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# W21a

## CD-0001-19

## MAY 24, 2019

## APPENDIX F: May 13, 2019 supplemental information from the Trinidad Rancheria regarding hazards

Trinidad Rancheria Responses to Coastal Commission Staff Report
Regarding Coastal Consistency Determination CD-0001-19

## HAZARDS

### Page 3, Paragraph 3 – Hazards

**The Staff Report indicated**:

"The draft EA for the proposed project states that a portion of the proposed site for the hotel is a landslide area, and a draft geotechnical feasibility and preliminary design report suggests that either the hotel footprint will be modified to avoid the landslide or extensive slope stabilization features will be required to ensure structural integrity and stability of the hotel. However, the details of a selected option to ensure slope stability and structural integrity for the hotel are not provided in the BIA consistency determination and are not described in the draft EA for the proposed project. The staff recommends the Commission find it does not have sufficient information to find the proposed project consistent with Sections 30253(a) and 30253(b) of the Coastal Act. See page 21 for additional information and accompanying analysis that staff is recommending the BIA would need to provide to enable the Commission to find the project consistent with Section 30253(a) and 30253(b)."

### Staff Report – Hazards – Page 20-21

### F. Hazards

Section 30253(a) and (b) of the Coastal Act state:

> Development shall do all of the following:
>
> *a) Minimize risks to life and property in areas of high geologic, flood, and fire hazard.*
> *b) Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that substantially alter natural landforms along bluffs and cliffs.*

The draft EA for the proposed project states that while Humboldt County is located in a seismically active region, the proposed hotel would not be located within or on an active fault and there is little chance of an active fault on the project site. However, the draft EA for the proposed project also states:

> *"The active landslide that currently extends from the southwest corner of the proposed hotel southwest toward Scenic Drive has the potential to affect the foundation for the proposed hotel. However, the active landslide is relatively shallow in nature and may be*

*readily stabilized utilizing measures such as retaining wall systems, slope reconstruction and sub-drainage elements."*

To address the potential effect to the hotel foundation, the draft EA for the proposed project identifies the following mitigation measures:

- Prior to construction of the Hotel foundation, the contractor shall implement one of the slope stabilization options recommended by the soil engineer…options include soil nail walls, reconstructed embankment, soldier pile, and welded wire walls.

A draft geotechnical feasibility and preliminary design report for the proposed hotel (attached as an appendix to the draft EA for the proposed project) also states:

> *Based on preliminary discussions with the design team, we expect the hotel footprint will be modified to avoid the slide feature. Depending on the final hotel layout, some level of slope stabilization should be considered to limit headward encroachment of the slide. Appropriate stabilization work may include such options as a soil nail wall, welded wire wall, or cantilevered soldier pile wall, with wall height likely on the order of 10-15 feet. If the hotel footprint cannot be modified to avoid the slide, then more extensive slope stabilization will be required, such as a drained reconstruction embankment, regraded slope, tie-bank soldier pile wall(s) or a tiered wall system.*

From this information, it appears that the options for addressing the risks posed by the landslide, and also thus assuring the stability and structural integrity of the proposed hotel, have not been completely determined. Given the potential considerations raised in the draft geotechnical feasibility and preliminary design report for the proposed hotel, the selected option involves extensive slope stabilization measures. However, the details of a selected option have not been provided in the BIA consistency determination and are not described in the draft EA for the proposed project.

Therefore, staff recommends that the Commission find there is insufficient information to find the proposed project consistent with Sections 30253(a) and 30253(b) of the Coastal Act. Staff further recommends that the Commission find that in order for it to find the proposed project consistent with Sections 30253(a) and 30253(b), the BIA would need to provide information describing the measures(s) proposed to mitigate the existing landslide hazard, including design details or other proposed measures and their potential location. In addition, if stabilization measures require extensive grading or construction of retaining walls, the BIA would need to provide information sufficient for the Commission to determine consistency of those measures with Section 30251 of the Coastal Act, including its requirement to minimize the alternation of natural land forms.

**Section 30253(a), 30253(b), and 30251**

Development shall do all of the following:

*a) Minimize risks to life and property in areas of high geologic, flood, and fire hazard.*
*b) Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that substantially alter natural landforms along bluffs and cliffs.*

**Trinidad Rancheria Response**

**Section 30253(a) and (b)**

a) The Rancheria will minimize risks to life and property as part of the design of this project.

b) The Rancheria will also assure stability and structural integrity through the design process with the direction and assistance of Crawford and Associates, Geotechnical Engineers. (See Geotechnical Update Letter in attachments).

**Section 30251 Scenic and visual qualities**

The scenic and visual qualities of coastal areas shall be considered and protected as a resource of public importance. Permitted development shall be sited and designed to protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural land forms, to be visually compatible with the character of surrounding areas, and, where feasible, to restore and enhance visual quality in visually degraded areas. New development in highly scenic areas such as those designated in the California Coastline Preservation and Recreation Plan prepared by the Department of Parks and Recreation and by local government shall be subordinate to the character of its setting.

**Trinidad Rancheria Response**

The Rancheria agrees that at the time of the release of the draft EA options for addressing the risks posed by the landslide had not been completely determined. There was a draft Geotechnical report at the time, and the citations in the draft EA were from that report. As noted below, the conclusion of the Preliminary Study indicated that "further geotechnical study by this office will be completed for final design." The Preliminary Geotechnical Feasibility Study was completed in November of 2016. (See Final Geotechnical Feasibility Report in Attachments).

The conclusion of this report indicated:

**"Based on the data presented above, we consider the site is suitable for construction of the proposed hotel and complementary facilities provided that appropriate mitigation of the**

**geologic hazards is incorporated into project design. Below, we provide a discussion of the geologic hazards, mitigation alternatives, and preliminary geotechnical recommendations for the structure foundations, retaining walls, pavement structural sections and site grading. We anticipate that the project will be somewhat modified based on these conclusions. Further geotechnical study by this office will be completed for final design, based on the final structure layout, retaining walls and site grading."[1]**

Additionally, the Principal Engineer of Crawford and Associates, Inc., Rick Sowers, wrote a Geotechnical Update Letter on May 2, 2019, for further clarification and in support of his earlier preliminary design report. Mr. Sowers' letter specifically addresses concerns raised by the Coastal Commission in its February 14, 2019 Staff Report. Below is a summary of the letter's findings.

Slope stabilization:

The updated letter recommends a "Mechanically Stabilized Earth (MSE) wall or welded wire wall retaining system, such as a Hilfiker wall". This recommendation has been reviewed by the project's civil engineer and is included in the current design. See included site plan markup "00 - SITE PLAN - HAZARDS - 11x17.pdf" showing the location of the existing slide. (See Geotechnical Update Letter in attachments).

Site Retaining Walls:

The updated letter recommends "MSE or Hilfiker walls are also considered appropriate here, with design heights to about 20 feet." This recommendation has been reviewed by the project's civil engineer and is included in the current design. (See attached Site Plan Markup "00 - SITE PLAN - HAZARDS - 11x17.pdf" showing the location of the proposed retaining walls).

Hotel Foundations:

The updated letter recommends "Foundation support for the anticipated structure loads can be achieved by cast-in-drilled-hole (CIDH) piles with minimum penetration of 10 feet into the underlying bedrock." This recommendation has been reviewed by the project's Structural Engineer and is included in the current design. (See attached letter from the Project Structural Engineer Kenneth W. Karren, Jr., P.E., S.E. of Lochsa Engineering confirming his agreement with the Geotechnical Recommendations).

## Conclusion

The Rancheria will incorporate the mitigations above as well as any additional recommendations that Crawford and Associates may recommend as part of the final design criteria for geologic hazards as needed for this site. The hotel is a large investment and must be seismically sound.

[1] Final Geotechnical Feasibility Report at pg. 9.

We are working closely with our engineers to take the appropriate measures needed to ensure the stability of the hotel, to ensure the safety of the public, and to determine the best way to protect the natural environment. As design progresses, we are happy to coordinate with the Commission staff and share information and details in this regard.

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services
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May 2, 2019
CAInc File No. 16-319.2

Mr. David Tyson
Trinidad Rancheria Economic Development Corporation
P.O. Box 630
Trinidad, CA 95570

Subject: **GEOTECHNICAL UPDATE LETTER**
Trinidad Rancheria Cher-Ae Heights Hotel
Trinidad, California

Dear Mr. Tyson,

This letter updates our "Geotechnical Feasibility and Preliminary Design Report", dated November 2016, for the subject project. This letter addresses concerns raised by the California Coastal Commission in their Staff Report (file date 2/14/2019), primarily with respect to slope stabilization at the southeast corner of the proposed hotel.

## Project Description

The current project is shown on a Site Plan by TBE Architects (dated 12/6/18) to include a 5-story hotel with the lower floor (and underlying level) supported on a concrete "podium" and the upper floors of wood-frame construction. The building footprint is essentially the same as that described in our 2016 geotechnical report. The southeast corner is near the head of an active slide that extends to Scenic Drive and continues below to the ocean. The active slide involves primarily terrace deposits overlying the bedrock, as discussed in the 2016 report. The Site Plan also shows new parking areas along the southwest side of the hotel with access from near the existing casino entrance at Scenic Drive.

## Slope Stabilization

Stabilization near the head of the slide is required to support and protect the proposed development. We propose a Mechanically Stabilized Earth (MSE) wall or welded wire wall retaining system, such as a Hilfiker wall. These systems have been successfully used in similar environments and are common to the area. Key elements of these walls include:

- Excavate and remove disturbed slide materials within the wall area.
- Establish base of wall into undisturbed terrace soils and/or bedrock.
- Construct the wall using compacted imported backfill material and horizontal reinforcing elements (wire mats, fabric or geo-grid) placed at 1-foot intervals.
- Install sub-drainage behind the wall with gravity relief.
- Control surface runoff to direct water away from the slide area, such as with an AC dike.
- Reconstruct pavement/parking section.

Based on preliminary drawings by TBE, we estimate the wall height at about 15 feet or less. The exterior face can be vegetated or receive other face-treatment to reduce visual impacts. Similar walls along Scenic Drive are almost completely obscured by native vegetation.

## Hotel Foundations

Foundation support for the anticipated structure loads can be achieved by cast-in-drilled-hole (CIDH) piles with minimum penetration of 10 feet into the underlying bedrock. Final pile tips will be provided in the design geotechnical report. CIDH piles have the advantage of requiring smaller equipment for installation than for driven piles and minimize noise/vibrations. Based on the strength data obtained from the field and laboratory tests, we recommend preliminary axial pile capacities be based on factored (allowable) adhesion value in bedrock of 1.5 kips/ft$^2$ and frictional capacity of 0.5 kips/ft$^2$ in the terrace deposits.

## Retaining Walls

Additional retaining walls may be required for new parking areas southwest of the proposed hotel. The parking areas are outside of the slide limits discussed above. MSE or Hilkifer walls are also considered appropriate here, with design heights to about 20 feet. The use of rigid wall systems, such as a reinforced concrete cantilever walls, are not recommended due to height requirements, visual impacts and limited tolerance for movement.

## Site Grading

Depending on the final site grades and civil design geometrics, cut/fill slopes may be considered in lieu of walls (or in combination to reduce wall heights). Fills constructed at exterior slopes of 2:1 (H:V) or flatter and cut slopes of 1½:1 (H:V) or flatter are appropriate. Grading criteria typically include the following:

- Clear the site to remove vegetation, tree roots, debris, abandoned utilities, soft or unstable soils and other deleterious materials.
- Subexcavate fill keys about 2 feet to expose undisturbed, native ground, then scarify the fill foundation and keyway to a depth of 6 inches, moisture-condition and compact to at least 90% relative compaction (per ASTM D1557).
- Provide subdrainage at the base of new fills to control springs and seasonal “perched” groundwater throughout the slopes.
- Compact fill to at least 90% relative compaction (per ASTM D1557).
- Protect exposed slopes from erosion with vegetation or other appropriate control measures.
- Direct surface runoff to suitable discharge points with erosion dissipaters, as necessary.

## Stormwater Infiltration

Stormwater discharge should be directed away from the slide area to a suitable discharge point. Bedrock is exposed at the casino entrance road at Scenic Drive and this area would be suitable for a discharge point.

Please call if you have any questions on this update. Further geotechnical study and a design geotechnical report is anticipated for final design of this project.

Sincerely,
**Crawford & Associates, Inc.**


Rick Sowers, PE, CEG
Principal

T 702-365-9312 | F 702-365-9317
6345 S Jones Blvd, Suite 100
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Lochsa engineering

May 10, 2019

Mr. David Nejelski
Creative Director + Principal
Thalden Boyd Emery Architects
1133 Olivette Executive Parkway
St. Louis, MO 63132

Subject: Cher Ae Heights Casino Hotel
Lochsa Engineering Job No. 192040.00

Dear Mr. Nejelski,

As requested, we have considered the feasibility of supporting a new hotel addition at the existing site following the recommendations of the geotechnical engineer, Crawford & Associates, Inc. The new hotel will consist of two levels of concrete podium having one level below grade with four levels of wood framing above and will be located to the southeast of the existing Casino (see Thalden Boyd Emery Architects Enlarged Site Plan and Building Section 2 dated 12/06/18).

We have been provided a geotechnical report prepared by Crawford & Associates, Inc. dated November 2016 (CAInc File No. 16-319.1) along with an update letter dated May 2, 2019 (CAInc File No. 16-319.2). Crawford has recommended pile foundations anchoring into the bedrock based on the site conditions with cast-in-drilled-hole piles (caissons) as the most appropriate solution. We agree that this is an appropriate foundation system for the new hotel. Preliminary calculations show that the hotel can be supported by 2' diameter or 3' diameter caissons with pile caps. Piles would be embedded 10' minimum into bedrock.

In our opinion, supporting the tower with a pile foundation using concrete caissons is a sound structural approach for this project.

Regards,
**LOCHSA ENGINEERING**

REGISTERED PROFESSIONAL ENGINEER
KENNETH W. KARREN, JR.
No. S4475
Exp. 9/30/19
STRUCTURAL
STATE OF CALIFORNIA

5/10/19

Kenneth W. Karren, Jr., P.E., S.E.
Principal

# GEOTECHNICAL FEASIBILITY AND PRELIMINARY DESIGN REPORT

## TRINIDAD RANCHERIA CHER-AE HEIGHTS HOTEL

**Trinidad, California**

Prepared by:


**Crawford & Associates, Inc.**
4220 Rocklin Road, Suite 1
Rocklin, CA 95677


November 2016

Prepared for:

**Trinidad Rancheria Economic Development Corporation**
P.O. Box 630
Trinidad, CA 95570

Crawford & Associates, Inc.
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November 2016
CAInc File No. 16-319.1

Mr. David Tyson
Trinidad Rancheria Economic Development Corporation
P.O. Box 630
Trinidad, CA 95570

Subject: **GEOTECHNICAL FEASIBILITY AND PRELIMINARY DESIGN REPORT**
**Trinidad Rancheria Cher-Ae Heights Hotel**
Trinidad, California

Dear Mr. Tyson,

Attached is our Geotechnical Feasibility and Preliminary Design Report for the Trinidad Rancheria Cher-Ae Heights Hotel. Crawford & Associates, Inc. (CAInc) completed this report in accordance with our agreement with Trinidad Rancheria Economic Development Corporation (TREDC) dated August 26, 2016.

This report provides geotechnical data, geological hazards assessment, and preliminary geotechnical recommendations for the proposed hotel project.

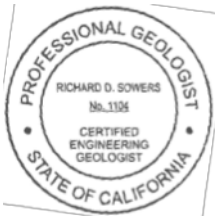
Please call if you have questions or require additional information.

Sincerely,

**Crawford & Associates, Inc.,**

Benjamin D. Crawford, PE, GE
Principal


Rick Sowers, PE, CEG
Principal Engineering Geologist




Taber
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# 1 INTRODUCTION

## 1.1 PURPOSE

Crawford & Associates, Inc. (CAInc) prepared this Geotechnical Feasibility and Preliminary Design Report for the Trinidad Rancheria Cher-Ae Heights Hotel project in Trinidad, California. This report provides our geotechnical data, geologic hazards evaluation, feasibility assessment and preliminary geotechnical recommendations for planning and preliminary design/costing. CAInc will prepare a final Geotechnical Design Report for the project based on further definition of project details, including final structure layouts, building loads, retaining walls, site grading and drainage/subdrainage elements.

## 1.2 SCOPE OF SERVICES

To prepare this report, CAInc:

- Reviewed published geologic, soils, groundwater and seismic maps pertaining to the site;
- Reviewed previous geotechnical studies at the casino and along nearby sections of Scenic Drive;
- Conducted geologic reconnaissance of the site and immediate area;
- Discussed the project elements with the design team;
- Drilled, logged, and sampled 6 exploratory borings to a maximum depth of 81.4 ft below ground surface (bgs);
- Performed laboratory testing on soil samples recovered from the borings;
- Conducted engineering analysis for preliminary foundation design; and
- Developed preliminary geotechnical recommendations based on the data and test results.

# 2 SITE & PROJECT DESCRIPTION

The site is located near the top of a 230±ft high bluff overlooking Trinidad Bay. Scenic Drive traverses the slope between the site and the ocean, approximately 65ft below the top of bluff. The overall slope between the casino and the ocean is about 2:1 (H:V) and is heavily vegetated, including numerous water-loving plants suggestive of shallow groundwater/springs. Scenic Drive is a county-owned road that has experienced numerous slip-outs and slides due to wave attach undercutting the ocean bluff. Several structures are present along the slope below the casino, including a residence about half-way along the slope between the casino and Scenic Drive.

The project includes a proposed 6-story hotel and complementary facilities (e.g. pool, fitness center, mechanical building, offices, etc.) located along the southwest side of the existing casino building. The hotel will be a steel-frame, stand-alone structure. The base level is expected to be near existing grade, which is generally flat within the building footprint. Some retaining walls may be incorporated into the final design to account for sloping ground to the southwest of the building.

Public access to the hotel is expected to be from a porte cochere with entrance from an existing paved roadway along the east side of the casino property; no additional grading is required for this access. Truck/delivery access is expected to be via a new road constructed from near the existing exit road at Scenic Drive with a “hairpin” turn near the existing residence and end near the northwest corner of the casino near the existing kitchen/restaurant. The road grade will be on the order of 7-12% and require

new cut/fills to about 10-15 feet high. New cuts may require retaining walls to about 10 ft high. We understand the existing residence will be acquired by the tribe and removed as part of this project.

We show the tentative layout on Figure 1.

# 3 GEOLOGY

The site is underlain by Pleistocene marine terrace sediments deposited on a wave-cut bench in rock of the Jura-Cretaceous Franciscan Complex. The marine terrace sediments are generally comprised of pebbly sand, silt and clay. The underlying Franciscan Complex is comprised of weathered/sheared shale. We show the site geology on Figure 6.

Rock consistent with the Franciscan Complex is exposed near beach-level and locally in the site vicinity near the intersection of Scenic Drive and the casino exit road. This rock is observed to be variably-weathered shale and greywacke sandstone, with layering dipping typically to the northeast. Some rock is very hard while some is soft (mostly within sheared shale layers). The hard rock is generally resistant to erosion, as evidenced by the "sea stacks" left standing in the bay and along the shore.

We observed marine terrace deposits exposed along the road cuts of Scenic Drive and along the slopes below the casino. These soils are partly-cemented, pebbly sand and silt.

The slopes adjacent west of the site are moderately steep with localized areas of instability. An active slide is located along at the south end of the site and extends from the top of bluff to ocean level 200+ft below. The existing casino is not affected by this feature, although the existing parking area near the mechanical building is at the head of this slide and the outer edge of the pavement has broken and dropped about 6-inches vertically. Scenic Drive crosses this slide and has experienced distress from this movement. This slope contains evidence of shallow groundwater and springs that likely contribute to the slope instability in this area.

The active Trinidad Fault is mapped near the ocean and trending about parallel to the shoreline. The proposed hotel project is located approximately 500 feet northeast of this fault. Further discussion of fault rupture hazard and seismic ground motions are presented in Sections 8 and 9 below.

# 4 PREVIOUS EXPLORATION

## 4.1 CASINO EXPANSION EXPLORATIONS

The original casino building was expanded in 2000 from 21,000±sf to 50,000±sf, including expansions to the north and south. SHN Consulting Engineers & Geologists (SHN) performed three machine-drilled borings and one hand boring for the northern expansion to a maximum depth of 27ft bgs (report dated October 1998). Taber Consultants (Taber) excavated six test pits for the southern expansion, including a retaining wall and water tank, to a maximum depth of 12ft bgs (reports dated January 1999 and May 1999). These studies show that the existing casino, retaining wall and water tank are founded on strip/ring footings established in the weathered shale bedrock. We include pertinent data from the existing casino expansions in Appendix D.

### 4.2 SCENIC DRIVE SLOPE STABILITY EXPLORATIONS

Reviewed nearby geotechnical studies along Scenic Drive include three investigations performed by Taber (at PM 2.45, PM 2.20 and PM 1.25) and one investigation performed by SHN Consulting Engineers & Geologists (at PM 2.05). These studies show that groundwater is a primary initiator of landslides in the area. Terrace deposit and slide debris thicknesses varied from 0 to up to 40ft (generally 10-20ft), which lie on top of the weathered bedrock.

Slope stability measures to support the road have included drained, reconstructed embankments, soldier-pile retaining walls and welded-wire retaining walls.

## 5 CURRENT EXPLORATION

For this project, CAInc retained Geo-Ex Subsurface Exploration (Geo-Ex) to perform six (6) exploratory test borings between September 13, 2016 and September 16, 2016 ranging in depth from 31½ to 81½ ft below ground surface (bgs). Geo-Ex used a truck-mounted CME 75 drill rig equipped with flight augers or rotary wash techniques to perform this work.

