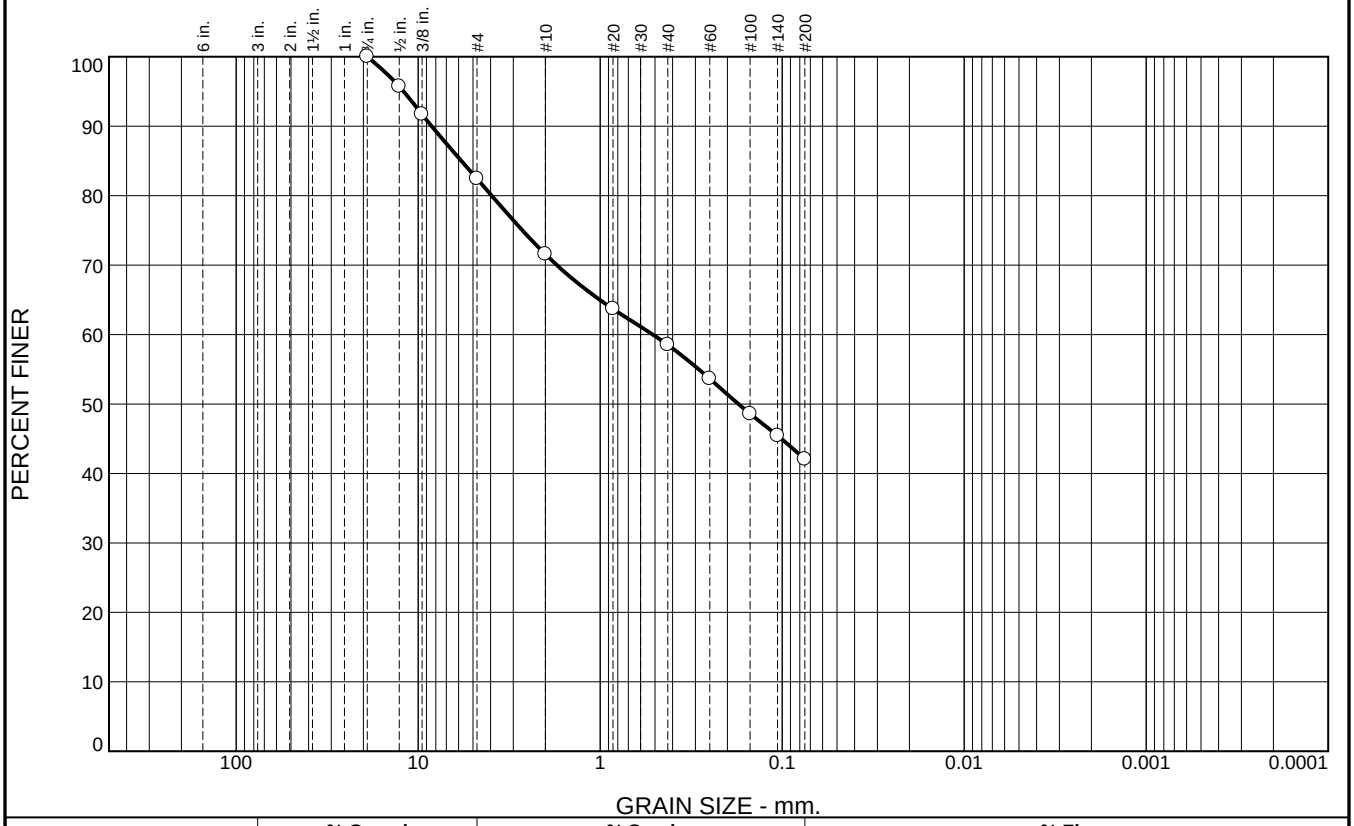
Source of Sample: A-23-005 **Depth:** 10-11.5'
Sample Number: S3 **Date:**

Blackburn Consulting

W. Sacramento, CA

Client: HDR/WRECO
Project: Crow Canyon Road Phase IV Guardrail Replacement Project, Alameda County Public Works Agency
Project No: 4390.X002 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	17.6	10.8	13.1	16.5	42.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	95.7		
3/8"	91.7		
#4	82.4		
#10	71.6		
#20	63.7		
#40	58.5		
#60	53.6		
#100	48.6		
#140	45.4		
#200	42.0		

* (no specification provided)

Soil Description

CLAYEY SAND with GRAVEL, dark greyish brown

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 8.4351 D_{85}= 5.7897 D_{60}= 0.5140
D_{50}= 0.1739 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