During the drilling operations, penetration tests (blow counts) were performed at regular intervals using a Modified California Sampler (2.4" ID) or Standard Penetration Test Sampler (1.4" ID) to evaluate the relative density of coarse-grained (cohesionless) soil and to retain soil samples for laboratory testing. The penetration tests were performed by using a 140-pound automatic trip-hammer falling 30 inches. The recorded blow counts are shown on our boring logs and on the cross sections (Figures 3 and 4). The consistency of fine-grained (cohesive) soil was determined in accordance with ASTM D2488.

Our project engineer, Mr. Nick Anderson, logged the borings and visually classified the soils encountered according to the Unified Soil Classification System (USCS). Soil samples obtained from the borings were packaged and sealed in the field to reduce moisture loss and disturbance and delivered to laboratories for testing.

CAInc made ground water observations during drilling operations. One-inch diameter piezometers were installed in B3 and B5 to monitor future groundwater fluctuations. The remaining borings were backfilled with soil cuttings or neat cement grout. Details of the piezometer construction are shown on Detail 1.

## 6 SURFACE AND SUBSURFACE CONDITIONS

### 6.1 SOIL UNITS

We divide the soils overlying the bedrock into two general units. The uppermost unit is fill comprised of mostly stiff sandy lean clay and medium dense silty gravel. This unit is present across the majority of the hotel site and generally less than about 5 feet in depth.

The fill is underlain by marine terrace deposits within the northern half of the hotel footprint. These deposits are generally orange-tan, medium dense to very dense, silty and clayey sand with variable amounts of gravel and cementation. We encountered these soils to a depth of about 8 feet in B3 (near center of hotel footprint); the thickness then increases rapidly to a depth of 43 feet at B2 (north end of

hotel footprint). The sharp drop in the bedrock surface toward the north likely represents deposition over an eroded, wave-cut bedrock surface.

## 6.2 BEDROCK

We encountered bedrock consistent with the Franciscan Complex as described above in each of the borings below the fill and/or terrace soils. The rock is predominately decomposed to moderately weathered shale with lesser sandstone and mudstone layers. Where decomposed, the rock is mostly angular rock fragments within a sheared clay matrix. The rock unit was drillable to the full depth of our test borings (maximum 81.4 ft, B3) with power auger and rotary wash methods; rock coring was not required for drill penetration. Table 1 summarizes the bedrock depth/elevation and description at the exploration locations completed by this office and those of SHN (1998) and Taber (1998) for the casino expansion work.

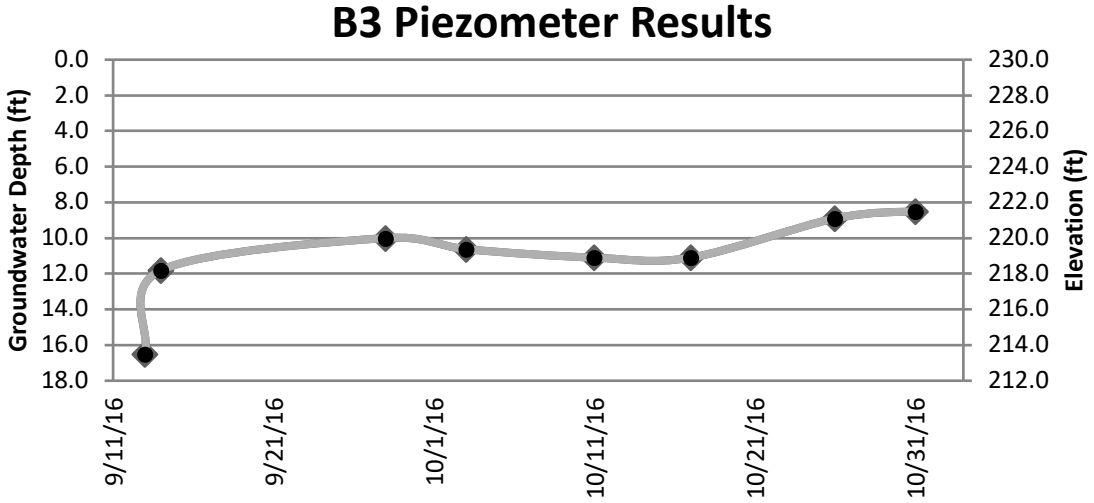
**Table 1: Bedrock Summary**

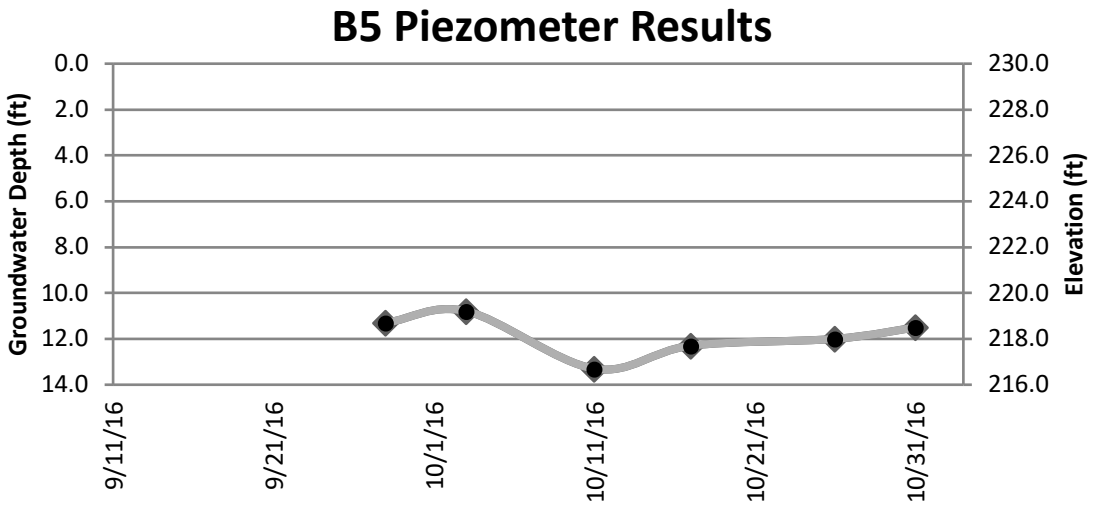
| Exploration | Boring/Test Pit Number | Depth (ft) | Approximate Elevation (ft) | Description |
|---|---|---|---|---|
| SHN (1998) | B1 | 6.0 | 210 | Sandstone/Mudstone, fractured |
| | B2 | Unknown | Unknown | Unknown |
| | B3 | 6.0 | 213 | Sandstone/Mudstone, fracture, highly weathered |
| | HB1 | Unknown | Unknown | Unknown |
| Taber (1998) | TP1 | 6.5 | 227.5 | Shale, completely weathered and fractured |
| | TP2 | 8.5 | 230.0 | Shale, weathered and completely fractured |
| | TP3 | 6.5 | 229.0 | Shale, completely weathered and fractured/sheared |
| | TP4 | 10.0 | 228.0 | Shale, completely weathered and fractured/sheared |
| | TP5 | 4.0 | 227.0 | Shale, completely weathered and fractured/sheared |
| | TP6 | 1.0 | 234.0 | Shale, highly weathered and completely fractured |
| CAInc (2016) | B1 | >31 | <184 | Not encountered |
| | B2 | 43.2 | 181.8 | Shale, soft |
| | B3 | 8.0 | 222.0 | Shale, decomposed to moderately weathered |
| | B4 | 4.0 | 226.0 | Shale, decomposed to moderately weathered |
| | B5 | 3.5 | 226.5 | Shale, intensely to moderately weathered |
| | B6 | 4.0 | 226.0 | Shale, very intensely to moderately weathered |

We present detailed logs of our test borings in Appendix A. Data from the SHN and Taber studies are included in Appendix D.

## 6.3 GROUNDWATER

We encountered free groundwater during drilling in boring B3 at a depth of about 16.5 ft; this level rose to about depth 12 ft within 24 hours after drilling. The remaining borings were dry to full auger depth. Piezometers were installed in B3 and B5 to monitor seasonal groundwater fluctuations. The casino's Facilities Manager, Butch Rindels, is collecting groundwater readings using an electronic water level meter on a weekly basis. Through October, groundwater in both B3 and B5 has been measured at about depth 8-12 ft, as shown below. Groundwater rises significantly shortly after heavy rains.




In general, we interpret groundwater to be seasonally present within the terrace soils near the bedrock contact. The groundwater is likely "perched" over the less-permeable bedrock and daylights onto the subjacent slope as springs/seeps, as evidenced by extensive water-loving plants along the slopes below the casino. Groundwater within the bedrock unit appears to be intermittent and restricted to the decomposed/sheared zones.

## 7 LABORATORY TESTING

CAInc completed the following laboratory tests on representative soil samples obtained from our exploratory borings:

- Moisture Content / Dry Density (ASTM D2216 / D2937)
- Particle Size Analysis (ASTM D422)
- No. 200 Sieve Wash (ASTM D1140)
- Atterberg Limits (ASTM D4318)
- Expansion Index Test (ASTM D4829)
- Unconsolidated-Undrained Triaxial Shear Strength Test (ASTM D2850)
- Unconfined Compressive Strength (ASTM D2166)
- Direct Shear Strength (ASTM D3080)
- R-value (CTM 301)
- Sulfate/Chloride Content (CTM 417/422)
- pH/Minimum Resistivity (CTM 643)

We present the complete laboratory test results in Appendix B.

## 7.1 CLASSIFICATION AND STRENGTH TESTS

Table 2 summarizes the results of classification and strength tests on representative samples from the terrace soils and weathered bedrock.

**Table 2: Classification and Strength Tests**

| Sub-surface Unit | Sample | | Classification Tests | | | | | Strength Tests | |
|---|---|---|---|---|---|---|---|---|---|
| | Boring - Sample Number | Depth (ft) | Moisture Content (%) | Dry Density (pcf) | % Passing 200 | Liquid Limit | Plastic Limit | Cohesion (psf) | Friction Angle (°) |
| Terrace Deposits | B1-1 | 6.0 | 18.3 | 105.3 | 24 | NP | NP | - | - |
| | B1-2 | 11.0 | 9.2 | 123.4 | 16 | - | - | - | - |
| | B1-3 | 16.0 | 12.7 | 103.1 | 15 | - | - | - | - |
| | B1-4 | 21.0 | 13.4 | 94.5 | - | - | - | 85 | 34.4 |
| | B1-5 | 25.0 | - | - | 22 | - | - | - | - |
| | B1-6 | 31.0 | 6.3 | 124.3 | - | - | - | - | - |
| | B2-2 | 8.0 | 6.9 | 114.9 | - | - | - | - | - |
| | B2-3 | 13.0 | 14.6 | 113.0 | 18 | - | - | - | - |
| | B2-4 | 18.0 | 13.0 | 116.3 | 22 | - | - | - | - |
| | B2-5 | 23.0 | 8.5 | 109.9 | 15 | - | - | - | - |
| | B2-6 | 28.0 | 13.7 | 95.0 | - | - | - | 50 | 34.3 |
| | B2-7 | 33.0 | - | - | 23 | - | - | - | - |
| | B3-1 | 5.3 | 15.5 | 100.9 | - | - | - | - | - |
| Bedrock | B3-2 | 11.0 | 8.5 | 133.0 | - | - | - | 3,051 | - |
| | B3-3 | 16.0 | 4.9 | 138.2 | - | - | - | 2,387 | - |
| | B3-4 | 21.0 | - | - | - | 27 | 14 | - | - |
| | B3-6 | 31.0 | 8.1 | 127.7 | - | - | - | - | - |
| | B3-10 | 51.0 | 7.0 | 142.3 | - | - | - | - | - |
| | B4-1 | 6.0 | 8.8 | 129.6 | - | - | - | 1,272 | - |
| | B4-2 | 11.0 | 8.5 | 137.1 | - | - | - | - | - |
| | B4-4 | 21.0 | - | - | - | 33 | 17 | - | - |
| | B4-7 | 36.0 | 6.2 | 143.0 | - | - | - | 1,400 | 21.8 |
| | B5-1 | 6.0 | 4.1 | 137.3 | - | - | - | - | - |
| | B5-3 | 16.0 | - | - | - | 24 | 13 | - | - |
| | B5-4 | 21.0 | 5.8 | 148.7 | - | - | - | - | - |
| | B5-7 | 36.0 | - | - | - | 29 | 14 | - | - |
| | B5-8 | 41.0 | 6.2 | 141.0 | - | - | - | 1,225 | 27.5 |
| | B6-2 | 11.0 | 6.6 | 123.6 | - | - | - | 3,783 | - |

Based on these results, we assign an average angle of internal friction value of 32 degrees to the terrace soils and modeled the weak bedrock with an undrained shear strength of 3,750 psf (represented as a very stiff to hard clay). The rock specimens tested were of the sheared matrix material that is weak relative to the rock mass as a whole; overall, we consider the rock unit to be classed as "soft" and "highly weathered", with typical allowable bearing pressures on the order of 4-8 tsf (8,000-16,000 psf).

## 7.2 CORROSION TESTS

Table 3 summarizes the results of soil corrosivity tests on samples from various levels within the bedrock unit.

**Table 3: Soil Corrosion Test Summary**

| Boring - Sample Number | Depth (ft) | pH | Minimum Resistivity (ohm-cm) | Chloride Content (ppm) | Sulfate Content (ppm) |
|---|---|---|---|---|---|
| B3-7 | 36.0 | 8.57 | 1,070 | 12.1 | 225.9 |
| B4-4 | 21.0 | 8.18 | 1,150 | 12.0 | 175.2 |
| B4-8 | 40.0 | 8.54 | 1,850 | 3.7 | 19.4 |
| B5-9 | 46.0 | 8.55 | 800 | 12.9 | 131.8 |
| B6-1 | 6.0 | 7.72 | 1,720 | 6.9 | 100.4 |

According to Caltrans Corrosion Guidelines, a site is considered corrosive to foundation elements if one or more of the following conditions exist: Chloride concentration is greater than or equal to 500 ppm, sulfate concentration is greater than or equal to 2000 ppm, minimal resistivity of 1000 ohm-cm or less, or the pH is 5.5 or less.

Based on Caltrans guidelines, the site soils are non-corrosive to cementitious materials but may be corrosive to ferrous material. We recommend consulting a corrosion engineer to develop possible corrosion mitigation measures, as needed.

## 7.3 EXPANSION INDEX TESTS

Results of Expansion Index (EI) tests conducted on both the terrace soils and the bedrock show EI = 3 and 54, respectively. Table 4 summarizes these results and those previously performed for the casino expansion in 2000 by Taber Consultants.

**Table 4: Expansion Index Test Summary**

| Exploration | Boring - Sample Number | Description | EI | Expansion Potential |
|---|---|---|---|---|
| Crawford (2016) | Bulk 1 | Terrace Deposits | 3 | Very Low |
| | Bulk 2 | Bedrock | 54 | Medium |
| Taber (1998) | TP1@4' | Terrace Deposits | 14 | Very Low |
| | TP3@8' | Bedrock | 30 | Low |

These results indicate that some portions of the bedrock (likely the decomposed, clay-rich matrix) may be at least moderately expansive and require consideration in design of some project elements (e.g., slab-on-grade floors, flatwork, etc).

## 8 SEISMIC DESIGN PARAMETERS

The USGS Interactive Deaggregation Page[1] indicates a maximum peak horizontal ground acceleration (PGA) of 0.52g for a seismic event with a 10% probability of exceedance in 50 years.

Based on our exploratory borings and the previous site investigations, we provide the California Building Code (CBC) seismic parameters as shown in Table 5. We determined these values using a site latitude of 41.0530°N and longitude of 124.1293°W.

**Table 5: Seismic Parameters**

| Site Class | C |
|---|---|
| **Risk Category** | **I/II/III/IV** |
| Ss – Acceleration Parameter | 2.440 g |
| S1 – Acceleration Parameter | 1.001 g |
| Fa – Site Coefficient | 1.000 |
| Fv – Site Coefficient | 1.300 |
| SMS – Adjusted MCE* Spectral Response Acceleration Parameter | 2.440 g |
| SM1 – Adjusted MCE* Spectral Response Acceleration Parameter | 1.301 g |
| SDS – Design Spectral Acceleration Parameter | 1.627 g |
| SD1 – Design Spectral Acceleration Parameter | 0.868 g |
| Tl – Long-Period Transition Period** | 12 |

* Maximum Considered Earthquake
** Figure 22-12, ASCE 7-10

## 9 PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

Based on the data presented above, we consider the site is suitable for construction of the proposed hotel and complementary facilities provided that appropriate mitigation of the geologic hazards is incorporated into project design. Below, we provide a discussion of the geologic hazards, mitigation alternatives, and preliminary geotechnical recommendations for the structure foundations, retaining walls, pavement structural sections and site grading.

We anticipate that the project will be somewhat modified based on these conclusions. Further geotechnical study by this office will be completed for final design, based on the final structure layout, retaining walls and site grading.

[1] http://geohazards.usgs.gov/deaggint/2008/ accessed June 8, 2016

## 9.1 GEOLOGIC HAZARDS

### 9.1.1 FAULT RUPTURE

The active Trinidad Fault is mapped near the shoreline approximately 500±ft to the southwest of the proposed hotel. The California Geologic Survey (CGS) considers a fault to be active if it has shown evidence of ground displacement during the Holocene period, defined as about the last 11,000 years. The hotel lies at the eastern edge of an Alquist–Priolo Earthquake Fault Zone (EFZ) as defined by CGS.


The Earthquake Fault Zone Act requires structures for human occupancy to be set-back a minimum of 50 ft from an active fault. EFZ boundaries are commonly set at 500 feet from major active faults to accommodate imprecise fault locations and possible branches of active faults. The basis for establishing the Trinidad EFZ is a Fault Evaluation Report (FER-138, California Division of Mines and Geology, 1982); this report concludes that the fault scarp can be traced with confidence north of the site but is less distinct along the coast to the south. The relatively wide zone in this area reflects the imprecise location of the Trinidad Fault and potential for other branches of this fault to exist.

Except for the northwest corner, the proposed hotel footprint is positioned outside of the mapped EFZ. While we cannot say conclusively that an active fault is not present within this footprint, we consider the likelihood of an active fault through the site to be low and that the risk of fault rupture does not represent a “fatal flaw” to the project. Further investigation would be necessary to confirm this assessment, if required.

### 9.1.2 LANDSLIDES

Landslides are common along the slopes below the site, particularly at and below Scenic Drive. These slides are typically initiated at the beach level by wave erosion that undercuts the toe of slope preferentially within the “weak rock” areas of the shale bedrock. This erosion leads to block failures within the bedrock that translate upslope as individual translational/rotational slides. Several of these slides have affected Scenic Drive in this vicinity and have been the subject of past site investigations;

roadway slope stabilization measures taken by Humboldt County have included retaining walls systems, slope reconstruction and subdrainage elements.

An active slide extends upslope of Scenic Drive to near the southwest corner of the proposed hotel. This slide appears to be relatively shallow (perhaps on the order of 10-15 feet deep). The head of the slide is near the edge of the existing casino parking area. We show the approximate limits of this slide on Figure 1.

The active slide appears to involve primarily the terrace deposits overlying the bedrock. Groundwater is a major contributor to slope instability and appears to move within and through the terrace materials, "daylighting" out-of-slope where the rock is exposed. Areas of surface seepage, springs and water-loving vegetation are evidence of seasonal, shallow groundwater within the slope.

Based on preliminary discussions with the design team, we expect the hotel footprint will be modified to avoid the slide feature. Depending on the final hotel layout, some level of slope stabilization should be considered to limit headward encroachment of the slide. Appropriate stabilization work may include such options as a soil nail wall, welded wire wall or cantilevered soldier pile wall, with wall height likely on the order of 10-15 feet. If the hotel footprint cannot be modified to avoid the slide, then more extensive slope stabilization will be required, such as a drained, reconstructed embankment, regraded slope, tie-back soldier pile wall(s) or a tiered wall system. Table 6, below, summarizes a few of these options. Figure 5 shows some conceptual design elements.

**Table 6: Slope Stabilization Options**

| Stabilization Technique/System | Advantages | Disadvantages |
|---|---|---|
| Soil Nail Wall | • Minor grading required to install "nails" (comprised of steel bars placed in pre-drilled holes, grouted in place)<br>• "Top-down" construction minimizes ground disturbance<br>• Cost-effective | • Requires drain elements against the excavation face and permanent facing connected to the nail heads |
| Drained, Reconstructed Embankment | • Provides secure slope stabilization if slope geometry and slide depth is confirmed<br>• Utilizes on-site soils for reconstruction | • Requires significant grading and subdrainage<br>• Requires keyway at toe into intact material<br>• Likely requires work beyond property limits |
| Lightweight Fill Slope | • Unloads the slope and creates usable fill<br>• Free draining material<br>• Possibly qualifies for state grant funds | • Requires significant grading and off-haul of native soils<br>• Costly (without the use of State grant)<br>• Limited contractors have experience |
| Soldier Pile and Lagging Wall | • Stabilizes the upper portion of the slope<br>• May provide additional usable area | • Requires moderate grading<br>• Requires tie-backs for systems typically greater than 8-10 ft high |
| Tensar Geopier SRT System | • Suitable for shallow unstable soil<br>• Low impact<br>• Cost-effective | • Proprietary design<br>• Loud installation<br>• Slide plane may be too deep (>15ft limit) |
| Welded Wire (e.g., Hilfiker) Wall | • Flexible and cost-effective<br>• Local product (based in Eureka, CA)<br>• Commonly used in the area | • Requires secure support at toe of wall<br>• Requires backslope excavation into the slope |

### 9.1.3 LIQUEFACTION POTENTIAL

Liquefaction can occur when saturated, loose to medium dense, granular soils (generally within 50 ft of the surface), or specifically defined cohesive soils, are subjected to ground shaking. Based on the soil, rock, and groundwater conditions encountered during our exploration and current industry accepted liquefaction evaluation methods, liquefaction is not generally expected to occur, unless sustained high groundwater levels are identified within the granular terrace soils. Liquefaction potential is considered low within the underlying bedrock.