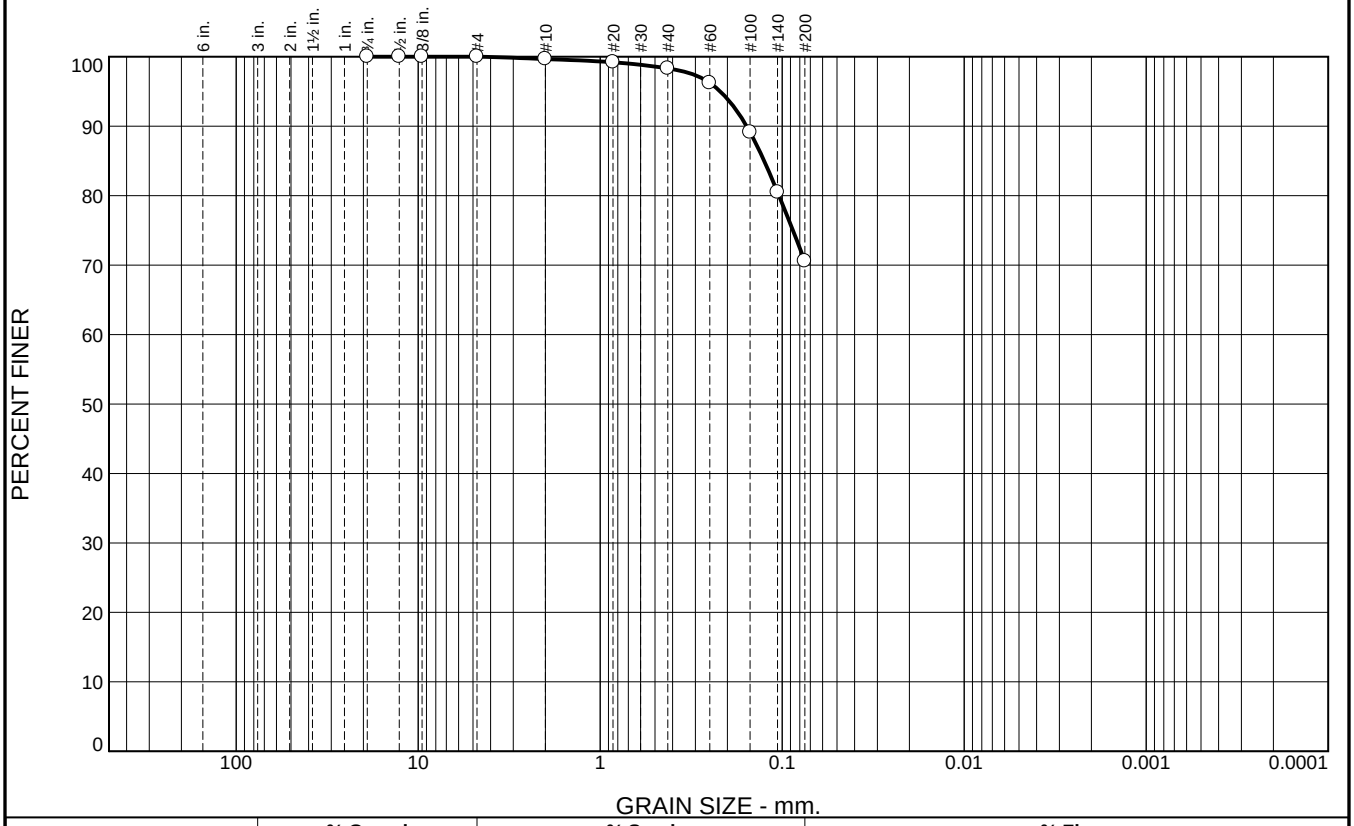
Source of Sample: A-23-006 **Depth:** 5-6.5'
Sample Number: S2 **Date:**

Blackburn Consulting

W. Sacramento, CA

Client: HDR/WRECO
Project: Crow Canyon Road Phase IV Guardrail Replacement Project, Alameda County Public Works Agency
Project No: 4390.X002 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	1.4	27.7	70.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	100.0		
#10	99.7		
#20	99.2		
#40	98.3		
#60	96.2		
#100	89.1		
#140	80.5		
#200	70.6		

* (no specification provided)

Soil Description

Lean CLAY with SAND, very dark greyish brown

Atterberg Limits

PL= 16 LL= 31 PI= 15

Coefficients

D_{90}= 0.1568 D_{85}= 0.1256 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(8)