### 9.1.4 TSUNAMI

The coastal area is mapped within a tsunami inundation hazard to an elevation of less than 50ft as shown on Figure 7. The casino site is at an elevation approximately 230 feet above the ocean level and is therefore outside of the hazard mapping.

## 9.2 PRELIMINARY RECOMMENDATIONS

### 9.2.1 HOTEL SUPPORT

The site is considered stable for hotel foundations established within undisturbed terrace deposits and/or bedrock. Due to the potential for landsliding along the subjacent slope and the variable materials across the longitudinal footprint (involving both weak bedrock and terrace soils), we do not recommend spread footings or other shallow foundation systems for the hotel structure. Pile foundations, achieving penetration into the bedrock unit, are therefore recommended. Driven piles (e.g., pre-cast concrete, cast-in-steel-shell (CISS), pipe piles, and H-piles) may be feasible, however, are not considered as appropriate as drilled piles due to vibrations/noise from the pile-driving equipment and variable driving conditions into the rock unit.

We consider cast-in-drilled-hole (CIDH) piles to be most appropriate; these piles require smaller equipment for installation than for driven piles and minimize noise/vibrations. The potential for groundwater and caving soils will require casing and minimum 24-inch diameter piles. For use in preliminary design, we recommend using skin friction only due to the "wet" method installation. Based on the strength data obtained from the field and laboratory tests, we recommend preliminary axial pile capacities be based on factored (allowable) adhesion value in bedrock of 1.5 kips/ft$^2$ and frictional capacity of 0.5 kips/ft$^2$ in the terrace deposits. Piles should be embedded a minimum of 10ft into bedrock. See Figure 4 for our interpreted bedrock profile along the longitudinal axis of the hotel.

We performed preliminary lateral pile analysis for both 24-inch and 36-inch diameter CIDH piles with 1% steel and a fixed-head condition (as requested by Steve Vasquez, PE) for ½-inch of deflection at the top of the pile. We performed two models – one model assuming terrace deposits and one model assuming bedrock to the surface. We summarize these results in Table 7. We will perform additional analysis to develop axial and lateral pile capacities for final design.

**Table 7: Lateral Pile Analysis (Shear Resistance, ½-in deflection)**

| Soil/Rock Deposit | 24-inch CIDH | 36-inch CIDH |
|---|---|---|
| Terrace Deposits | 75 kips | 150 kips |
| Bedrock | 127 kips | 235 kips |

We include deflection vs depth, bending moment vs depth, and shear resistance vs depth graphs in Appendix C.

### 9.2.2 COMPLEMENTARY FACILITIES SUPPORT

Soil support for the complementary facilities (e.g. fitness center, mechanical building, offices, etc.) are available by means of shallow spread or isolated footings bearing in compacted fill, undisturbed terrace deposits, or bedrock at least 2ft below nearest adjacent grade and at least 2ft wide. Allowable bearing pressure on the order of 2,000 psf in compacted fill or terrace deposits and 4,000 psf in bedrock is available for support. Maintain a minimum 5ft horizontal clearance from the top of slope.

Support for the pool (currently shown at the south end of the hotel, near the slide) may require drilled piers into bedrock depending on final layouts. Use similar adhesion values as for the hotel support. The pool should be set back a minimum of 10ft from the top of slope and the slope adequately stabilized to prevent headward encroachment of the slide.

### 9.2.3 RETAINING WALL SUPPORT & LATERAL PRESSURES

Depending on final structure layouts, retaining walls up to 10ft in height (e.g., concrete cantilever walls or similar) may be required for this project. On level ground, adequate soil support for the retaining wall foundations are available by means of shallow spread footings bearing in newly compacted fill, undisturbed terrace deposits, or bedrock at least 2ft below nearest adjacent grade and 2ft wide. Allowable bearing pressure on the order of 2,000 psf in compacted fill or terrace deposits and 4,000 psf in bedrock is available for support.

On sloped ground, soil support may be available on spread footings with reduced bearing pressure. However, drilled piers into bedrock may be recommended depending on the location and proximity to slide features.

Retaining walls should be drained with a minimum of 1ft thick permeable rock with filter fabric backing, or an appropriate geocomposite drain (e.g., Mirafi G-series or equivalent).

For preliminary design, use the equivalent fluid weights (EFWs) shown in Table 8 below to design assuming level backfill conditions. These values are based on a soil friction of 32 degrees and assume the use of native granular terrace soils or granular import for backfill. These use of native soils will be verified as part of the final design study.

**Table 8: Equivalent Fluid Weights**

| Condition | Static EFW (pcf) | Seismic EFW (pcf) |
|---|---|---|
| Active | 39 | 45 |
| Passive | 203 | 152 |

For static design, apply the resultant of the static at-rest earth pressure at a depth of 0.33H from the base of the wall where H equals the wall height.

For seismic design, apply the additional resultant force of the seismic at-rest earth pressure at a depth of 0.66H from the base of the wall where H equals the wall height.

### 9.2.4 PAVEMENT

We completed one R-Value test (CTM 301) on a bulk sample of near surface (granular fill) soil. Test results indicate an R-value of 74 by stabilometer. Using a maximum Caltrans allowable R-Value of 50 and Chapter 600 of the Caltrans Highway Design Manual (CHDM), 6th Edition, and assuming similar native (granular) soils at pavement subgrade, we recommend the sections shown in Table 9 below for design of entrance and parking lot pavement.

**Table 9: Pavement Design**

| Traffic Index (TI) | 5.0 | 6.0 | 7.0 | 8.0 | 9.0 |
|---|---|---|---|---|---|
| Hot Mix Asphalt (feet) | 0.20 | 0.25 | 0.30 | 0.40 | 0.45 |
| Class 2 Aggregate Base (feet) | 0.30 | 0.35 | 0.45 | 0.45 | 0.55 |

*The upper 0.2 feet of HMA may be replaced with rubberized hot mix asphalt.

If select import fill is used for pavement subgrade, we recommend the R-value of import fill to be greater than 50.

## 9.3 GRADING

For preliminary design of the truck/delivery access road, use fill slopes of 2:1 (H:V) or flatter and cut slopes of 1½:1 or flatter. Fill slopes constructed at 1½:1 may be acceptable depending on the quality of the embankment fill.

General grading recommendations typically include clearing the site to remove vegetation, tree roots, debris, abandoned utilities, soft or unstable areas, and other deleterious materials. For this site, we estimate an average sub-excavation average of about 2 feet to expose undisturbed, native ground. This exposed surface should then be scarified to a minimum depth of 6 inches, moisture-conditioned, and compacted to at least 90% relative compaction per ASTM D1557. Local swale and/or spring areas may create wet ground conditions that would require drainage and/or drying of soil to achieve the required compaction.

Due to the presence of springs and possible “perched” groundwater throughout the slopes, we recommend subdrainage at the base of new fills. Depending on the final alignment and fill prism, a trenched underdrain or blanket drains may be suitable along the upslope side of the fill sections. Final subdrain details will depend on the selected alignment and fill dimensions and be addressed in the geotechnical design report.

Site soils are erodible (especially the granular terrace soils) and surface drainage will require control by directing runoff to suitable discharge points with erosion dissipaters, as necessary.

# 10 LIMITATIONS

CAInc performed these services in accordance with generally accepted geotechnical engineering principles and practices currently used in this area. This report is intended to provide assistance to the design team for project feasibility, planning and preliminary design/costing. CAInc will complete a Geotechnical Report for final design based on specific structure layout, grades, loading conditions and other details. Do not use this report for different locations and/or projects without the written consent of CAInc. Where referenced, we used ASTM or Caltrans standards as a general (not strict) guideline only.

CAInc based this report on the current site conditions. We assumed the soil/rock and groundwater conditions are representative of the subsurface conditions on the site. Actual conditions between explorations will vary.

Our scope did not include evaluation of on-site hazardous materials.

Logs of our explorations are presented in Appendix A. The lines designating the interface between soil types are approximate. The transition between soil types may be abrupt or gradual. Our recommendations are based on the final logs, which represent our interpretation of the field logs and general knowledge of the site and geological conditions.

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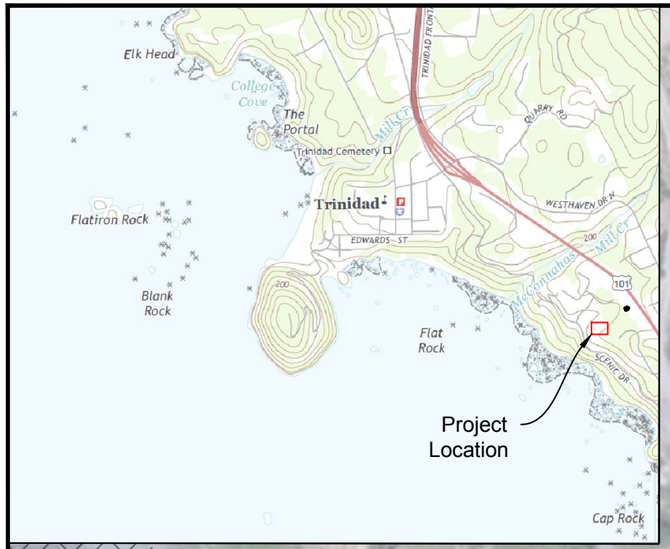
## FIGURES




(OFF SCREEN) SHN-B1 and SHN-HB1

SHN-B2

(OFF SCREEN) TAB-TP5

Sandstone/shale exposed

(E) CASINO

TAB-TP4

TAB-TP6

(OFF SCREEN) Taber PM 2.45 Slide Investigation

SHN-B3

CAI-B1

(E) CONCRETE RETAINING WALL

(P) ACCESS/DELIVERY ROAD

B

B'

TAB-TP3

CAI-B2

(E) WATER TANK

TAB-TP1

CAI-B3

TAB-TP2

CAI-B6

CAI-B4

A

A'

CAI-B5

(E) RESIDENCE

Marine terrace deposits exposed locally along the bluff slope and road cuts

Sandstone/shale exposed along base of bluff

Taber PM 2.20 Slide Investigation

(E) SCENIC DRIVE

PACIFIC OCEAN

(OFF SCREEN) SHN PM 2.05 Slide Investigation and Taber PM 1..25 Slide Investigation

North

## LEGEND

- CAI-B1 — CAInc Boring Locations (2016)
- TAB-TP1 — Taber Test Pit Locations (1998)
- SHN-B1 — SHN Boring Locations (1998)
- Active Landslide

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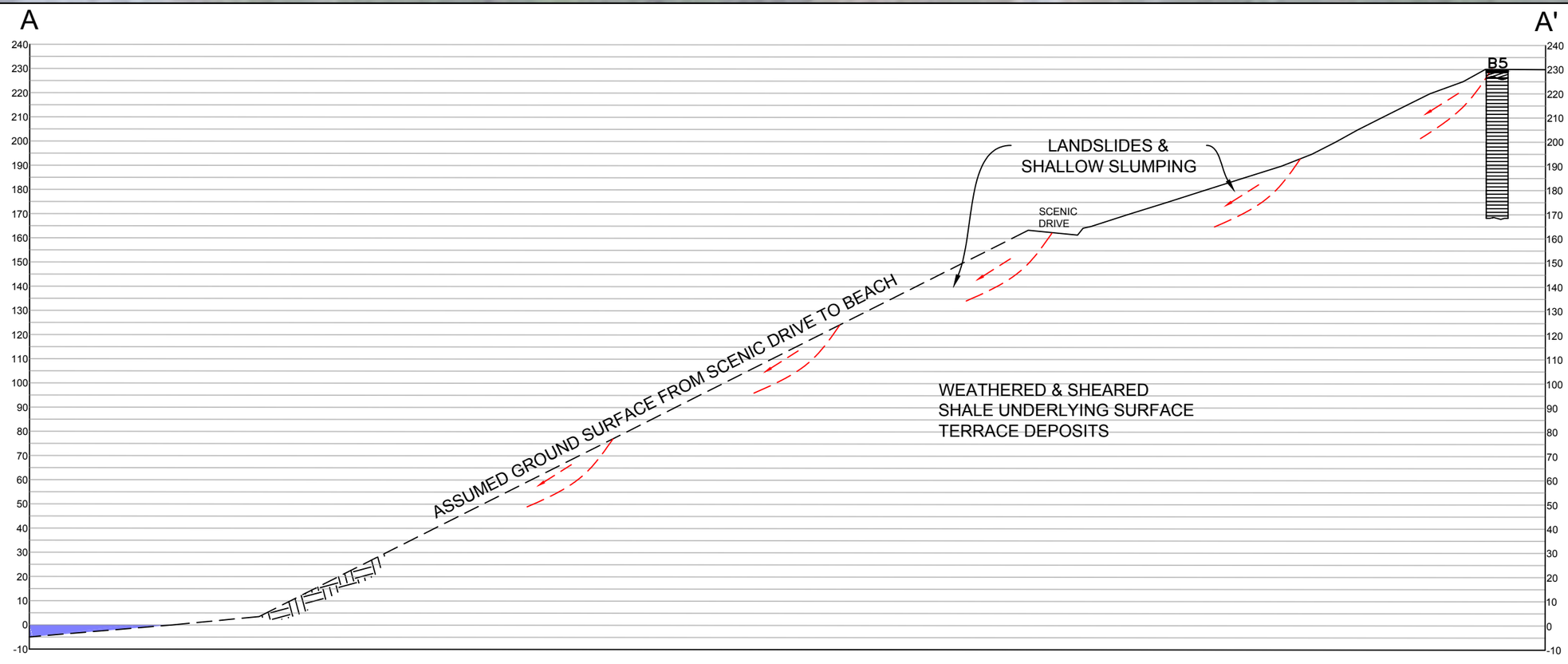
| | | |
|---|---|---|
| Project Mgr. | AJK | 11/1/16 |
| Project Eng. | NRA | 11/1/16 |
| Designer | | |
| Checked By | | |
| Drawn By | NRA | 11/1/16 |
| | | |
| | | |
| | By | Date |

Trinidad Rancheria
Cher-Ae Heights Hotel
27 Scenic Drive
Trinidad, California 95570

Figure 1
Exploration Location Map

| | |
|---|---|
| Project No. | 16-319.1 |
| Scale | 1"=100' |
| Date | 11/1/16 |


See Appendix A for detailed boring logs

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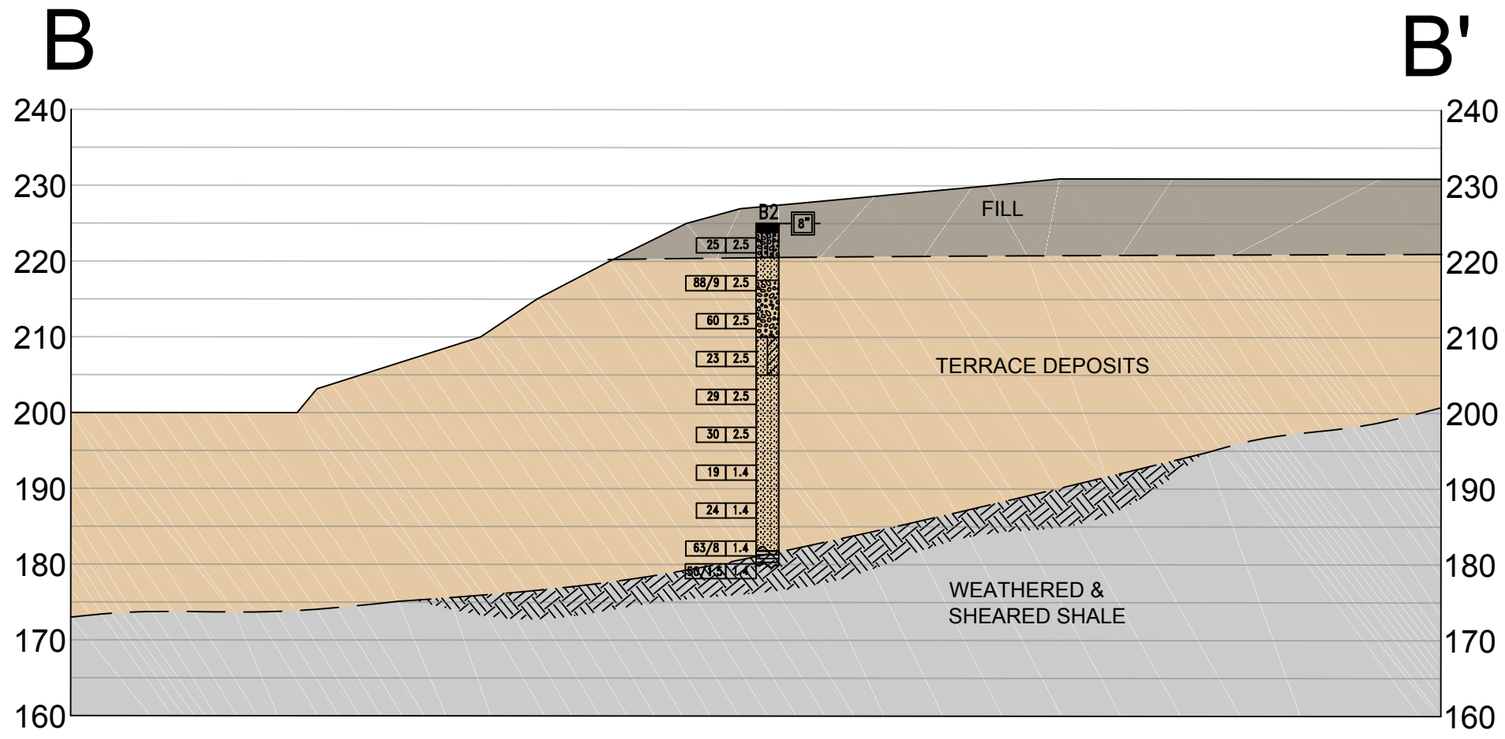
| | | |
|---|---|---|
| Project Mgr. | AJK | 11/1/16 |
| Project Eng. | NRA | 11/1/16 |
| Designer | | |
| Checked By | | |
| Drawn By | NRA | 11/1/16 |
| | | |
| | | |
| | By | Date |

Trinidad Rancheria
Cher-Ae Heights Hotel
27 Scenic Drive
Trinidad, California 95570

Figure 2
Cross Section AA'

| | |
|---|---|
| Project No. | 16-319.1 |
| Scale | 1"=50' |
| Date | 11/1/16 |


See Appendix A for detailed boring logs

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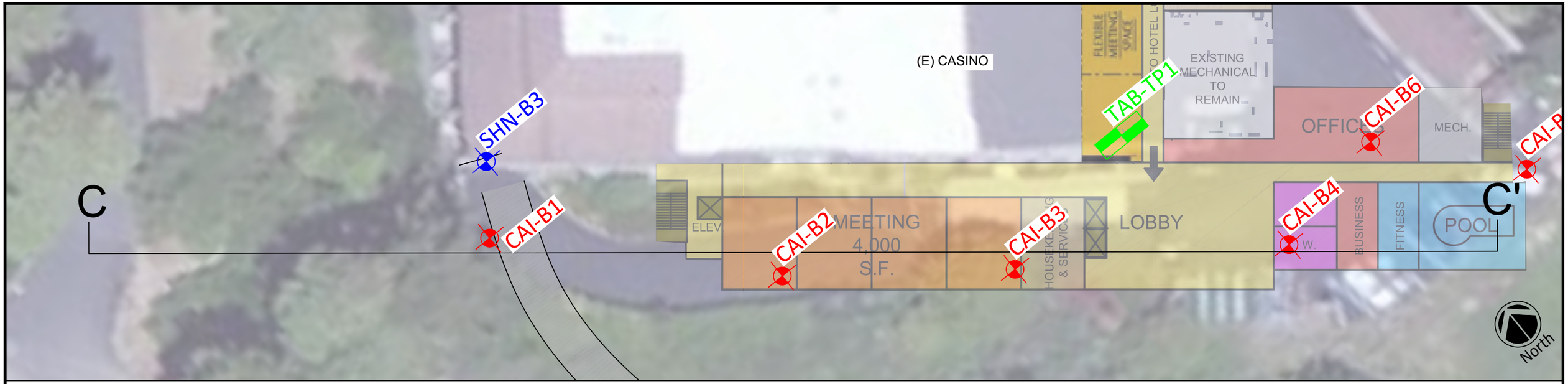
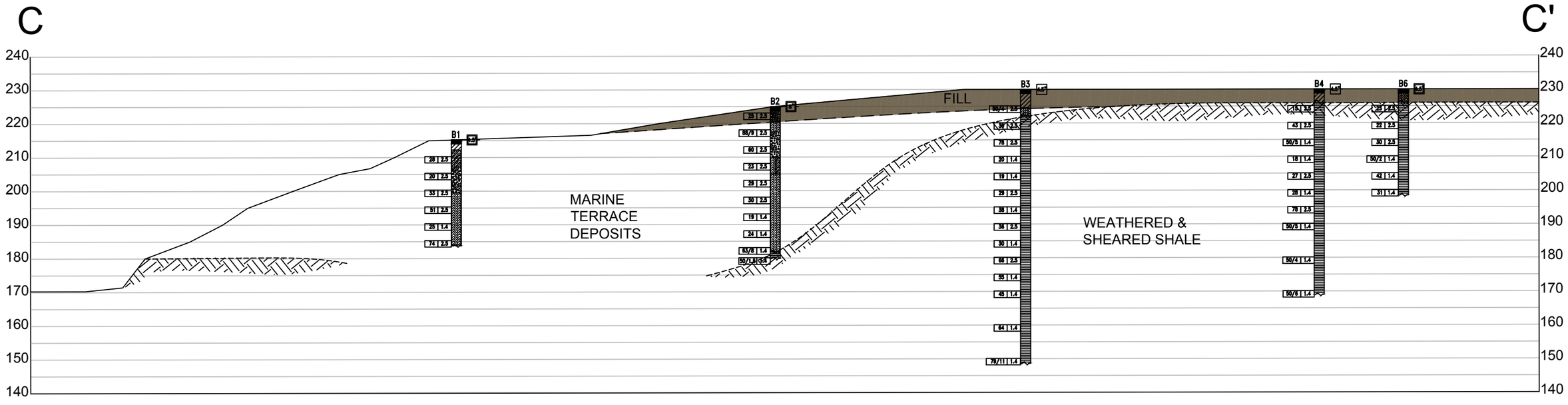
| | | |
|---|---|---|
| Project Mgr. | AJK | 11/1/16 |
| Project Eng. | NRA | 11/1/16 |
| Designer | | |
| Checked By | | |
| Drawn By | NRA | 11/1/16 |
| | | |
| | | |
| | By | Date |

Trinidad Rancheria
Cher-Ae Heights Hotel
27 Scenic Drive
Trinidad, California 95570

Figure 3
Cross Section BB'

| | |
|---|---|
| Project No. | 16-319.1 |
| Scale | 1"=20' |
| Date | 11/1/16 |

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| Designer | | |
| Checked By | | |
| Drawn By | NRA | 11/1/16 |
| | | |
| | | |
| | By | Date |

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Cher-Ae Heights Hotel
27 Scenic Drive
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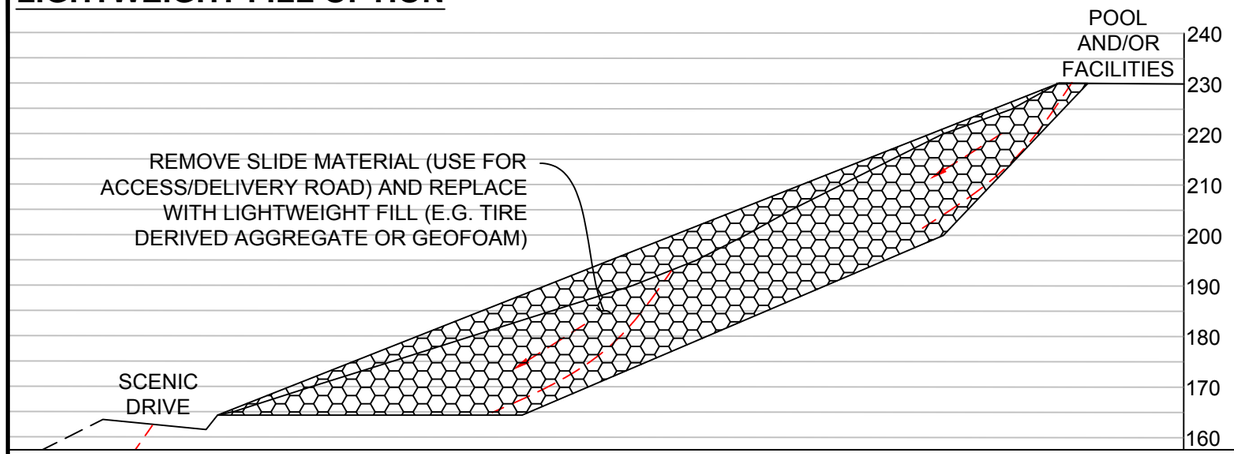
Figure 4
Cross Section CC'

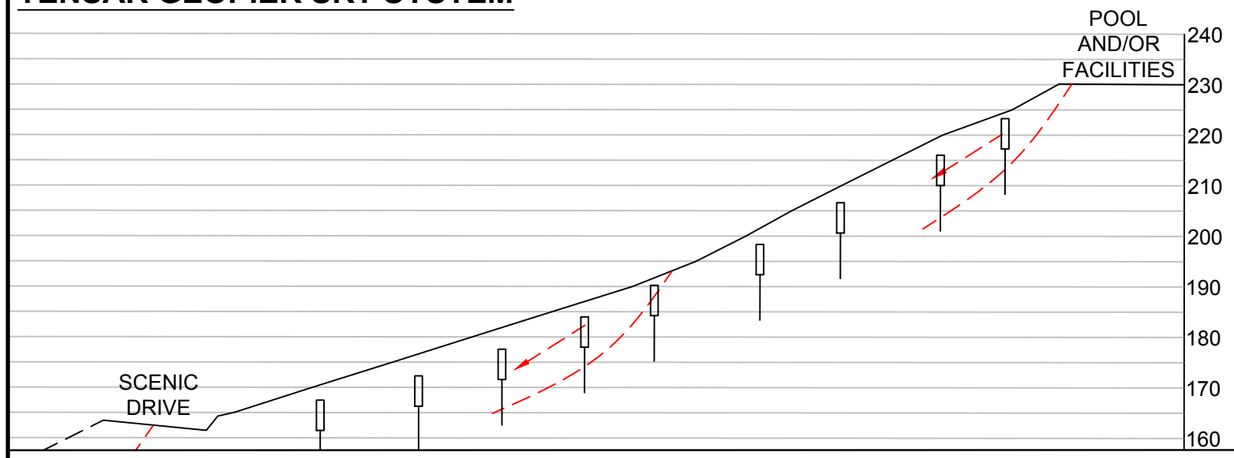
| | |
|---|---|
| Project No. | 16-319.1 |
| Scale | 1"=30' |
| Date | 11/1/16 |

## LIGHTWEIGHT FILL OPTION

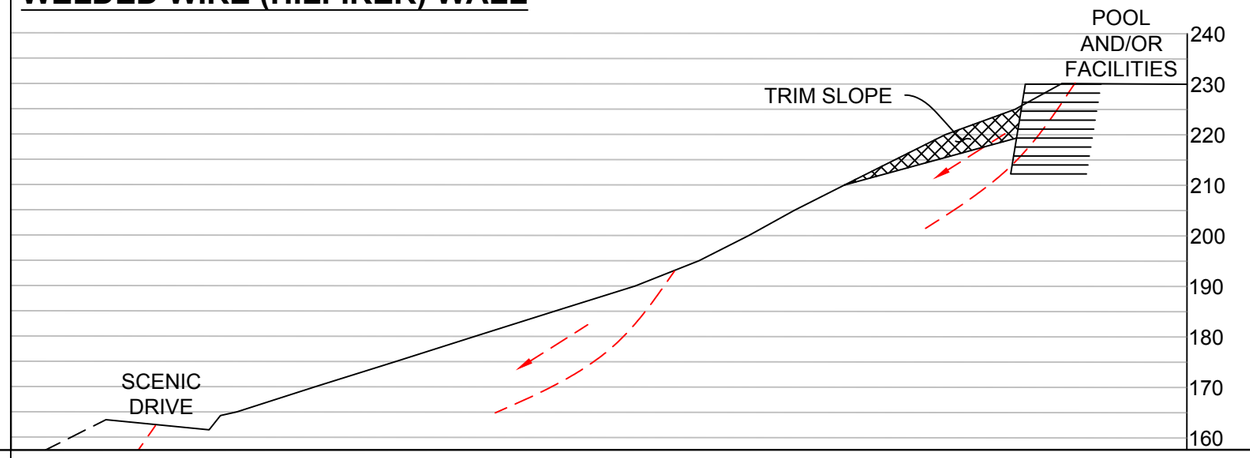



## SOLDIER PILE AND LAGGING WALL

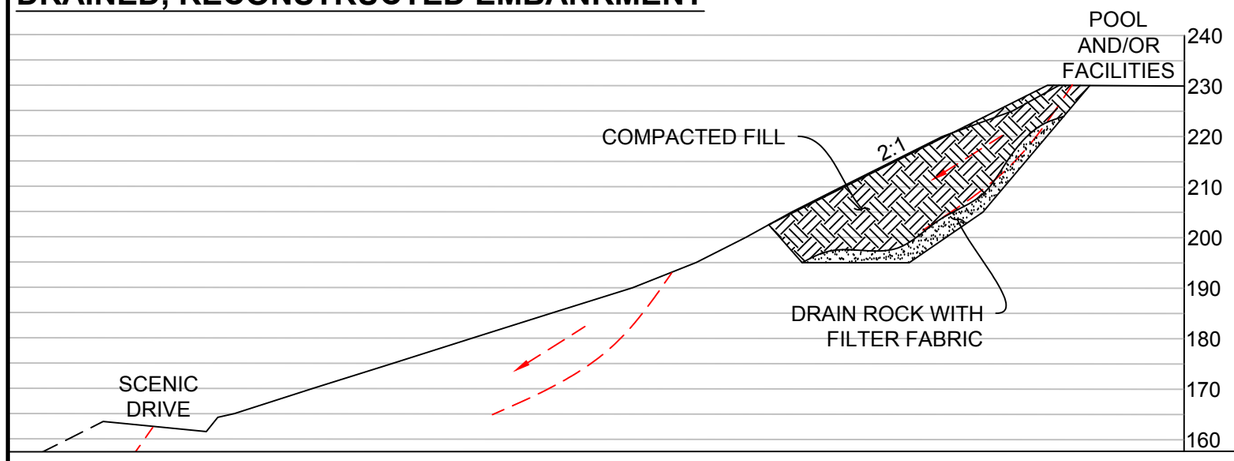

## TENSAR GEOPIER SRT SYSTEM



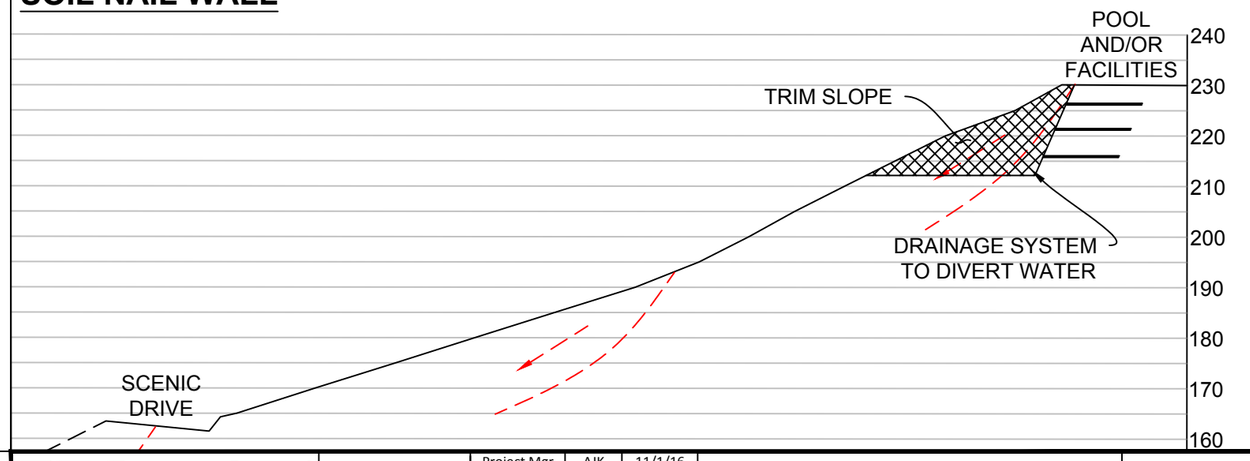

## WELDED WIRE (HILFIKER) WALL




## DRAINED, RECONSTRUCTED EMBANKMENT




## SOIL NAIL WALL





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| Designer | | |
| Checked By | | |
| Drawn By | NRA | 11/1/16 |
| | | |
| | | |
| | By | Date |

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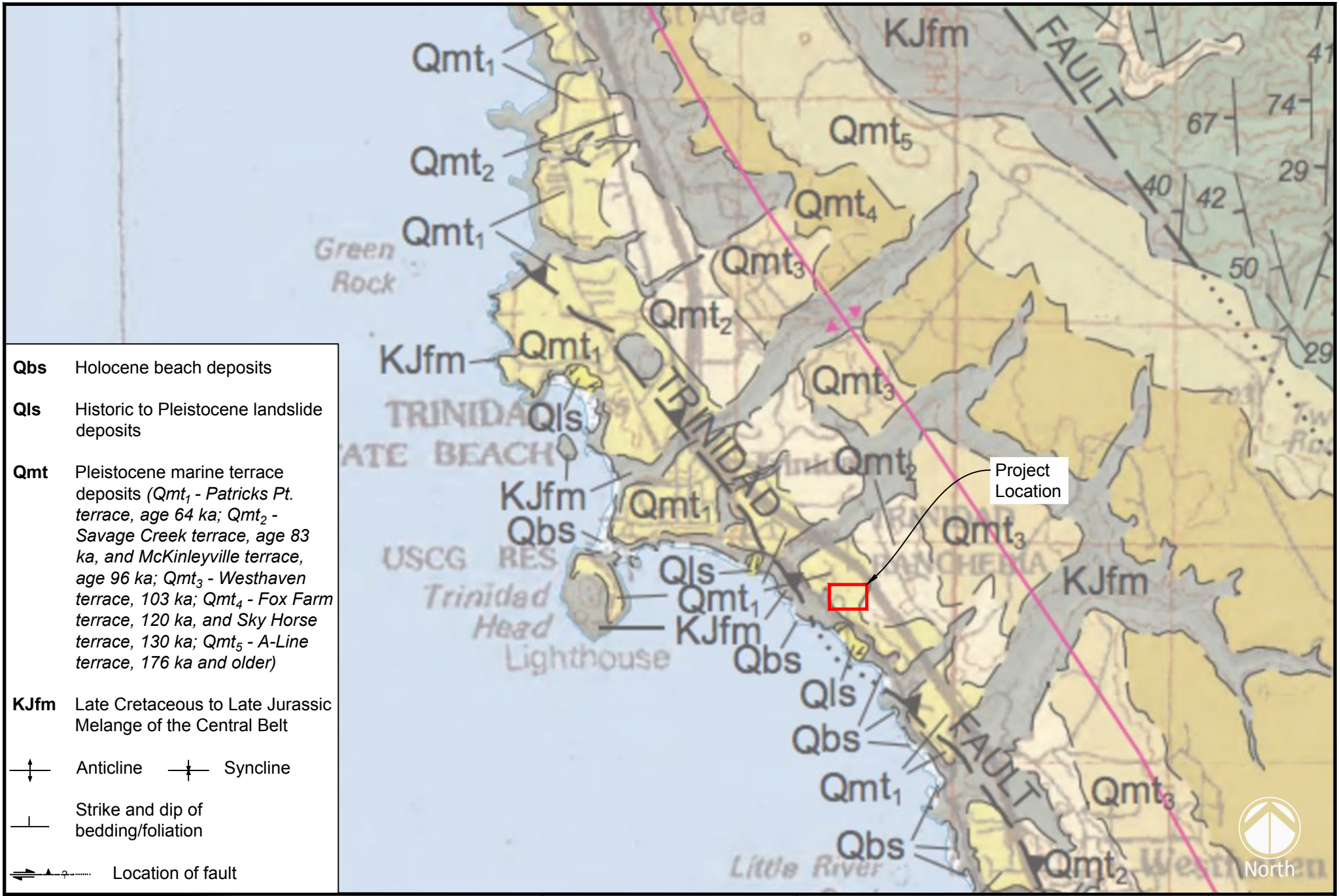
27 Scenic Drive
Trinidad, California 95570

Figure 5
Slope Remediation Examples

| | |
|---|---|
| Project No. | 16-319.1 |
| Scale | 1"=30' |
| Date | 11/1/16 |




**Qbs** Holocene beach deposits

**Qls** Historic to Pleistocene landslide deposits

**Qmt** Pleistocene marine terrace deposits *($Qmt_1$ - Patricks Pt. terrace, age 64 ka; $Qmt_2$ - Savage Creek terrace, age 83 ka, and McKinleyville terrace, age 96 ka; $Qmt_3$ - Westhaven terrace, 103 ka; $Qmt_4$ - Fox Farm terrace, 120 ka, and Sky Horse terrace, 130 ka; $Qmt_5$ - A-Line terrace, 176 ka and older)*

**KJfm** Late Cretaceous to Late Jurassic Melange of the Central Belt

Anticline — Syncline

Strike and dip of bedding/foliation

Location of fault

| | | |
|---|---|---|
| Project Mgr. | AJK | 11/1/16 |
| Project Eng. | NRA | 11/1/16 |
| Designer | | |
| Checked By | | |
| Drawn By | NRA | 11/1/16 |
| | | |
| | | |
| | By | Date |

Source: "Preliminary Geologic Map of Onshore Portions of the Crescent City and Orick 30' x 60' Quadrangles, California", California Geologic Survey, 2012

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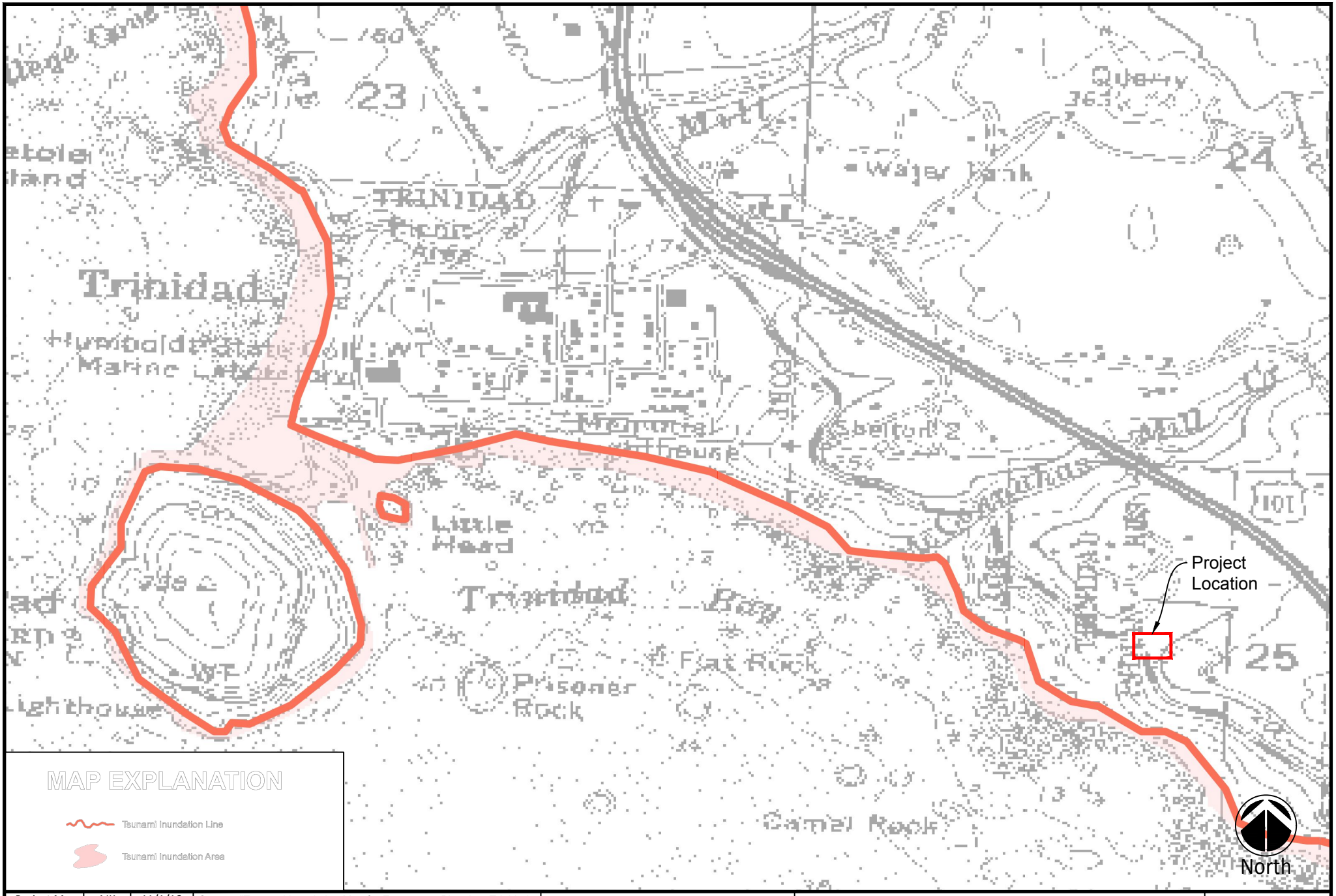
Figure 6
Geology Map

| | |
|---|---|
| Project No. | 16-319.1 |
| Scale | 1"=3,000' |
| Date | 11/1/16 |




| | | |
|---|---|---|
| Project Mgr. | AJK | 11/1/16 |
| Project Eng. | NRA | 11/1/16 |
| Designer | | |
| Checked By | | |
| Drawn By | NRA | 11/1/16 |
| | | |
| | | |
| | By | Date |

Source: "Tsunami Inundation Map for Emergency Planning, Trinidad Quadrangle, Crannel Quadrangle", California Emergency Management Agency, 2009

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**Figure 7**
Tsunami Inundation Map

| | |
|---|---|
| Project No. | 16-319.1 |
| Scale | 1"=1,000' |
| Date | 11/1/16 |


# LEGEND

**Quaternary Fault (Age)**
- <150 years
- <15,000 years
- <130,000 years

**Quaternary Fault (Age)**
- <750,000 years
- <1.6 million years

**Location**
- Well Constrained
- Moderately Constrained
- Inferred

| | | |
|---|---|---|
| Project Mgr. | AJK | 11/1/16 |
| Project Eng. | NRA | 11/1/16 |
| Designer | | |
| Checked By | | |
| Drawn By | NRA | 11/1/16 |
| | | |
| | | |
| | By | Date |