Remarks

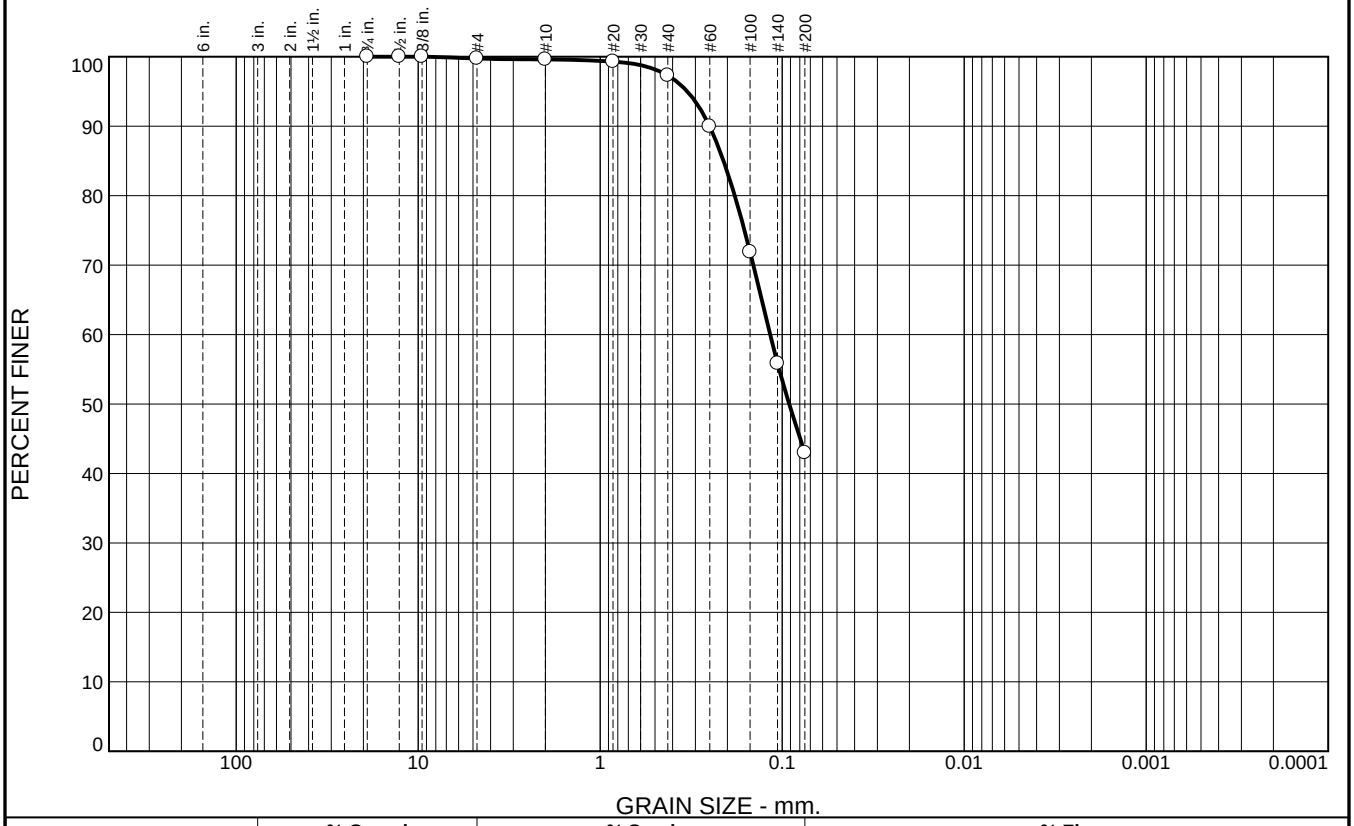
Source of Sample: A-23-006 **Depth:** 10-11.5'
Sample Number: S3 **Date:**

Blackburn Consulting

W. Sacramento, CA

Client: HDR/WRECO
Project: Crow Canyon Road Phase IV Guardrail Replacement Project, Alameda County Public Works Agency
Project No: 4390.X002 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	0.1	2.3	54.3	43.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	99.7		
#10	99.6		
#20	99.3		
#40	97.3		
#60	89.9		
#100	71.9		
#140	55.8		
#200	43.0		

* (no specification provided)

Soil Description

SILTY SAND, brown

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2506 D_{85}= 0.2099 D_{60}= 0.1165
D_{50}= 0.0915 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

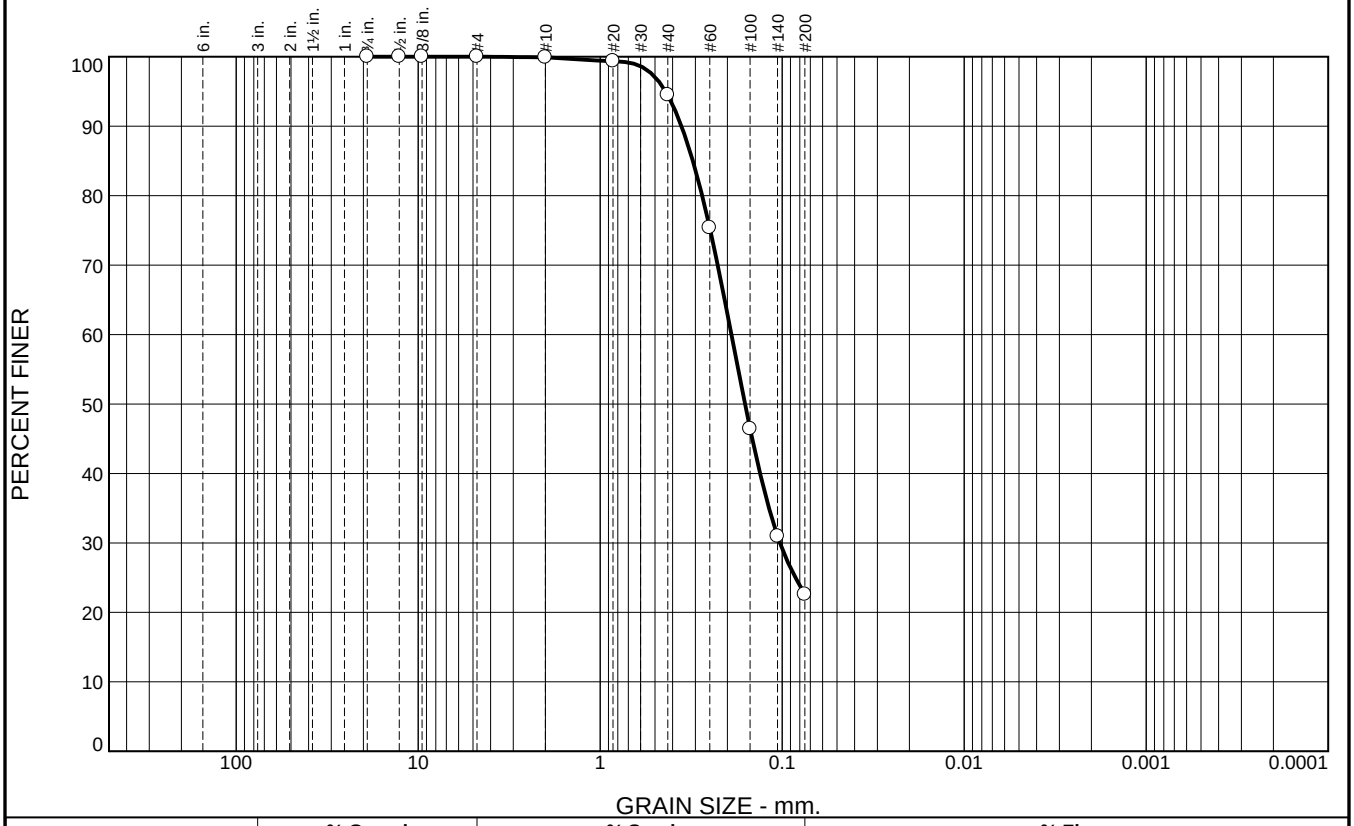
Source of Sample: A-23-006 **Depth:** 15-16.5'
Sample Number: S4 **Date:**