Source: Google Earth with USGS Fault Map overlay

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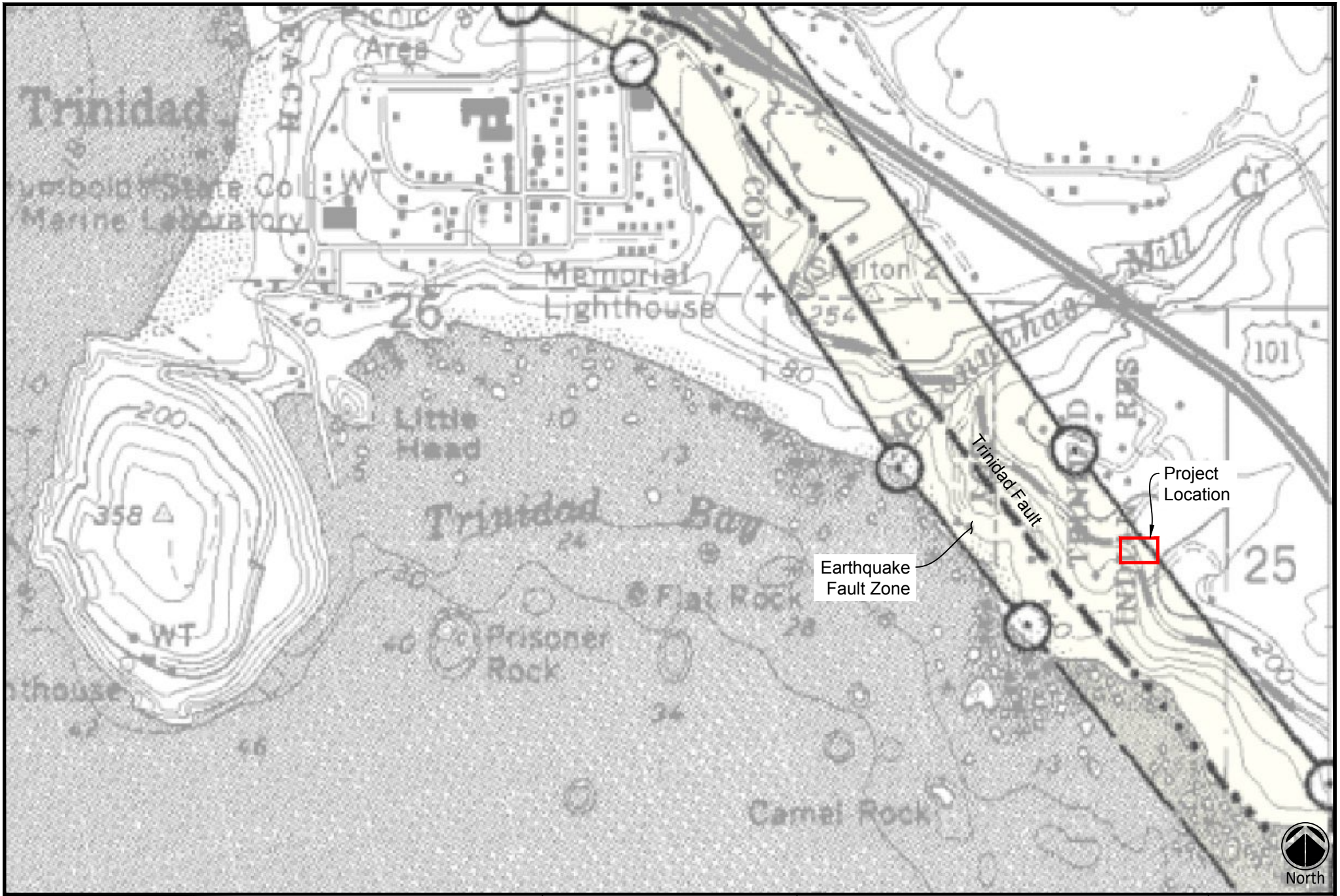
Figure 8
Fault Activity Map

| | |
|---|---|
| Project No. | 16-319.1 |
| Scale | 1"=20,000' |
| Date | 11/1/16 |




| | | |
|---|---|---|
| Project Mgr. | AJK | 11/1/16 |
| Project Eng. | NRA | 11/1/16 |
| Designer | | |
| Checked By | | |
| Drawn By | NRA | 11/1/16 |
| | | |
| | | |
| | By | Date |

Source: "State of California Special Studies Zones, Trinidad Quadrangle", California Division of Mines and Geology, 1983

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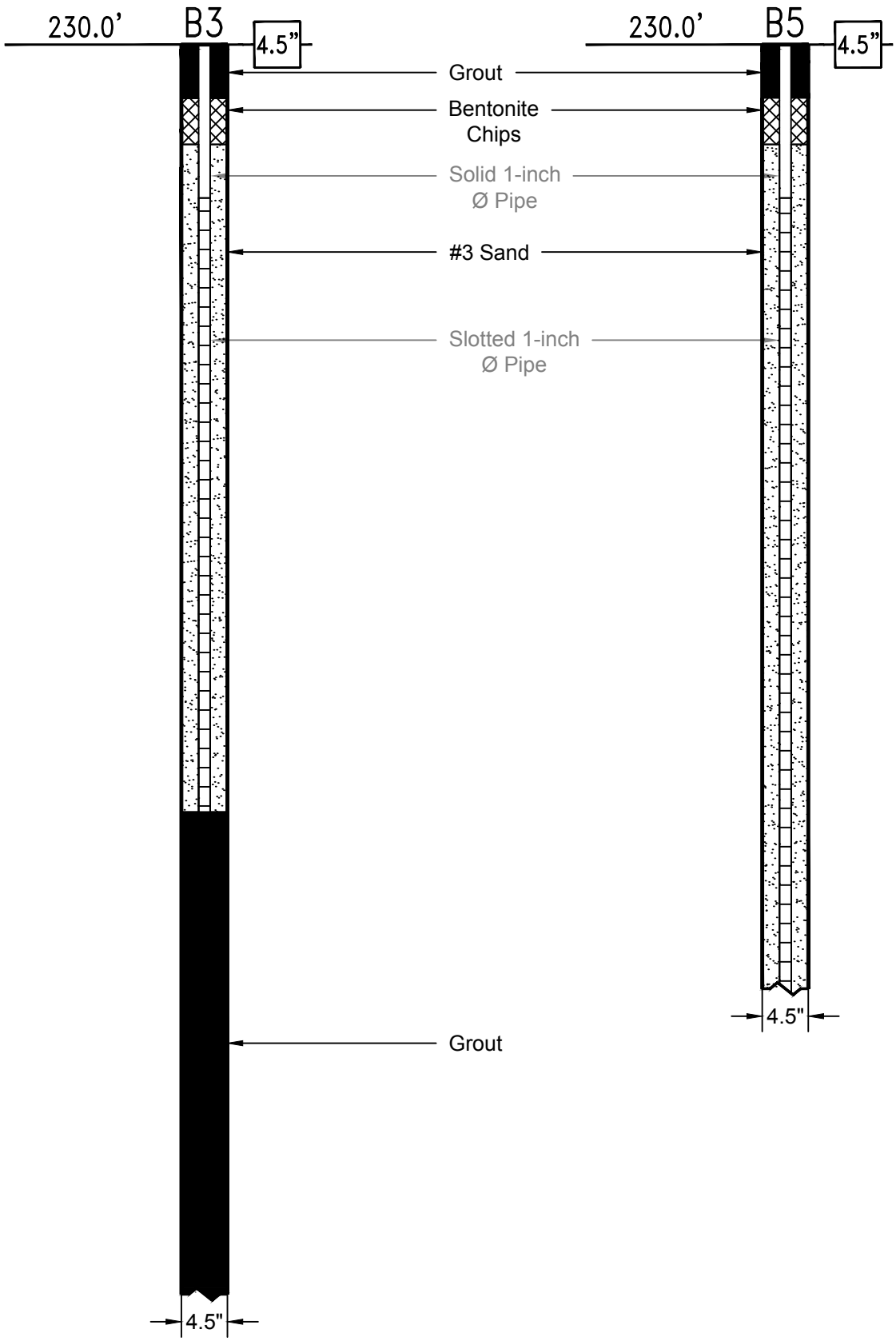
Figure 9
Earthquake Fault Zone Map

| | |
|---|---|
| Project No. | 16-319.1 |
| Scale | NTS |
| Date | 11/1/16 |

# Piezometer Logs




| | | |
|---|---|---|
| Project Mgr. | AJK | 11/1/16 |
| Project Eng. | NRA | 11/1/16 |
| Designer | | |
| Checked By | | |
| Drawn By | NRA | 11/1/16 |
| | | |
| | | |
| | By | Date |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Detail 1
Piezometer Logs

| | |
|---|---|
| Project No. | 16-319.1 |
| Scale | 1"=10' |
| Date | 11/1/16 |

# APPENDIX A

**Boring Log Legend**
**Boring Logs**

# UNIFIED SOIL CLASSIFICATION (ASTM D 2487-06)

| MATERIAL TYPES | CRITERIA FOR ASSIGNING SOIL GROUP NAMES | | | GRAPHIC SYMBOL | GROUP SYMBOL | SOIL GROUP NAMES |
|---|---|---|---|---|---|---|
| COARSE-GRAINED SOILS >50% RETAINED ON NO. 4 SIEVE | GRAVELS >50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE | CLEAN GRAVELS <5% FINES | Cu ≥ 4 AND 1 ≤ Cc ≤ 3 | | GW | WELL-GRADED GRAVEL |
| | | | Cu < 4 AND/OR 1 > Cc > 3 | | GP | POORLY-GRADED GRAVEL |
| | | GRAVELS WITH FINES >12% FINES | FINES CLASSIFY AS ML OR MH | | GM | SILTY GRAVEL |
| | | | FINES CLASSIFY AS CL OR CH | | GC | CLAYEY GRAVEL |
| | SANDS <50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE | CLEAN SANDS <5% FINES | Cu ≥ 6 AND 1 ≤ Cc ≤ 3 | | SW | WELL-GRADED SAND |
| | | | Cu < 6 AND/OR 1 > Cc > 3 | | SP | POORLY-GRADED SAND |
| | | SANDS WITH FINES >12% FINES | FINES CLASSIFY AS ML OR MH | | SM | SILTY SAND |
| | | | FINES CLASSIFY AS CL OR CH | | SC | CLAYEY SAND |
| FINE-GRAINED SOILS >50% PASSING NO. 200 SIEVE | SILTS AND CLAYS LIQUID LIMIT <50 | INORGANIC | PI>7 AND PLOTS ON OR ABOVE "A" LINE | | CL | LEAN CLAY |
| | | | PI>4 AND PLOTS BELOW "A" LINE | | ML | SILT |
| | | ORGANIC | LL (oven dried)<0.75/LL (not dried) | | OL | ORGANIC CLAY OR SILT |
| | SILTS AND CLAYS LIQUID LIMIT >50 | INORGANIC | PI PLOTS ON OR ABOVE "A" LINE | | CH | FAT CLAY |
| | | | PI PLOTS BELOW "A" LINE | | MH | ELASTIC SILT |
| | | ORGANIC | LL (oven dried)<0.75/LL (not dried) | | OH | ORGANIC CLAY OR SILT |
| HIGHLY ORGANIC SOILS | | PRIMARILY ORGANIC MATTER, DARK COLOR, ORGANIC ODOR | | | PT | PEAT |

NOTE: $Cu = D_{60}/D_{10}$

$Cc = (D_{30})^2 / D_{10} \times D_{60}$

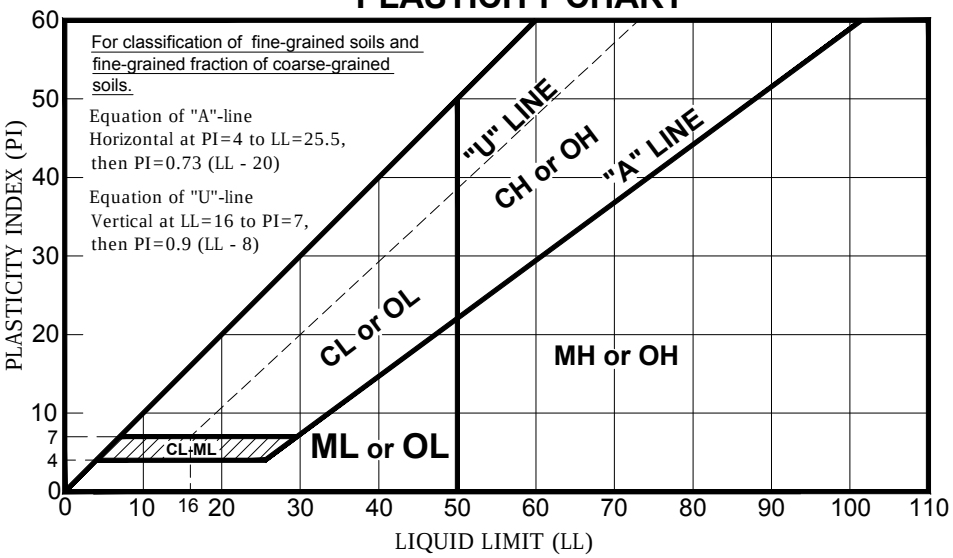
## BLOW COUNT

The number of blows of a 140-lb. hammer falling 30-inches required to drive the sampler the last 12-inches of an 18-inch drive. The notation 50/0.4 indicates 4-inches of penetration achieved in 50 blows.

## SAMPLE TYPES

- Auger or backhoe cuttings
- Shelby tube
- Standard Penetration (SPT)
- Bulk Sample
- Modified California 2"
- California Standard 2.5"
- Rock core

## PLASTICITY CHART




## ADDITIONAL TESTS

| | |
|---|---|
| C | - Consolidation |
| CP | - Compaction Curve |
| CR | - Corrosivity Testing |
| CU | - Consolidated Undrained Triaxial |
| DS | - Direct Shear |
| EI | - Expansion Index |
| P | - Permeability |
| PA | - Partical Size Analysis |
| PI | - Plasticity Index |
| PP | - Pocket Penetrometer |
| R | - R-Value |
| SE | - Sand Equivalent |
| SG | - Specific Gravity |
| SL | - Shrinkage Limit |
| SW | - Swell Potential |
| TV | - Pocket Torvane Shear Test |
| UC | - Unconfined Compression |
| UU | - Unconsolidated Undrained Triaxial |

## GROUND WATER LEVELS

- Later water level after drilling
- Water level at time of drilling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# BORING LOG / TEST PIT LEGEND AND SOIL DESCRIPTIONS

## LOG OF BORING B1

PROJECT NO: 16-319.1
PROJECT: Trinidad Rancheria Hotel
LOCATION: Trinidad, CA
CLIENT: TREDC
LOGGED BY: NRA
DEPTH OF BORING: 31.5 (ft)

BEGIN DATE: 9/13/2016
COMPLETION DATE: 9/13/2016
SURFACE ELEVATION: 215 (ft)
SURFACE CONDITION: Asphalt
WATER DEPTH: Not encountered
READING TAKEN: 9/13/2016
HAMMER EFFICIENCY: 70%

DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: Solid-Stem Auger
DRILL RIG: CME 75
HAMMER TYPE: Auto 140lb, 30" drop
SAMPLER TYPE & SIZE: MCAL (2.5"ID), SPT (1.4"ID)
BOREHOLE DIAMETER: 4.5 (in)
BACKFILL METHOD: Soil cuttings

| FIELD | | | | | | | | | LABORATORY | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEVATION (ft) | DEPTH ( ft) | SAMPLE | SAMPLE NO | BLOWS PER 6 IN. | BLOWS PER FOOT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION | RECOVERY(%) | PLASTIC LIMIT | LIQUID LIMIT | MOISTURE (%) | DRY DENSITY (PCF) | % PASSING 200 SIEVE | REMARKS |
| | | | | | | | | ASPHALT. | | | | | | | |
| | 1 | | | | | | | Well-graded GRAVEL with SAND (GW); aggregate base. | | | | | | | |
| 213 | 2 | | | | | | | SANDY lean CLAY (CL); brown; dry to moist [FILL]. | | | | | | | |
| | 3 | | | | | | | | | | | | | | |
| 211 | 4 | | | | | | | SILTY SAND (SM); medium dense; light orange tan; dry to moist; about 10% fine, subangular to subrounded GRAVEL; about 65% medium to fine SAND; about 25% nonplastic fines [TERRACE DEPOSITS]. | | | | | | | |
| | 5 | | 1 | 13 | 28 | | | | 89 | | | | | | |
| 209 | 6 | | | 14 | | | | | | | | 18 | 105 | 24 | Atterberg limits shown to be non-plastic. |
| | 7 | | | 14 | | | | | | | | | | | |
| 207 | 8 | | | | | | | CLAYEY GRAVEL with SAND (GC); medium dense; orange tan; moist; about 50% fine GRAVEL, max. 1 in. dia.; about 36% medium to fine SAND; about 15% medium plasticity fines; subangular to rounded gravel. | | | | | | | |
| | 9 | | | | | | | | | | | | | | |
| 205 | 10 | | 2 | 6 | 20 | | | | 72 | | | | | | |
| | 11 | | | 7 | | | | | | | | 9 | 123 | 16 | |
| 203 | 12 | | | 13 | | | | | | | | | | | |
| | 13 | | | | | | | | | | | | | | |
| 201 | 14 | | | | | | | | | | | | | | |
| | 15 | | 3 | 11 | 33 | | | | 100 | | | | | | |
| 199 | 16 | | | 12 | | | | SILTY SAND (SM); medium dense; orange tan; moist to wet; about 85% fine SAND; about 15% fines. | | | | 13 | 103 | 15 | |
| | 17 | | | 21 | | | | | | | | | | | |
| 197 | 18 | | | | | | | | | | | | | | |
| | 19 | | | | | | | | | | | | | | |
| 195 | 20 | | 4 | 14 | 51 | | | Dense; light orange tan; medium to fine SAND. | 94 | | | | | | |
| | 21 | | | 22 | | | | | | | | 13 | 95 | | Direct Shear Strength<br>phi = 34.4 psf<br>cohesion = 85 psf |
| 193 | 22 | | | 29 | | | | | | | | | | | |
| | 23 | | | | | | | | | | | | | | |
| 191 | 24 | | | | | | | | | | | | | | |


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PROJECT NUMBER: 16-319.1
PROJECT: Trinidad Rancheria Hotel
BORING: B1
ENTRY BY: NRA
CHECKED BY:

| ELEVATION (ft) | DEPTH ( ft) | SAMPLE | SAMPLE NO | BLOWS PER 6 IN. | BLOWS PER FOOT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION | RECOVERY(%) | LABORATORY: PLASTIC LIMIT | LABORATORY: LIQUID LIMIT | LABORATORY: MOISTURE (%) | LABORATORY: DRY DENSITY (PCF) | LABORATORY: % PASSING 200 SIEVE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 5 | 12<br>12<br>13 | 25 | | | Medium dense; about 20% fines.<br>SILTY SAND (SM) *(continued)*. | 89 | | | | | 22 | Some caving. |
| 189 | 26 | | | | | | | | | | | | | | |
| | 27 | | | | | | | | | | | | | | |
| 187 | 28 | | | | | | | | | | | | | | |
| | 29 | | | | | | | | | | | | | | |
| 185 | 30 | | 6 | 11<br>29<br>45 | 74 | | | Dense; coarse to fine, subangular to subrounded SAND. | 89 | | | | | | |
| | 31 | | | | | | | | | | | 6 | 124 | | |
| 183 | 32 | | | | | | | Poorly graded GRAVEL with SAND (GP); very dense; orange tan with white and gray gravel; about 60% fine, subrounded GRAVEL; medium to fine SAND; trace fines. | | | | | | | |
| | 33 | | | | | | | Bottom of borehole at 31.5 ft bgs | | | | | | | |
| 181 | 34 | | | | | | | No free groundwater encountered on 9/13/16. | | | | | | | |
| | 35 | | | | | | | | | | | | | | |
| 179 | 36 | | | | | | | | | | | | | | |
| | 37 | | | | | | | | | | | | | | |
| 177 | 38 | | | | | | | | | | | | | | |
| | 39 | | | | | | | | | | | | | | |
| 175 | 40 | | | | | | | | | | | | | | |
| | 41 | | | | | | | | | | | | | | |
| 173 | 42 | | | | | | | | | | | | | | |
| | 43 | | | | | | | | | | | | | | |
| 171 | 44 | | | | | | | | | | | | | | |
| | 45 | | | | | | | | | | | | | | |
| 169 | 46 | | | | | | | | | | | | | | |
| | 47 | | | | | | | | | | | | | | |
| 167 | 48 | | | | | | | | | | | | | | |
| | 49 | | | | | | | | | | | | | | |
| 165 | 50 | | | | | | | | | | | | | | |
| | 51 | | | | | | | | | | | | | | |
| 163 | 52 | | | | | | | | | | | | | | |
| | 53 | | | | | | | | | | | | | | |
| 161 | 54 | | | | | | | | | | | | | | |
| | 55 | | | | | | | | | | | | | | |

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PROJECT NUMBER: 16-319.1
PROJECT: Trinidad Rancheria Hotel
BORING: B1
ENTRY BY: NRA
CHECKED BY:

## LOG OF BORING B2

PROJECT NO: 16-319.1
PROJECT: Trinidad Rancheria Hotel
LOCATION: Trinidad, CA
CLIENT: TREDC
LOGGED BY: NRA
DEPTH OF BORING: 45.1 (ft)

BEGIN DATE: 9/13/2016
COMPLETION DATE: 9/13/2016
SURFACE ELEVATION: 225 (ft)
SURFACE CONDITION: Asphalt
WATER DEPTH: Not encountered
READING TAKEN: 9/13/2016
HAMMER EFFICIENCY: 70%

DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: Hollow-Stem Auger
DRILL RIG: CME 75
HAMMER TYPE: Auto 140lb, 30" drop
SAMPLER TYPE & SIZE: MCAL (2.5"ID), SPT (1.4"ID)
BOREHOLE DIAMETER: 8 (in)
BACKFILL METHOD: Soil cuttings

| FIELD | | | | | | | | | LABORATORY | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEVATION (ft) | DEPTH ( ft) | SAMPLE | SAMPLE NO | BLOWS PER 6 IN. | BLOWS PER FOOT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION | RECOVERY(%) | PLASTIC LIMIT | LIQUID LIMIT | MOISTURE (%) | DRY DENSITY (PCF) | % PASSING 200 SIEVE | REMARKS |
| | 1 | | | | | | | ASPHALT. Well-graded GRAVEL with SAND (GW); aggregate base. | | | | | | | |
| 223 | 2 | | 1 | 6 | 25 | | | SILTY GRAVEL with SAND (GM); medium dense; reddish brown; moist; about 30% coarse to fine, subangular to subrounded GRAVEL; about 25% coarse to fine SAND; about 45% low plasticity fines; bark/mulch present near surface [FILL]. | 0 | | | | | | |
| | 3 | | | 11 | | | | | | | | | | | |
| 221 | 4 | | | 14 | | | | | | | | | | | |
| | 5 | | | | | | | Poorly graded SAND (SP); medium dense; orange; dry to moist; medium to fine, subangular to subrounded SAND; trace fines [TERRACE DEPOSITS]. | | | | | | | |
| 219 | 6 | | | | | | | | | | | | | | |
| | 7 | | 2 | 15 | 88/9 | | | | 100 | | | | | | |
| 217 | 8 | | | 38 | | | | SILTY SAND with GRAVEL (SM); very dense; tan with bronze mottling and black spots; dry to moist; about 30% fine, angular to subangular GRAVEL; about 55% angular to subangular SAND; about 15% fines. | | | | 7 | 115 | |
| | 9 | | | 50/3 | | | | | | | | | | | |
| 215 | 10 | | | | | | | | | | | | | | |
| | 11 | | | | | | | | | | | | | | |
| 213 | 12 | | 3 | 11 | 60 | | | Dense; moist; moderate cementation; quartz gravel present. | 83 | | | | | | |
| | 13 | | | 27 | | | | | | | | 15 | 113 | 18 | |
| 211 | 14 | | | 33 | | | | | | | | | | | |
| | 15 | | | | | | | CLAYEY SAND (SC); medium dense; orange and bronze; moist to wet; trace fine GRAVEL; coarse to medium, subangular to subrounded SAND; about 20% medium plasticity fines. | | | | | | | |
| 209 | 16 | | | | | | | | | | | | | | |
| | 17 | | 4 | 8 | 23 | | | | 78 | | | | | | |
| 207 | 18 | | | 10 | | | | | | | | 13 | 116 | 22 | |
| | 19 | | | 13 | | | | | | | | | | | |
| 205 | 20 | | | | | | | SILTY SAND (SM); medium dense; orangish gray; moist to wet; about 85% medium to fine, subangular to subrounded SAND; about 15% fines. | | | | | | | |
| | 21 | | | | | | | | | | | | | | |
| 203 | 22 | | 5 | 9 | 29 | | | | 100 | | | | | | |
| | 23 | | | 13 | | | | | | | | 9 | 110 | 15 | |
| 201 | 24 | | | 16 | | | | | | | | | | | |

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PROJECT NUMBER: 16-319.1
PROJECT: Trinidad Rancheria Hotel
BORING: B2
ENTRY BY: NRA
CHECKED BY:

| ELEVATION (ft) | DEPTH ( ft) | SAMPLE | SAMPLE NO | BLOWS PER 6 IN. | BLOWS PER FOOT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION | RECOVERY(%) | LABORATORY: PLASTIC LIMIT | LABORATORY: LIQUID LIMIT | LABORATORY: MOISTURE (%) | LABORATORY: DRY DENSITY (PCF) | LABORATORY: % PASSING 200 SIEVE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | SILTY SAND (SM) *(continued)*. | | | | | | | |
| 199 | 26 | | | | | | | | | | | | | | |
| | 27 | | 6 | 10<br>12<br>18 | 30 | | | Orangish brown. | 89 | | | | | | |
| 197 | 28 | | | | | | | | | | | 14 | 95 | | Direct Shear Strength<br>phi = 34.3 psf<br>cohesion = 50 psf |
| | 29 | | | | | | | | | | | | | | |
| 195 | 30 | | | | | | | | | | | | | | |
| | 31 | | | | | | | | | | | | | | |
| 193 | 32 | | 7 | 8<br>9<br>10 | 19 | | | Moist; about 25% fines. | 100 | | | | | | |
| | 33 | | | | | | | | | | | | | 23 | |
| 191 | 34 | | | | | | | | | | | | | | |
| | 35 | | | | | | | | | | | | | | |
| 189 | 36 | | | | | | | | | | | | | | |
| | 37 | | 8 | 8<br>11<br>13 | 24 | | | | 94 | | | | | | |
| 187 | 38 | | | | | | | | | | | | | | |
| | 39 | | | | | | | | | | | | | | |
| 185 | 40 | | | | | | | | | | | | | | |
| | 41 | | | | | | | | | | | | | | |
| 183 | 42 | | 9 | 9<br>13<br>50/2 | 63/8 | | | Very dense; wet; coarse to fine, subangular to subrounded SAND. | 86 | | | | | | |
| | 43 | | | | | | | SEDIMENTARY ROCK (SHALE) [BEDROCK]. | | | | | | | Very tough, slow drilling. |
| 181 | 44 | | | | | | | | | | | | | | |
| | 45 | | 10 | 50/1.5 | REF | | | Bottom of borehole at 45.1 ft bgs | 0 | | | | | | |
| 179 | 46 | | | | | | | Auger refusal.<br>No free groundwater encountered on 9/13/16. | | | | | | | |
| | 47 | | | | | | | | | | | | | | |
| 177 | 48 | | | | | | | | | | | | | | |
| | 49 | | | | | | | | | | | | | | |
| 175 | 50 | | | | | | | | | | | | | | |
| | 51 | | | | | | | | | | | | | | |
| 173 | 52 | | | | | | | | | | | | | | |
| | 53 | | | | | | | | | | | | | | |
| 171 | 54 | | | | | | | | | | | | | | |
| | 55 | | | | | | | | | | | | | | |

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(916) 455-4225

PROJECT NUMBER: 16-319.1
PROJECT: Trinidad Rancheria Hotel
BORING: B2
ENTRY BY: NRA
CHECKED BY:

## LOG OF BORING B3

PROJECT NO: 16-319.1
PROJECT: Trinidad Rancheria Hotel
LOCATION: Trinidad, CA
CLIENT: TREDC
LOGGED BY: NRA
DEPTH OF BORING: 81.4 (ft)

BEGIN DATE: 9/13/2016
COMPLETION DATE: 9/14/2016
SURFACE ELEVATION: 230 (ft)
SURFACE CONDITION: Asphalt
WATER DEPTH: 16.5
READING TAKEN: 9/14/2016
HAMMER EFFICIENCY: 70%

DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: Rotary Wash
DRILL RIG: CME 75
HAMMER TYPE: Auto 140lb, 30" drop
SAMPLER TYPE & SIZE: MCAL (2.5"ID), SPT (1.4"ID)
BOREHOLE DIAMETER: 4.5 (in)
BACKFILL METHOD: Piezometer Installed

| ELEVATION (ft) | DEPTH ( ft) | SAMPLE | SAMPLE NO | BLOWS PER 6 IN. | BLOWS PER FOOT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION | RECOVERY(%) | LABORATORY: PLASTIC LIMIT | LABORATORY: LIQUID LIMIT | LABORATORY: MOISTURE (%) | LABORATORY: DRY DENSITY (PCF) | LABORATORY: % PASSING 200 SIEVE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | ASPHALT. | | | | | | | |
| | 1 | | | | | | | Well-graded GRAVEL with SAND (GW); aggregate base. | | | | | | | |
| 228 | 2 | | | | | | | SANDY lean CLAY (CL); orange brown; moist; about 30% medium to fine SAND; about 70% medium plasticity fines [FILL]. | | | | | | | |
| | 3 | | | | | | | | | | | | | | |
| 226 | 4 | | | | | | | | | | | | | | |
| | 5 | | 1 | 29<br>50/4 | 50/4 | | | | 80 | | | 16 | 101 | | Tough drilling. |
| 224 | 6 | | | | | | | SILTY SAND (SM); very dense; orange, light tan, gray, and bronze; dry to moist; about 80% medium to fine SAND; about 20% low plasticity fines; moderate cementation [TERRACE DEPOSITS]. | | | | | | | |
| | 7 | | | | | | | | | | | | | | |
| 222 | 8 | | | | | | | SEDIMENTARY ROCK (SHALE), blue gray to dark gray, decomposed, moist; angular shale fragments and sub-grounded gravel in clay matrix [BEDROCK]. | | | | | | | Easier drilling. |
| | 9 | | | | | | | | | | | | | | |
| 220 | 10 | | 2 | 6<br>14<br>16 | 30 | | | | 100 | | | 9 | 133 | | Unconfined Compressive Strength<br>cohesion = 3051 psf |
| | 11 | | | | | | | | | | | | | | |
| 218 | 12 | | | | | | | | | | | | | | |
| | 13 | | | | | | | | | | | | | | |
| 216 | 14 | | | | | | | | | | | | | | |
| | 15 | | 3 | 22<br>34<br>44 | 78 | | | Intensely weathered. | 100 | | | 5 | 138 | | Unconfined Compressive Strength<br>cohesion = 2387 psf |
| 214 | 16 | | | | | | | | | | | | | | |
| | 17 | | | | | | | | | | | | | | |
| 212 | 18 | | | | | | | | | | | | | | Tough drilling; auger bit grinds against rock. |
| | 19 | | | | | | | | | | | | | | |
| 210 | 20 | | 4 | 10<br>8<br>12 | 20 | | | Very intensely weathered, wet. | 78 | 14 | 27 | | | | Switch from auger to mud rotary.<br>PI |
| | 21 | | | | | | | | | | | | | | |
| 208 | 22 | | | | | | | | | | | | | | |
| | 23 | | | | | | | | | | | | | | |
| 206 | 24 | | | | | | | | | | | | | | |

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| ELEVATION (ft) | DEPTH ( ft) | SAMPLE | SAMPLE NO | BLOWS PER 6 IN. | BLOWS PER FOOT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION | RECOVERY(%) | LABORATORY: PLASTIC LIMIT | LABORATORY: LIQUID LIMIT | LABORATORY: MOISTURE (%) | LABORATORY: DRY DENSITY (PCF) | LABORATORY: % PASSING 200 SIEVE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 5 | 7<br>7<br>12 | 19 | | | Decomposed.<br>SEDIMENTARY ROCK (Shale) *(continued)*. | 44 | | | | | | |
| 204 | 26 | | | | | | | | | | | | | | |
| | 27 | | | | | | | | | | | | | | |
| 202 | 28 | | | | | | | | | | | | | | |
| | 29 | | | | | | | | | | | | | | |
| 200 | 30 | | 6 | 9<br>13<br>16 | 29 | | | Intensely weathered. | 89 | | | 8 | 128 | | |
| | 31 | | | | | | | | | | | | | | |
| 198 | 32 | | | | | | | | | | | | | | |
| | 33 | | | | | | | | | | | | | | |
| 196 | 34 | | | | | | | | | | | | | | |
| | 35 | | 7 | 10<br>13<br>25 | 38 | | | | 56 | | | | | | |
| 194 | 36 | | | | | | | | | | | | | | Corrosion Testing<br>pH = 8.57<br>Min. Resistivity = 1,070 ohm-cm<br>Chlorides = 12.1 ppm<br>Sulfates = 225.9 ppm |
| | 37 | | | | | | | | | | | | | | |
| 192 | 38 | | | | | | | | | | | | | | |
| | 39 | | | | | | | | | | | | | | |
| 190 | 40 | | 8 | 14<br>14<br>22 | 36 | | | Decomposed. | 22 | | | | | | |
| | 41 | | | | | | | | | | | | | | |
| 188 | 42 | | | | | | | | | | | | | | |
| | 43 | | | | | | | | | | | | | | |
| 186 | 44 | | | | | | | | | | | | | | |
| | 45 | | 9 | 15<br>11<br>19 | 30 | | | | 39 | | | | | | |
| 184 | 46 | | | | | | | | | | | | | | |
| | 47 | | | | | | | | | | | | | | |
| 182 | 48 | | | | | | | | | | | | | | Tough drilling. |
| | 49 | | | | | | | | | | | | | | |
| 180 | 50 | | 10 | 10<br>28<br>38 | 66 | | | Intensely weathered. | 44 | | | 7 | 142 | | |
| | 51 | | | | | | | | | | | | | | |
| 178 | 52 | | | | | | | | | | | | | | |
| | 53 | | | | | | | | | | | | | | |
| 176 | 54 | | | | | | | | | | | | | | |
| | 55 | | 11 | | 55 | | | Moderately weathered. | 50 | | | | | | |

| ELEVATION (ft) | DEPTH ( ft) | SAMPLE | SAMPLE NO | BLOWS PER 6 IN. | BLOWS PER FOOT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION | RECOVERY(%) | LABORATORY: PLASTIC LIMIT | LIQUID LIMIT | MOISTURE (%) | DRY DENSITY (PCF) | % PASSING 200 SIEVE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 174 | 56 | | 11 | 8<br>29<br>26 | 55 | | | | 50 | | | | | | |
| | 57 | | | | | | | | | | | | | | |
| 172 | 58 | | | | | | | | | | | | | | |
| | 59 | | | | | | | | | | | | | | |
| 170 | 60 | | 12 | 11<br>20<br>25 | 45 | | | Intensely weathered. | 39 | | | | | | Tough drilling and easy drilling sections from 48ft to 70ft. |
| | 61 | | | | | | | | | | | | | | |
| 168 | 62 | | | | | | | | | | | | | | |
| | 63 | | | | | | | | | | | | | | |
| 166 | 64 | | | | | | | | | | | | | | |
| | 65 | | | | | | | | | | | | | | |
| 164 | 66 | | | | | | | | | | | | | | |
| | 67 | | | | | | | | | | | | | | |
| 162 | 68 | | | | | | | | | | | | | | |
| | 69 | | | | | | | | | | | | | | |
| 160 | 70 | | 13 | 16<br>18<br>46 | 64 | | | Intensely to moderately weathered. | 72 | | | | | | Very tough, slow drilling from 70-80ft. |
| | 71 | | | | | | | | | | | | | | |
| 158 | 72 | | | | | | | | | | | | | | |
| | 73 | | | | | | | | | | | | | | |
| 156 | 74 | | | | | | | | | | | | | | |
| | 75 | | | | | | | | | | | | | | |
| 154 | 76 | | | | | | | | | | | | | | |
| | 77 | | | | | | | | | | | | | | |
| 152 | 78 | | | | | | | | | | | | | | |
| | 79 | | | | | | | | | | | | | | |
| 150 | 80 | | 14 | 22<br>29<br>50/5 | 79/11 | | | Moderately weathered. | 41 | | | | | | |
| | 81 | | | | | | | | | | | | | | |
| 148 | 82 | | | | | | | Bottom of borehole at 81.4 ft bgs<br><br>Near mud rotary refusal.<br>Groundwater during augering encountered at 16.5ft on 9/13/16.<br>Groundwater rose to 11.8ft on 9/14/16.<br>Piezometer installed to 50ft; see Detail 1. | | | | | | | |
| | 83 | | | | | | | | | | | | | | |
| 146 | 84 | | | | | | | | | | | | | | |
| | 85 | | | | | | | | | | | | | | |

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(916) 455-4225

PROJECT NUMBER: 16-319.1
PROJECT: Trinidad Rancheria Hotel
BORING: B3
ENTRY BY: NRA
CHECKED BY:

# LOG OF BORING B4

PROJECT NO: 16-319.1
PROJECT: Trinidad Rancheria Hotel
LOCATION: Trinidad, CA
CLIENT: TREDC
LOGGED BY: NRA
DEPTH OF BORING: 61 (ft)

BEGIN DATE: 9/15/2016
COMPLETION DATE: 9/15/2016
SURFACE ELEVATION: 230 (ft)
SURFACE CONDITION: Asphalt
WATER DEPTH: Not encountered
READING TAKEN: 9/15/2016
HAMMER EFFICIENCY: 70%

DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: Rotary Wash
DRILL RIG: CME 75
HAMMER TYPE: Auto 140lb, 30" drop
SAMPLER TYPE & SIZE: MCAL (2.5"ID), SPT (1.4"ID)
BOREHOLE DIAMETER: 4.5 (in)
BACKFILL METHOD: Cement grout

| FIELD | | | | | | | | | LABORATORY | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEVATION (ft) | DEPTH ( ft) | SAMPLE | SAMPLE NO | BLOWS PER 6 IN. | BLOWS PER FOOT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION | RECOVERY(%) | PLASTIC LIMIT | LIQUID LIMIT | MOISTURE (%) | DRY DENSITY (PCF) | % PASSING 200 SIEVE | REMARKS |
| | | | | | | | | ASPHALT. | | | | | | | |
| | 1 | | | | | | | Well-graded GRAVEL with SAND (GW); aggregate base. | | | | | | | |
| 228 | 2 | | | | | | | SANDY lean CLAY (CL); grayish brown with bronze streaks; dry to moist; medium to fine SAND; medium plasticity fines [FILL]. | | | | | | | |
| | 3 | | | | | | | | | | | | | | |
| 226 | 4 | | | | | | | SEDIMENTARY ROCK (SHALE), dark gray, decomposed, moist; angular shale fragments and sub-grounded gravel in clay matrix [BEDROCK]. | | | | | | | |
| | 5 | | 1 | 3<br>6<br>9 | 15 | | | | 56 | | | | | | |
| 224 | 6 | | | | | | | | | | | 9 | 130 | | Unconfined Compressive Strength<br>cohesion = 1272 psf |
| | 7 | | | | | | | | | | | | | | |
| 222 | 8 | | | | | | | | | | | | | | |
| | 9 | | | | | | | | | | | | | | |
| 220 | 10 | | 2 | 3<br>8<br>35 | 43 | 4.5+ | | Intensely weathered, white quartz angular gravel present. | 78 | | | | | | |
| | 11 | | | | | | | | | | | 9 | 137 | | |
| 218 | 12 | | | | | | | | | | | | | | |
| | 13 | | | | | | | | | | | | | | |
| 216 | 14 | | | | | | | | | | | | | | |
| | 15 | | 3 | 4<br>50/5 | 50/5 | | | Moderately weathered. | 91 | | | | | | Very tough drilling. Auger bit grinding on rock. |
| 214 | 16 | | | | | | | | | | | | | | |
| | 17 | | | | | | | | | | | | | | |
| 212 | 18 | | | | | | | | | | | | | | Easier drilling. |
| | 19 | | | | | | | | | | | | | | |
| 210 | 20 | | 4 | 5<br>8<br>10 | 18 | | | Intensely weathered. | 89 | | | | | | Switch from auger to mud rotary. |
| | 21 | | | | | | | | | 17 | 33 | | | | Corrosion Testing<br>pH = 8.18<br>Min. Resistivity = 1,150 ohm-cm<br>Chlorides = 12.0 ppm<br>Sulfates = 175.2 ppm<br>PI |
| 208 | 22 | | | | | | | | | | | | | | |
| | 23 | | | | | | | | | | | | | | |
| 206 | 24 | | | | | | | | | | | | | | |

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PROJECT NUMBER: 16-319.1
PROJECT: Trinidad Rancheria Hotel
BORING: B4
ENTRY BY: NRA
CHECKED BY:

| ELEVATION (ft) | DEPTH ( ft) | SAMPLE | SAMPLE NO | BLOWS PER 6 IN. | BLOWS PER FOOT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION | RECOVERY(%) | LABORATORY: PLASTIC LIMIT | LABORATORY: LIQUID LIMIT | LABORATORY: MOISTURE (%) | LABORATORY: DRY DENSITY (PCF) | LABORATORY: % PASSING 200 SIEVE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 5 | 6<br>13<br>14 | 27 | | | SEDIMENTARY ROCK (Shale) *(continued)*. | 22 | | | | | | |
| 204 | 26 | | | | | | | | | | | | | | |
| | 27 | | | | | | | | | | | | | | |
| 202 | 28 | | | | | | | | | | | | | | |
| | 29 | | | | | | | | | | | | | | |
| 200 | 30 | | 6 | 20<br>15<br>13 | 28 | | | Intensely to moderately weathered, intensely fractured, white quartz angular gravel present. | 67 | | | | | | |
| | 31 | | | | | | | | | | | | | | |
| 198 | 32 | | | | | | | | | | | | | | |
| | 33 | | | | | | | | | | | | | | |
| 196 | 34 | | | | | | | | | | | | | | |
| | 35 | | 7 | 15<br>31<br>47 | 78 | | | Moderately weathered. | 56 | | | | | | |
| 194 | 36 | | | | | | | | | | | 6 | 143 | | Triaxial Shear Strength - Staged UU<br>phi = 21.8 degrees<br>cohesion = 1400 psf |
| | 37 | | | | | | | | | | | | | | |
| 192 | 38 | | | | | | | | | | | | | | |
| | 39 | | | | | | | | | | | | | | |
| 190 | 40 | | 8 | 50/5 | REF | | | | 60 | | | | | | |
| | 41 | | | | | | | | | | | | | | Corrosion Testing<br>pH = 8.54<br>Min. Resistivity = 1,850 ohm-cm<br>Chlorides = 3.7 ppm<br>Sulfates = 19.4 ppm |
| 188 | 42 | | | | | | | | | | | | | | |
| | 43 | | | | | | | | | | | | | | |
| 186 | 44 | | | | | | | | | | | | | | |
| | 45 | | | | | | | | | | | | | | |
| 184 | 46 | | | | | | | | | | | | | | |
| | 47 | | | | | | | | | | | | | | |
| 182 | 48 | | | | | | | | | | | | | | |
| | 49 | | | | | | | | | | | | | | |
| 180 | 50 | | 9 | 50/4 | REF | | | | 75 | | | | | | |
| | 51 | | | | | | | | | | | | | | |
| 178 | 52 | | | | | | | | | | | | | | |
| | 53 | | | | | | | | | | | | | | |
| 176 | 54 | | | | | | | | | | | | | | |
| | 55 | | | | | | | | | | | | | | |