Blackburn Consulting

W. Sacramento, CA

Client: HDR/WRECO
Project: Crow Canyon Road Phase IV Guardrail Replacement Project, Alameda County Public Works Agency
Project No: 4390.X002 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	5.4	71.9	22.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	100.0		
#10	99.9		
#20	99.3		
#40	94.5		
#60	75.4		
#100	46.4		
#140	30.9		
#200	22.6		

* (no specification provided)

Soil Description

SILTY SAND, brown

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3573 D_{85}= 0.3096 D_{60}= 0.1900
D_{50}= 0.1600 D_{30}= 0.1029 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

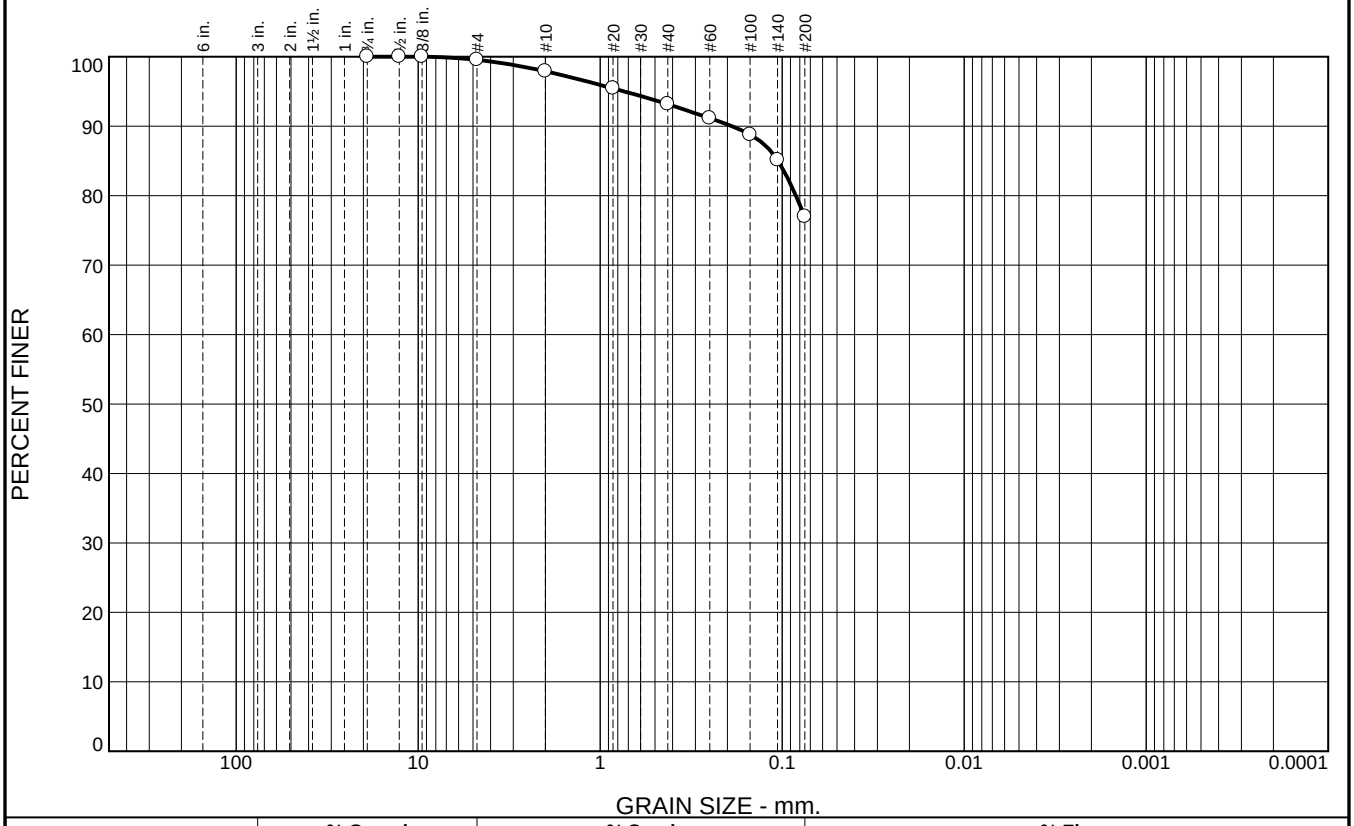
Source of Sample: A-23-006 **Depth:** 20-21.5'
Sample Number: S5 **Date:**