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PROJECT NUMBER: 16-319.1
PROJECT: Trinidad Rancheria Hotel
BORING: B4
ENTRY BY: NRA
CHECKED BY:

| ELEVATION (ft) | DEPTH ( ft) | SAMPLE | SAMPLE NO | BLOWS PER 6 IN. | BLOWS PER FOOT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION | RECOVERY(%) | LABORATORY: PLASTIC LIMIT | LABORATORY: LIQUID LIMIT | LABORATORY: MOISTURE (%) | LABORATORY: DRY DENSITY (PCF) | LABORATORY: % PASSING 200 SIEVE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 174 | 56 | | | | | | | | | | | | | | |
| | 57 | | | | | | | | | | | | | | |
| 172 | 58 | | | | | | | | | | | | | | |
| | 59 | | | | | | | | | | | | | | |
| 170 | 60 | | 10 | 45<br>50/6 | 50/6 | | | | 8 | | | | | | |
| | 61 | | | | | | | Bottom of borehole at 61.0 ft bgs<br><br>No free groundwater encountered within auger depth of 20ft on 9/15/16. | | | | | | | |
| 168 | 62 | | | | | | | | | | | | | | |
| | 63 | | | | | | | | | | | | | | |
| 166 | 64 | | | | | | | | | | | | | | |
| | 65 | | | | | | | | | | | | | | |
| 164 | 66 | | | | | | | | | | | | | | |
| | 67 | | | | | | | | | | | | | | |
| 162 | 68 | | | | | | | | | | | | | | |
| | 69 | | | | | | | | | | | | | | |
| 160 | 70 | | | | | | | | | | | | | | |
| | 71 | | | | | | | | | | | | | | |
| 158 | 72 | | | | | | | | | | | | | | |
| | 73 | | | | | | | | | | | | | | |
| 156 | 74 | | | | | | | | | | | | | | |
| | 75 | | | | | | | | | | | | | | |
| 154 | 76 | | | | | | | | | | | | | | |
| | 77 | | | | | | | | | | | | | | |
| 152 | 78 | | | | | | | | | | | | | | |
| | 79 | | | | | | | | | | | | | | |
| 150 | 80 | | | | | | | | | | | | | | |
| | 81 | | | | | | | | | | | | | | |
| 148 | 82 | | | | | | | | | | | | | | |
| | 83 | | | | | | | | | | | | | | |
| 146 | 84 | | | | | | | | | | | | | | |
| | 85 | | | | | | | | | | | | | | |

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Geotechnical Engineering, Design and Construction Services

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Sacramento, CA 95831
(916) 455-4225

PROJECT NUMBER: 16-319.1
PROJECT: Trinidad Rancheria Hotel
BORING: B4
ENTRY BY: NRA
CHECKED BY:

# LOG OF BORING B5

PROJECT NO: 16-319.1
PROJECT: Trinidad Rancheria Hotel
LOCATION: Trinidad, CA
CLIENT: TREDC
LOGGED BY: NRA
DEPTH OF BORING: 61.5 (ft)

BEGIN DATE: 9/16/2016
COMPLETION DATE: 9/16/2016
SURFACE ELEVATION: 230 (ft)
SURFACE CONDITION: Asphalt
WATER DEPTH: Not encountered
READING TAKEN: 9/16/2016
HAMMER EFFICIENCY: 70%

DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: Rotary Wash
DRILL RIG: CME 75
HAMMER TYPE: Auto 140lb, 30" drop
SAMPLER TYPE & SIZE: MCAL (2.5"ID), SPT (1.4"ID)
BOREHOLE DIAMETER: 4.5 (in)
BACKFILL METHOD: Piezometer Installed

| FIELD | | | | | | | | | LABORATORY | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEVATION (ft) | DEPTH ( ft) | SAMPLE | SAMPLE NO | BLOWS PER 6 IN. | BLOWS PER FOOT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION | RECOVERY(%) | PLASTIC LIMIT | LIQUID LIMIT | MOISTURE (%) | DRY DENSITY (PCF) | % PASSING 200 SIEVE | REMARKS |
| | | | | | | | | ASPHALT. | | | | | | | |
| | 1 | | | | | | | Well-graded GRAVEL with SAND (GW); aggregate base. | | | | | | | |
| 228 | 2 | | | | | | | SANDY lean CLAY (CL); grayish brown; moist; medium to fine SAND; medium plasticity fines [FILL]. | | | | | | | |
| | 3 | | | | | | | | | | | | | | |
| 226 | 4 | | | | | | | SEDIMENTARY ROCK (SHALE), dark bluish gray, intensely to moderately weathered, moist; angular shale fragments and sub-grounded gravel in clay matrix [BEDROCK]. | | | | | | | Tougher drilling. |
| | 5 | | 1 | 6 | 23 | | | | 61 | | | | | | |
| 224 | 6 | | | 10<br>13 | | | | | | | | 4 | 137 | | |
| | 7 | | | | | | | | | | | | | | |
| 222 | 8 | | | | | | | | | | | | | | |
| | 9 | | | | | | | | | | | | | | |
| 220 | 10 | | 2 | 17 | 33 | | | Moderately weathered. | 78 | | | | | | |
| | 11 | | | 17<br>16 | | | | | | | | | | | |
| 218 | 12 | | | | | | | | | | | | | | |
| | 13 | | | | | | | | | | | | | | |
| 216 | 14 | | | | | | | | | | | | | | |
| | 15 | | 3 | 18 | 40 | | | | 67 | | | | | | |
| 214 | 16 | | | 16<br>24 | | | | | | 13 | 24 | | | | PI |
| | 17 | | | | | | | | | | | | | | |
| 212 | 18 | | | | | | | | | | | | | | |
| | 19 | | | | | | | | | | | | | | |
| 210 | 20 | | 4 | 18 | 49 | | | Pebbly subrounded gravel in clay matrix. | 83 | | | | | | Switch from auger to mud rotary. |
| | 21 | | | 20<br>29 | | | | | | | | 6 | 149 | | |
| 208 | 22 | | | | | | | | | | | | | | |
| | 23 | | | | | | | | | | | | | | |
| 206 | 24 | | | | | | | | | | | | | | |

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| ELEVATION (ft) | DEPTH ( ft) | SAMPLE | SAMPLE NO | BLOWS PER 6 IN. | BLOWS PER FOOT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION | RECOVERY(%) | LABORATORY: PLASTIC LIMIT | LABORATORY: LIQUID LIMIT | LABORATORY: MOISTURE (%) | LABORATORY: DRY DENSITY (PCF) | LABORATORY: % PASSING 200 SIEVE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 5 | 7<br>5<br>11 | 16 | | | Moderately weathered.<br>SEDIMENTARY ROCK (Shale) *(continued)*. | 61 | | | | | | |
| 204 | 26 | | | | | | | | | | | | | | |
| | 27 | | | | | | | | | | | | | | |
| 202 | 28 | | | | | | | | | | | | | | |
| | 29 | | | | | | | | | | | | | | Easier drilling. |
| 200 | 30 | | 6 | 33<br>37<br>51 | 88 | | | | 22 | | | | | | Sample very disturbed. |
| | 31 | | | | | | | | | | | | | | |
| 198 | 32 | | | | | | | | | | | | | | |
| | 33 | | | | | | | | | | | | | | |
| 196 | 34 | | | | | | | | | | | | | | |
| | 35 | | 7 | 9<br>16<br>16 | 32 | | | Intensely to moderately weathered. | 83 | | | | | | |
| 194 | 36 | | | | | | | | | 14 | 29 | | | | PI |
| | 37 | | | | | | | | | | | | | | |
| 192 | 38 | | | | | | | | | | | | | | |
| | 39 | | | | | | | | | | | | | | |
| 190 | 40 | | 8 | 23<br>32<br>38 | 70 | | | Moderately weathered. | 22 | | | | | | |
| | 41 | | | | | | | | | | | 6 | 141 | | Triaxial Shear Strength - Staged UU<br>phi = 27.5 degrees<br>cohesion = 1225 psf |
| 188 | 42 | | | | | | | | | | | | | | |
| | 43 | | | | | | | | | | | | | | |
| 186 | 44 | | | | | | | | | | | | | | |
| | 45 | | 9 | 17<br>10<br>13 | 23 | | | Intensely to moderately weathered. | 78 | | | | | | |
| 184 | 46 | | | | | | | | | | | | | | Corrosion Testing<br>pH = 8.55<br>Min. Resistivity = 800 ohm-cm<br>Chlorides = 12.9 ppm<br>Sulfates = 131.8 ppm<br>Tougher drilling. Drill bit grinding on rock. |
| | 47 | | | | | | | | | | | | | | |
| 182 | 48 | | | | | | | | | | | | | | |
| | 49 | | | | | | | | | | | | | | |
| 180 | 50 | | 10 | 50/2 | REF | | | Light grayish green and white, slightly weathered, intensely fractured, partly serpentinized. | 100 | | | | | | |
| | 51 | | | | | | | | | | | | | | |
| 178 | 52 | | | | | | | | | | | | | | |
| | 53 | | | | | | | | | | | | | | |
| 176 | 54 | | | | | | | | | | | | | | |
| | 55 | | | | | | | | | | | | | | |

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PROJECT NUMBER: 16-319.1
PROJECT: Trinidad Rancheria Hotel
BORING: B5
ENTRY BY: NRA
CHECKED BY:

| ELEVATION (ft) | DEPTH ( ft) | FIELD: SAMPLE | FIELD: SAMPLE NO | FIELD: BLOWS PER 6 IN. | FIELD: BLOWS PER FOOT | FIELD: POCKET PEN. (TSF) | FIELD: GRAPHIC LOG | DESCRIPTION | RECOVERY(%) | LABORATORY: PLASTIC LIMIT | LABORATORY: LIQUID LIMIT | LABORATORY: MOISTURE (%) | LABORATORY: DRY DENSITY (PCF) | LABORATORY: % PASSING 200 SIEVE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 174 | 56 | | | | | | | | | | | | | | |
| | 57 | | | | | | | | | | | | | | |
| 172 | 58 | | | | | | | | | | | | | | |
| | 59 | | | | | | | | | | | | | | |
| 170 | 60 | X | 11 | 25<br>25<br>36 | 61 | | | Intensely weathered. | 89 | | | | | | |
| | 61 | | | | | | | | | | | | | | |
| 168 | 62 | | | | | | | Bottom of borehole at 61.5 ft bgs<br><br>Flushed with clean water prior to installing piezometer.<br>No free groundwater encountered within auger depth of 20ft on 9/16/16.<br>Piezometer installed to 61.5ft; see Detail 1. | | | | | | | |
| | 63 | | | | | | | | | | | | | | |
| 166 | 64 | | | | | | | | | | | | | | |
| | 65 | | | | | | | | | | | | | | |
| 164 | 66 | | | | | | | | | | | | | | |
| | 67 | | | | | | | | | | | | | | |
| 162 | 68 | | | | | | | | | | | | | | |
| | 69 | | | | | | | | | | | | | | |
| 160 | 70 | | | | | | | | | | | | | | |
| | 71 | | | | | | | | | | | | | | |
| 158 | 72 | | | | | | | | | | | | | | |
| | 73 | | | | | | | | | | | | | | |
| 156 | 74 | | | | | | | | | | | | | | |
| | 75 | | | | | | | | | | | | | | |
| 154 | 76 | | | | | | | | | | | | | | |
| | 77 | | | | | | | | | | | | | | |
| 152 | 78 | | | | | | | | | | | | | | |
| | 79 | | | | | | | | | | | | | | |
| 150 | 80 | | | | | | | | | | | | | | |
| | 81 | | | | | | | | | | | | | | |
| 148 | 82 | | | | | | | | | | | | | | |
| | 83 | | | | | | | | | | | | | | |
| 146 | 84 | | | | | | | | | | | | | | |
| | 85 | | | | | | | | | | | | | | |

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PROJECT NUMBER: 16-319.1
PROJECT: Trinidad Rancheria Hotel
BORING: B5
ENTRY BY: NRA
CHECKED BY:

# LOG OF BORING B6

PROJECT NO: 16-319.1
PROJECT: Trinidad Rancheria Hotel
LOCATION: Trinidad, CA
CLIENT: TREDC
LOGGED BY: NRA
DEPTH OF BORING: 31.5 (ft)

BEGIN DATE: 9/15/2016
COMPLETION DATE: 9/16/2016
SURFACE ELEVATION: 230 (ft)
SURFACE CONDITION: Asphalt
WATER DEPTH: Not encountered
READING TAKEN: 9/16/2016
HAMMER EFFICIENCY: 70%

DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: Solid-Stem Auger
DRILL RIG: CME 75
HAMMER TYPE: Auto 140lb, 30" drop
SAMPLER TYPE & SIZE: MCAL (2.5"ID), SPT (1.4"ID)
BOREHOLE DIAMETER: 4.5 (in)
BACKFILL METHOD: Soil cuttings

| ELEVATION (ft) | DEPTH ( ft) | SAMPLE | SAMPLE NO | BLOWS PER 6 IN. | BLOWS PER FOOT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION | RECOVERY(%) | PLASTIC LIMIT | LIQUID LIMIT | MOISTURE (%) | DRY DENSITY (PCF) | % PASSING 200 SIEVE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | ASPHALT. | | | | | | | |
| | 1 | | | | | | | Well-graded GRAVEL with SAND (GW); aggregate base. | | | | | | | |
| 228 | 2 | | | | | | | Poorly graded SAND (SP); brownish gray; moist; coarse to fine SAND; trace fines; fill for nearby storm drain trench [FILL]. | | | | | | | |
| | 3 | | | | | | | | | | | | | | |
| 226 | 4 | | | | | | | SEDIMENTARY ROCK (SHALE), gray, very intensely weathered [BEDROCK]. | | | | | | | |
| | 5 | | 1 | 18<br>15<br>8 | 23 | | | | 44 | | | | | | |
| 224 | 6 | | | | | | | | | | | | | | Corrosion Testing<br>pH = 7.72<br>Min. Resistivity = 1,720 ohm-cm<br>Chlorides = 6.9 ppm<br>Sulfates = 100.4 ppm |
| | 7 | | | | | | | | | | | | | | |
| 222 | 8 | | | | | | | | | | | | | | |
| | 9 | | | | | | | | | | | | | | |
| 220 | 10 | | 2 | 8<br>10<br>12 | 22 | | | Light gray, decomposed, dry to moist; subrounded to subangular gravel in clay matrix. | 61 | | | | | | |
| | 11 | | | | | | | | | | | 7 | 124 | | Unconfined Compressive Strength<br>cohesion = 3783 psf |
| 218 | 12 | | | | | | | | | | | | | | |
| | 13 | | | | | | | | | | | | | | |
| 216 | 14 | | | | | | | | | | | | | | |
| | 15 | | 3 | 4<br>11<br>19 | 30 | | | Intensely weathered. | 50 | | | | | | Very tough drilling, near auger refusal. |
| 214 | 16 | | | | | | | | | | | | | | |
| | 17 | | | | | | | | | | | | | | |
| 212 | 18 | | | | | | | | | | | | | | Drill bit grinding on rock. |
| | 19 | | | | | | | | | | | | | | |
| 210 | 20 | | 4 | 50/2 | REF | | | Moderately weathered, dry. | 0 | | | | | | Tougher drilling. |
| | 21 | | | | | | | | | | | | | | |
| 208 | 22 | | | | | | | | | | | | | | |
| | 23 | | | | | | | | | | | | | | |
| 206 | 24 | | | | | | | | | | | | | | |


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| ELEVATION (ft) | DEPTH ( ft) | SAMPLE | SAMPLE NO | BLOWS PER 6 IN. | BLOWS PER FOOT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION | RECOVERY(%) | LABORATORY: PLASTIC LIMIT | LABORATORY: LIQUID LIMIT | LABORATORY: MOISTURE (%) | LABORATORY: DRY DENSITY (PCF) | LABORATORY: % PASSING 200 SIEVE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 5 | 15<br>20<br>22 | 42 | | | SEDIMENTARY ROCK (Shale) *(continued)*. | 78 | | | | | | |
| 204 | 26 | | | | | | | | | | | | | | Easier drilling. |
| | 27 | | | | | | | | | | | | | | |
| 202 | 28 | | | | | | | | | | | | | | |
| | 29 | | | | | | | | | | | | | | |
| 200 | 30 | | 6 | 20<br>14<br>17 | 31 | | | Intensely to moderately weathered. | 78 | | | | | | |
| | 31 | | | | | | | | | | | | | | |
| 198 | 32 | | | | | | | Bottom of borehole at 31.5 ft bgs<br>No free groundwater encountered on 9/16/16. | | | | | | | |
| | 33 | | | | | | | | | | | | | | |
| 196 | 34 | | | | | | | | | | | | | | |
| | 35 | | | | | | | | | | | | | | |
| 194 | 36 | | | | | | | | | | | | | | |
| | 37 | | | | | | | | | | | | | | |
| 192 | 38 | | | | | | | | | | | | | | |
| | 39 | | | | | | | | | | | | | | |
| 190 | 40 | | | | | | | | | | | | | | |
| | 41 | | | | | | | | | | | | | | |
| 188 | 42 | | | | | | | | | | | | | | |
| | 43 | | | | | | | | | | | | | | |
| 186 | 44 | | | | | | | | | | | | | | |
| | 45 | | | | | | | | | | | | | | |
| 184 | 46 | | | | | | | | | | | | | | |
| | 47 | | | | | | | | | | | | | | |
| 182 | 48 | | | | | | | | | | | | | | |
| | 49 | | | | | | | | | | | | | | |
| 180 | 50 | | | | | | | | | | | | | | |
| | 51 | | | | | | | | | | | | | | |
| 178 | 52 | | | | | | | | | | | | | | |
| | 53 | | | | | | | | | | | | | | |
| 176 | 54 | | | | | | | | | | | | | | |
| | 55 | | | | | | | | | | | | | | |

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PROJECT NUMBER: 16-319.1
PROJECT: Trinidad Rancheria Hotel
BORING: B6
ENTRY BY: NRA
CHECKED BY:

# APPENDIX B

**Laboratory Test Results**

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

Project Name: Trinadad Rancheria Hotel
CAInc File No: 16-319.1
Date: 9/30/16
Technician: CAP

## MOISTURE-DENSITY TESTS - D2216

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Sample No. | B1-1 | B1-2 | B1-3 | B1-6 | B2-2 |
| USCS Symbol | SM | GC | SM | SP | GP |
| Depth (ft.) | 6 | 11 | 16 | 31 | 8 |
| Sample Length (in.) | 5.544 | 5.600 | 5.651 | 5.622 | 5.218 |
| Diameter (in.) | 2.388 | 2.374 | 2.374 | 2.405 | 2.375 |
| Sample Volume ($ft^3$) | 0.01437 | 0.01434 | 0.01448 | 0.01478 | 0.01338 |
| Total Mass Soil+Tube (g) | 1087.8 | 1151.6 | 1058.3 | 1157.9 | 998.2 |
| Mass of Tube (g) | 276.0 | 275.1 | 295.8 | 271.8 | 253.0 |
| Tare No. | P10 | P9 | P1 | P9 | G1 |
| Tare (g) | 131.7 | 254.6 | 131.4 | 254.5 | 20.7 |
| Wet Soil + Tare (g) | 580.3 | 741.6 | 506.6 | 740.6 | 59.5 |
| Dry Soil + Tare (g) | 510.8 | 700.7 | 464.4 | 711.8 | 57.0 |
| Dry Soil (g) | 379.1 | 446.1 | 333.0 | 457.3 | 36.4 |
| Water (g) | 69.5 | 40.9 | 42.2 | 28.8 | 2.5 |
| **Moisture (%)** | **18.3** | **9.2** | **12.7** | **6.3** | **6.9** |
| **Dry Density (pcf)** | **105.3** | **123.4** | **103.1** | **124.3** | **114.9** |

Notes:

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

Project Name: Trinadad Rancheria Hotel
CAInc File No: 16-319.1
Date: 9/30/16
Technician: CAP

## MOISTURE-DENSITY TESTS - D2216

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Sample No. | B2-3 | B2-4 | B2-5 | B3-1 | B3-6 |
| USCS Symbol | SM | SC | SM | SM | Rock |
| Depth (ft.) | 13 | 18 | 23 | 5.5 | 31 |
| Sample Length (in.) | 5.361 | 5.589 | 5.983 | 3.618 | 4.657 |
| Diameter (in.) | 2.377 | 2.392 | 2.358 | 2.408 | 2.418 |
| Sample Volume ($ft^3$) | 0.01377 | 0.01453 | 0.01512 | 0.00954 | 0.01238 |
| Total Mass Soil+Tube (g) | 1081.2 | 1138.4 | 1120.3 | 771.5 | 1040.1 |
| Mass of Tube (g) | 272.4 | 272.0 | 302.4 | 267.5 | 265.1 |
| Tare No. | P18 | P8 | Q6 | D17 | C15 |
| Tare (g) | 129.0 | 127.6 | 186.3 | 20.8 | 20.7 |
| Wet Soil + Tare (g) | 591.4 | 509.7 | 496.0 | 71.9 | 69.5 |
| Dry Soil + Tare (g) | 532.6 | 465.8 | 471.8 | 65.0 | 65.9 |
| Dry Soil (g) | 403.6 | 338.2 | 285.5 | 44.3 | 45.2 |
| Water (g) | 58.8 | 43.9 | 24.2 | 6.9 | 3.7 |
| **Moisture (%)** | **14.6** | **13.0** | **8.5** | **15.5** | **8.1** |
| **Dry Density (pcf)** | **113.0** | **116.3** | **109.9** | **100.9** | **127.7** |