Blackburn Consulting

W. Sacramento, CA

Client: HDR/WRECO
Project: Crow Canyon Road Phase IV Guardrail Replacement Project, Alameda County Public Works Agency
Project No: 4390.X002 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.5	1.6	4.7	16.2	77.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	99.5		
#10	97.9		
#20	95.4		
#40	93.2		
#60	91.1		
#100	88.8		
#140	85.1		
#200	77.0		

* (no specification provided)

Soil Description

Lean CLAY with SAND, very dark grayish brown

Atterberg Limits

PL= 16 LL= 34 PI= 18

Coefficients

D_{90}= 0.1891 D_{85}= 0.1053 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(12)

Remarks

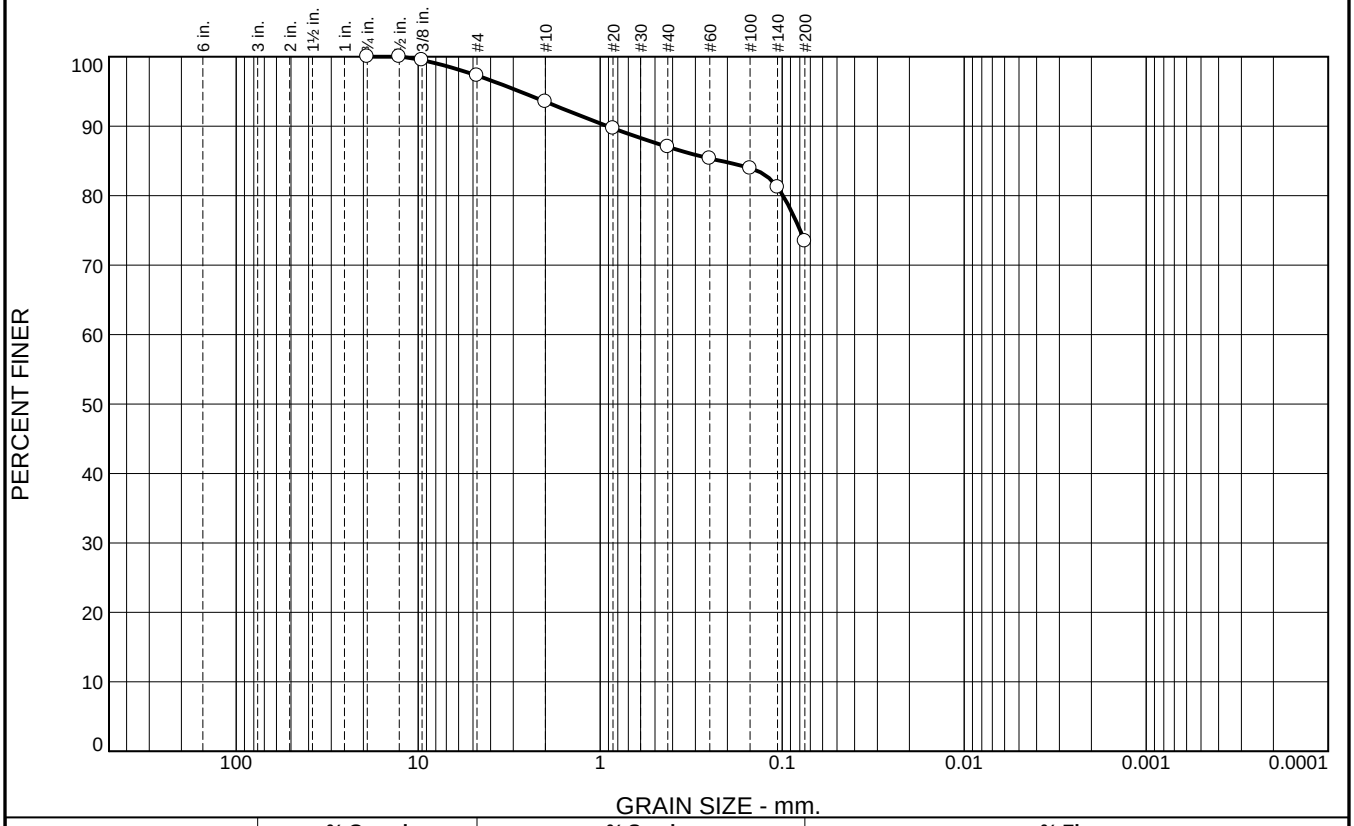
Source of Sample: A-23-007 **Depth:** 5-6.5'
Sample Number: S2 **Date:**

Blackburn Consulting

W. Sacramento, CA

Client: HDR/WRECO
Project: Crow Canyon Road Phase IV Guardrail Replacement Project, Alameda County Public Works Agency
Project No: 4390.X002 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.7	3.8	6.5	13.5	73.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	100.0		
3/8"	99.5		
#4	97.3		
#10	93.5		
#20	89.7		
#40	87.0		
#60	85.3		
#100	83.9		
#140	81.2		
#200	73.5		

* (no specification provided)

Soil Description

Fat CLAY with SAND, very dark gray

Atterberg Limits

PL= 21 LL= 69 PI= 48

Coefficients

D_{90}= 0.9125 D_{85}= 0.2176 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(36)

Remarks

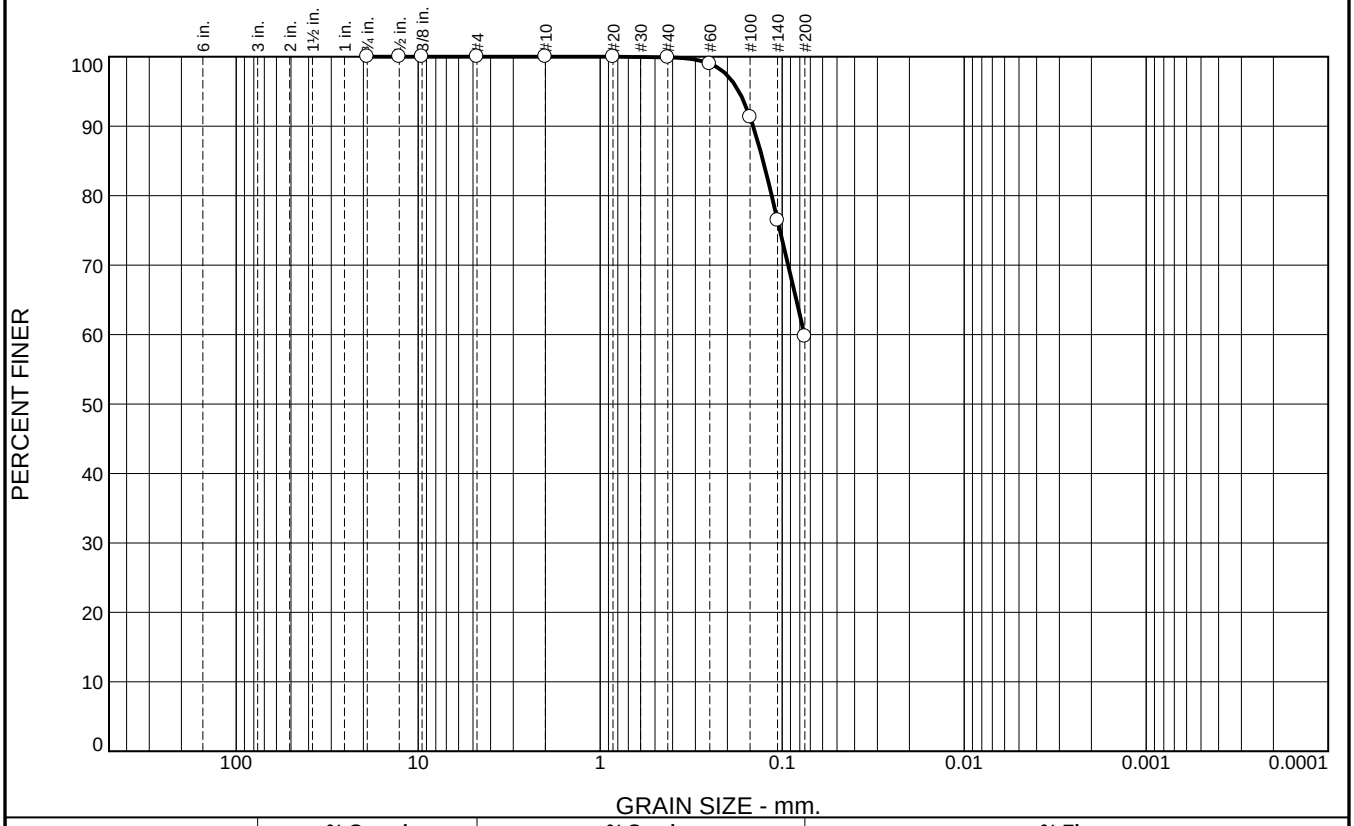
Source of Sample: A-23-007 **Depth:** 10-11.5'
Sample Number: S3 **Date:**

Blackburn Consulting

W. Sacramento, CA

Client: HDR/WRECO
Project: Crow Canyon Road Phase IV Guardrail Replacement Project, Alameda County Public Works Agency
Project No: 4390.X002 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	40.2	59.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.9		
#60	99.0		
#100	91.3		
#140	76.4		
#200	59.7		

* (no specification provided)

Soil Description

SANDY lean CLAY, dark graysih brown

Atterberg Limits

PL= 17 LL= 30 PI= 13

Coefficients

D_{90}= 0.1443 D_{85}= 0.1273 D_{60}= 0.0754
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(5)

Remarks

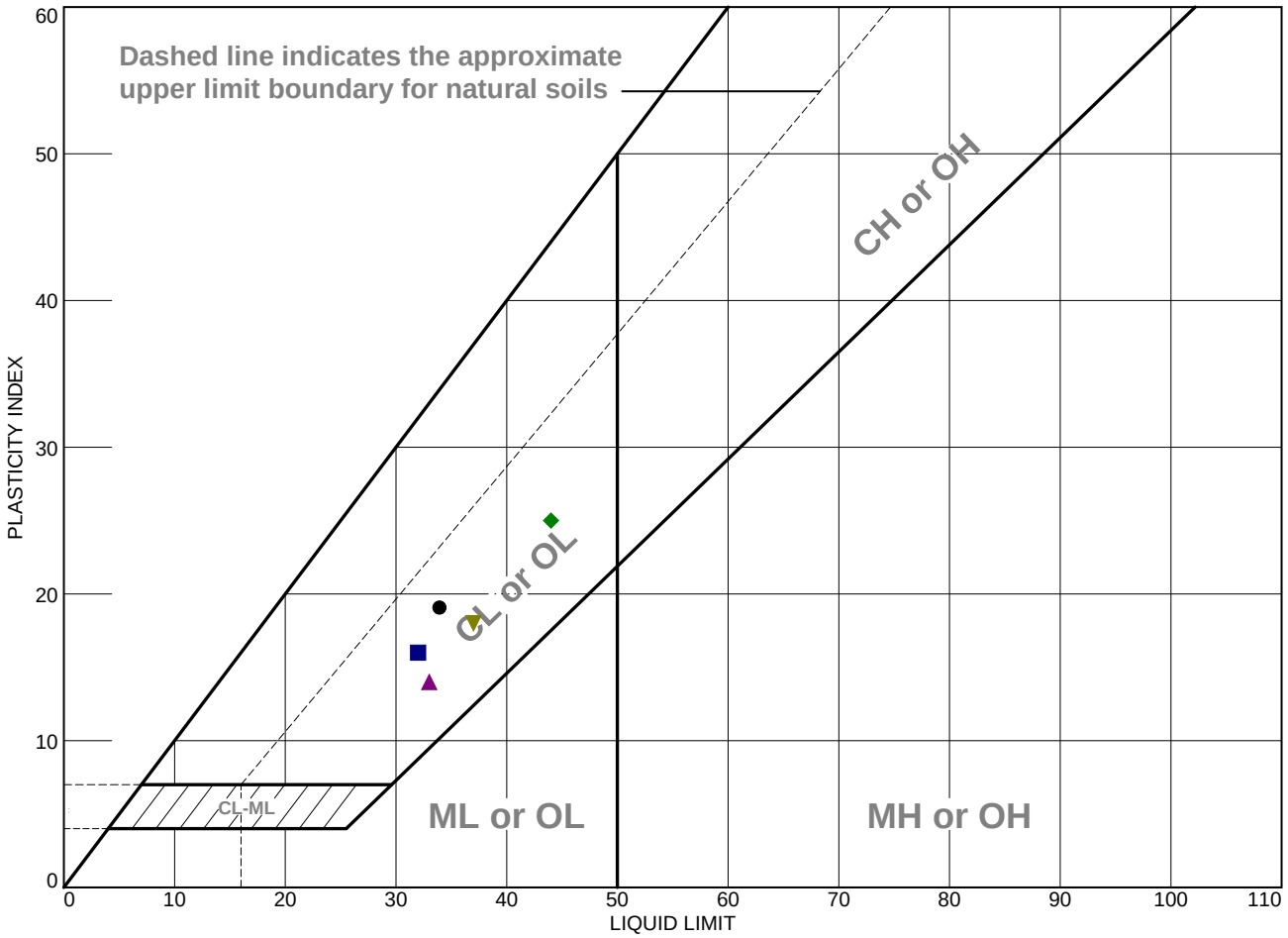
Source of Sample: A-23-008 **Depth:** 10-11.5'
Sample Number: S3 **Date:**

Blackburn Consulting

W. Sacramento, CA

Client: HDR/WRECO
Project: Crow Canyon Road Phase IV Guardrail Replacement Project, Alameda County Public Works Agency
Project No: 4390.X002 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean CLAY with SAND, dark reddish brown	34	15	19	98.1	74.1	CL
■	SANDY lean CLAY, very dark greyish brown	32	16	16	97.1	60.5	CL
▲	CLAYEY SAND with GRAVEL, dark yellowish brown	33	19	14	29.5	19.5	SC
◆	Lean CLAY, dark yellowish brown	44	19	25	96.3	87.7	CL
▼	CLAYEY GRAVEL with SAND, dark grayish brown	37	19	18	25.3	18.7	GC

Project No. 4390.X002 **Client:** HDR/WRECO

Project: Crow Canyon Road Phase IV Guardrail Replacement Project, Alameda County Public Works Agency

● **Source of Sample:** A-23-001 **Depth:** 5-6.5' **Sample Number:** S2

■ **Source of Sample:** A-23-003 **Depth:** 5-6.5' **Sample Number:** S2

▲ **Source of Sample:** A-23-004 **Depth:** 15-16.5' **Sample Number:** S4

◆ **Source of Sample:** A-23-005 **Depth:** 5-6.5' **Sample Number:** S2

▼ **Source of Sample:** A-23-005 **Depth:** 10-11.5' **Sample Number:** S3

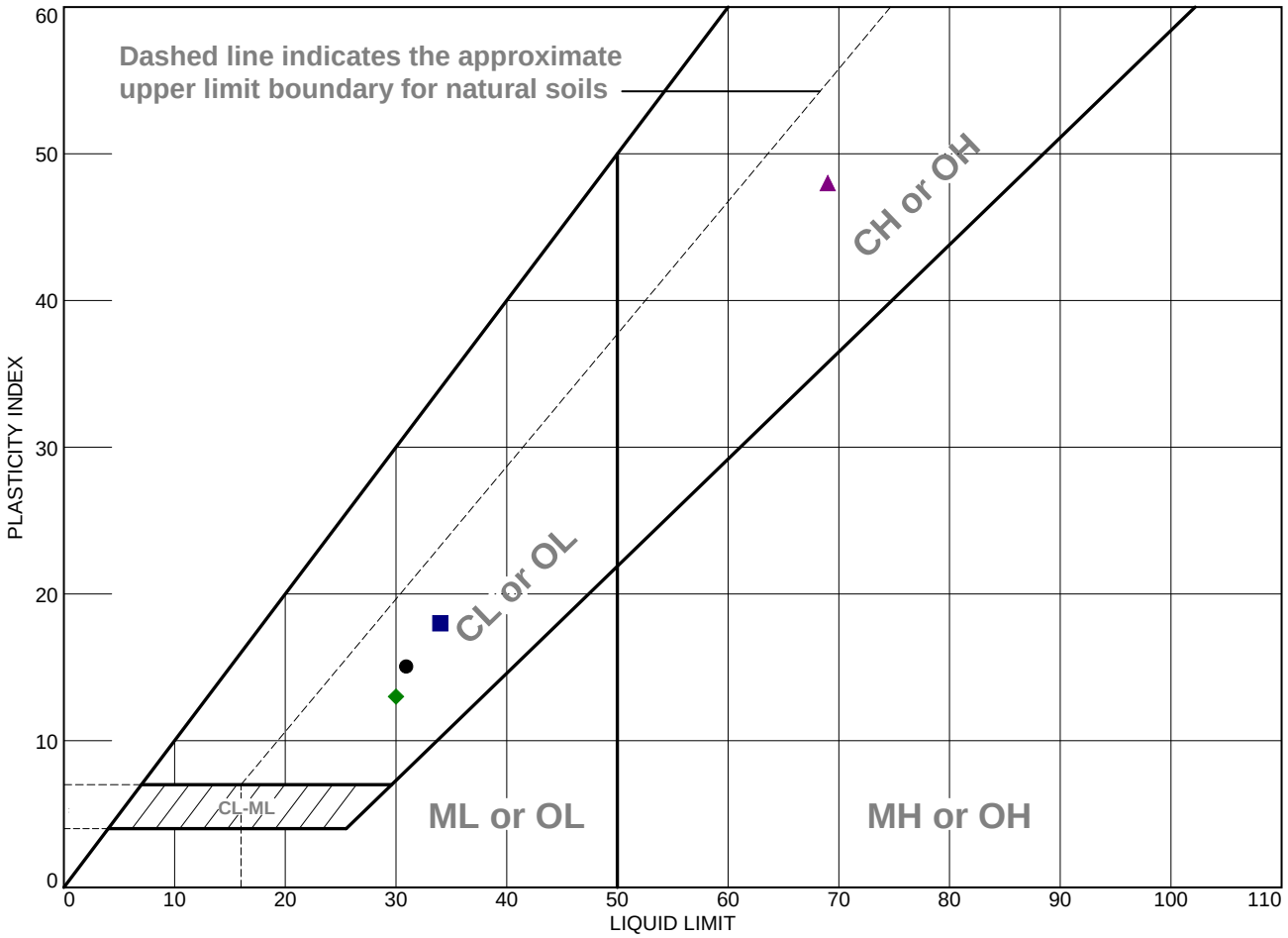
Blackburn Consulting

W. Sacramento, CA

Remarks:

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean CLAY with SAND, very dark greyish brown	31	16	15	98.3	70.6	CL
■	Lean CLAY with SAND, very dark grayish brown	34	16	18	93.2	77.0	CL
▲	Fat CLAY with SAND, very dark gray	69	21	48	87.0	73.5	CH
◆	SANDY lean CLAY, dark graysih brown	30	17	13	99.9	59.7	CL

Project No. 4390.X002 **Client:** HDR/WRECO

Project: Crow Canyon Road Phase IV Guardrail Replacement Project, Alameda County Public Works Agency

● **Source of Sample:** A-23-006 **Depth:** 10-11.5' **Sample Number:** S3

■ **Source of Sample:** A-23-007 **Depth:** 5-6.5' **Sample Number:** S2

▲ **Source of Sample:** A-23-007 **Depth:** 10-11.5' **Sample Number:** S3

◆ **Source of Sample:** A-23-008 **Depth:** 10-11.5' **Sample Number:** S3

Blackburn Consulting

W. Sacramento, CA

Remarks:

Figure