Notes:

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

Project Name: Trinadad Rancheria Hotel
CAInc File No: 16-319.1
Date: 9/30/16
Technician: CAP

## MOISTURE-DENSITY TESTS - D2216

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Sample No. | B3-10 | B4-2 | B5-1 | B5-4 | |
| USCS Symbol | Rock | Rock | Rock | Rock | |
| Depth (ft.) | 51 | 11 | 6 | 21 | |
| Sample Length (in.) | 5.983 | 5.907 | 5.749 | 5.635 | |
| Diameter (in.) | 2.377 | 2.375 | 2.369 | 2.377 | |
| Sample Volume ($ft^3$) | 0.01536 | 0.01514 | 0.01466 | 0.01447 | |
| Total Mass Soil+Tube (g) | 1334.7 | 1296.5 | 1235.5 | 1221.9 | |
| Mass of Tube (g) | 273.4 | 274.3 | 284.9 | 189.8 | |
| Tare No. | H5 | D15 | G7 | C5 | |
| Tare (g) | 20.7 | 20.9 | 20.5 | 21.1 | |
| Wet Soil + Tare (g) | 61.7 | 56.1 | 102.1 | 82.8 | |
| Dry Soil + Tare (g) | 59.0 | 53.4 | 98.89 | 79.4 | |
| Dry Soil (g) | 38.4 | 32.5 | 78.39 | 58.3 | |
| Water (g) | 2.7 | 2.8 | 3.21 | 3.4 | |
| **Moisture (%)** | **7.0** | **8.5** | **4.1** | **5.8** | |
| **Dry Density (pcf)** | **142.3** | **137.1** | **137.3** | **148.7** | |

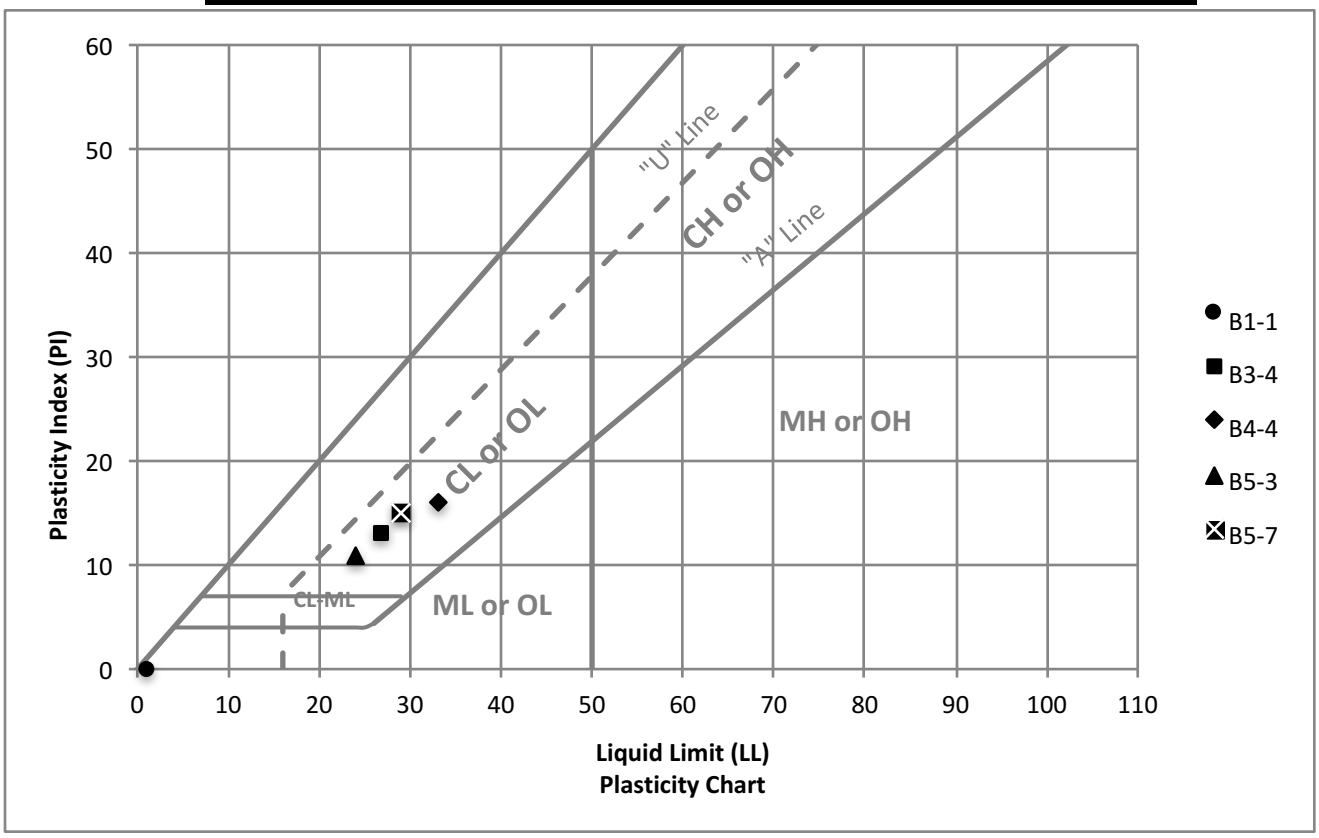
Notes:

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

Project Name: Trinidad Rancheria Hotel
CAInc File No: 16-319.1
Date: 10/3/16
Technician: KKL/CAP

## Plastic Index - ASTM D4318

| Sample ID | Depth (ft) | Liquid Limit | Plastic Limit | PI |
|---|---|---|---|---|
| B1-1 | 6 | NP | NP | NP |
| B3-4 | 21 | 27 | 14 | 13 |
| B4-4 | 21 | 33 | 17 | 16 |
| B5-3 | 16 | 24 | 13 | 11 |
| B5-7 | 36 | 29 | 14 | 15 |

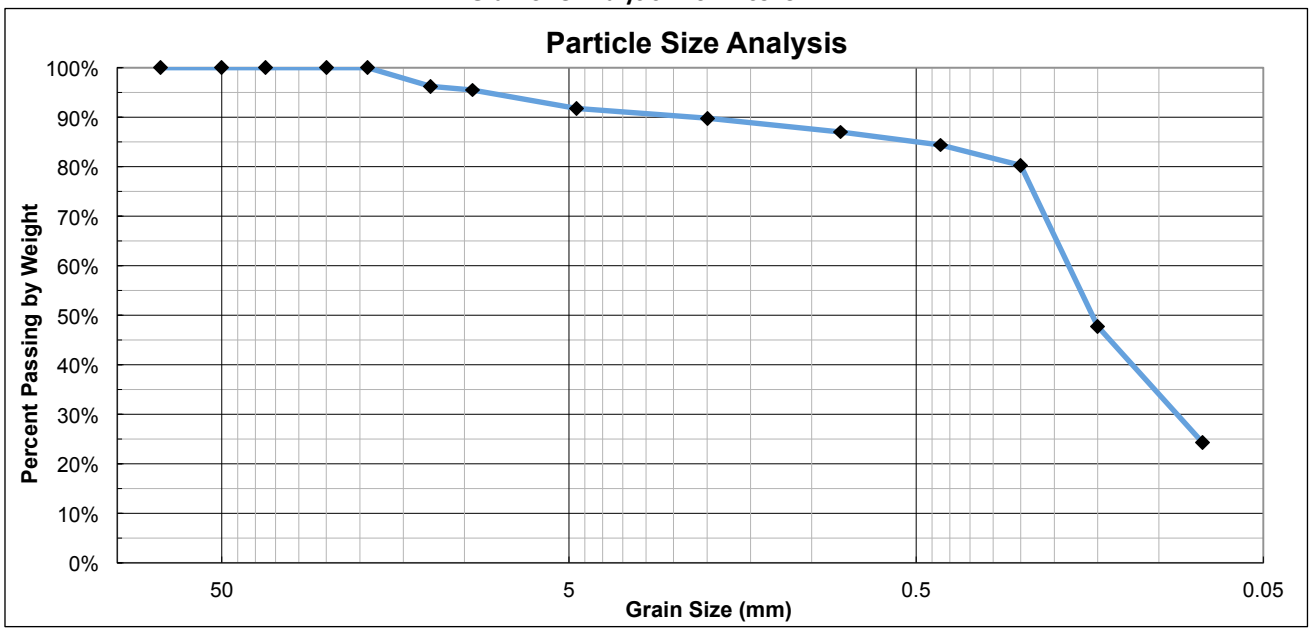



Note: For B1-1, the material was not able to be rolled into a 3.2 mm diameter thread for the plastic limit and the soil pat slid in the cup when performing the liquid limit.

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

Project Name: Trinadad Rancheria Hotel
CAInc File No: 16-319.1
Date: 10/4/16
Technician: KKL
Sample ID: B1-1
Depth: 6'
USCS Classification: Silty SAND

**Grain Size Analysis - ASTM 6913**



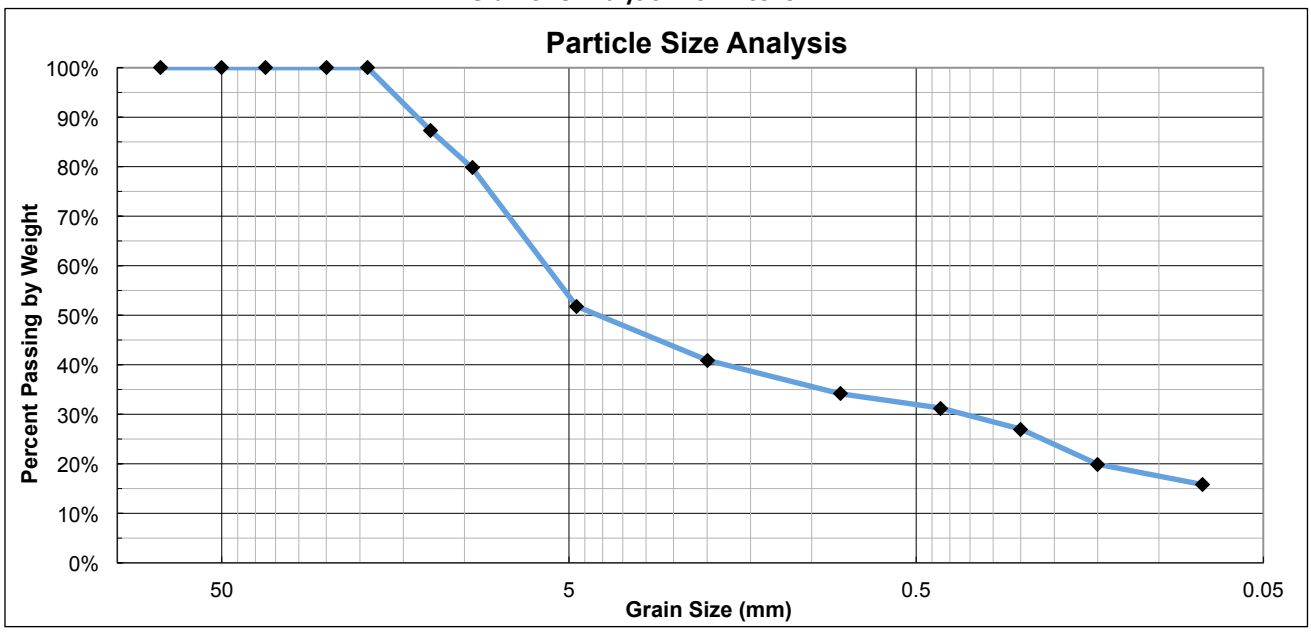

| % Cobble | % Gravel | | % Sand | | | % Fines |
|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt/Clay |
| | 0 | 8 | 2 | 6 | 60 | |
| **0** | **8** | | **68** | | | **24** |

| | | Sieve # | Opening mm | Cummulative Mass Retained (g) | % Passing % |
|---|---|---|---|---|---|
| Cobbles | | **3"** | 75 | 0.0 | 100% |
| Gravel | Coarse | **2"** | 50 | 0.0 | 100% |
| | | **1-1/2"** | 37.5 | 0.0 | 100% |
| | | **1"** | 25.0 | 0.0 | 100% |
| | | **3/4"** | 19.0 | 0.0 | 100% |
| | Fine | **1/2"** | 12.5 | 14.3 | 96% |
| | | **3/8"** | 9.50 | 17.1 | 95% |
| | | **#4** | 4.75 | 31.2 | 92% |
| Sand | Coarse | **#10** | 2.00 | 38.7 | 90% |
| | Medium | **#20** | 0.825 | 49.3 | 87% |
| | | **#40** | 0.425 | 59.2 | 84% |
| | Fine | **#60** | 0.250 | 74.8 | 80% |
| | | **#100** | 0.150 | 198.1 | 48% |
| | | **#200** | 0.075 | 286.7 | 24% |

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

Project Name: Trinadad Rancheria Hotel
CAInc File No: 16-319.1
Date: 10/3/16
Technician: KKL
Sample ID: B1-2
Depth: 11'
USCS Classification: Clayey GRAVEL with SAND

**Grain Size Analysis - ASTM 6913**



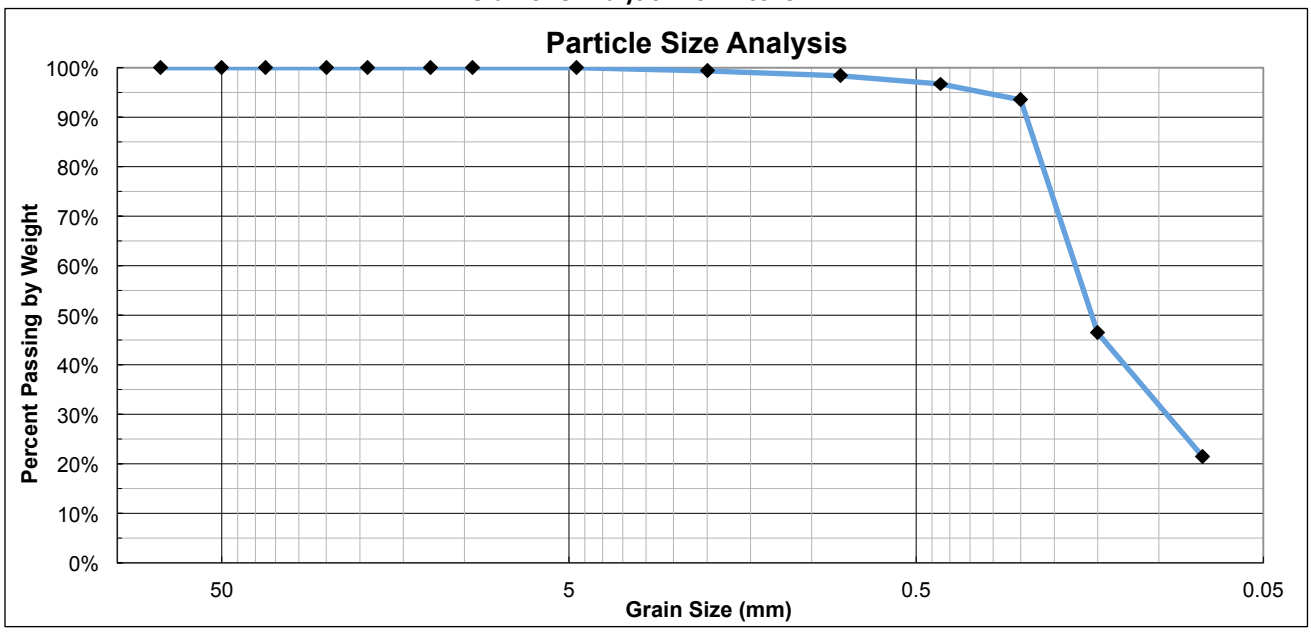

| % Cobble | % Gravel | | % Sand | | | % Fines |
|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt/Clay |
| | 0 | 48 | 11 | 10 | 15 | |
| **0** | **48** | | **36** | | | **16** |

| | | Sieve # | Opening mm | Cummulative Mass Retained (g) | % Passing % |
|---|---|---|---|---|---|
| Cobbles | | **3"** | 75 | 0.0 | 100% |
| Gravel | Coarse | **2"** | 50 | 0.0 | 100% |
| | | **1-1/2"** | 37.5 | 0.0 | 100% |
| | | **1"** | 25.0 | 0.0 | 100% |
| | | **3/4"** | 19.0 | 0.0 | 100% |
| | Fine | **1/2"** | 12.5 | 48.2 | 87% |
| | | **3/8"** | 9.50 | 76.7 | 80% |
| | | **#4** | 4.75 | 182.5 | 52% |
| Sand | Coarse | **#10** | 2.00 | 223.7 | 41% |
| | Medium | **#20** | 0.825 | 249.4 | 34% |
| | | **#40** | 0.425 | 260.3 | 31% |
| | Fine | **#60** | 0.250 | 276.4 | 27% |
| | | **#100** | 0.150 | 303.3 | 20% |
| | | **#200** | 0.075 | 318.8 | 16% |

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

Project Name: Trinadad Rancheria Hotel
CAInc File No: 16-319.1
Date: 10/7/16
Technician: CAP
Sample ID: B1-5
Depth: 26'
USCS Classification: Silty SAND

**Grain Size Analysis - ASTM 6913**



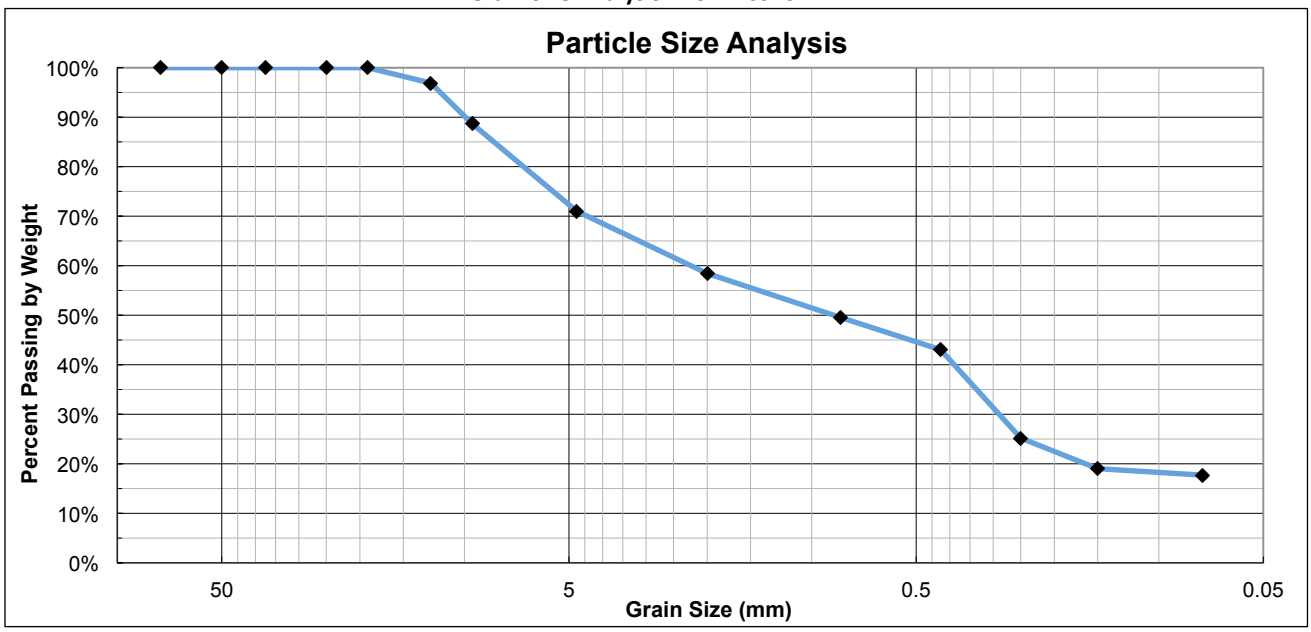

| % Cobble | % Gravel | | % Sand | | | % Fines |
|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt/Clay |
| | 0 | 0 | 1 | 2 | 75 | |
| **0** | **0** | | **78** | | | **22** |

| | | Sieve # | Opening mm | Cummulative Mass Retained (g) | % Passing % |
|---|---|---|---|---|---|
| Cobbles | | **3"** | 75 | 0.0 | 100% |
| Gravel | Coarse | **2"** | 50 | 0.0 | 100% |
| | | **1-1/2"** | 37.5 | 0.0 | 100% |
| | | **1"** | 25.0 | 0.0 | 100% |
| | | **3/4"** | 19.0 | 0.0 | 100% |
| | Fine | **1/2"** | 12.5 | 0.0 | 100% |
| | | **3/8"** | 9.50 | 0.0 | 100% |
| | | **#4** | 4.75 | 0.0 | 100% |
| Sand | Coarse | **#10** | 2.00 | 1.1 | 99% |
| | Medium | **#20** | 0.825 | 2.8 | 98% |
| | | **#40** | 0.425 | 5.6 | 97% |
| | Fine | **#60** | 0.250 | 11.0 | 94% |
| | | **#100** | 0.150 | 90.7 | 46% |
| | | **#200** | 0.075 | 132.8 | 22% |

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

Project Name: Trinadad Rancheria Hotel
CAInc File No: 16-319.1
Date: 10/4/16
Technician: KKL
Sample ID: B2-3
Depth: 13'
USCS Classification: Silty SAND with GRAVEL

**Grain Size Analysis - ASTM 6913**



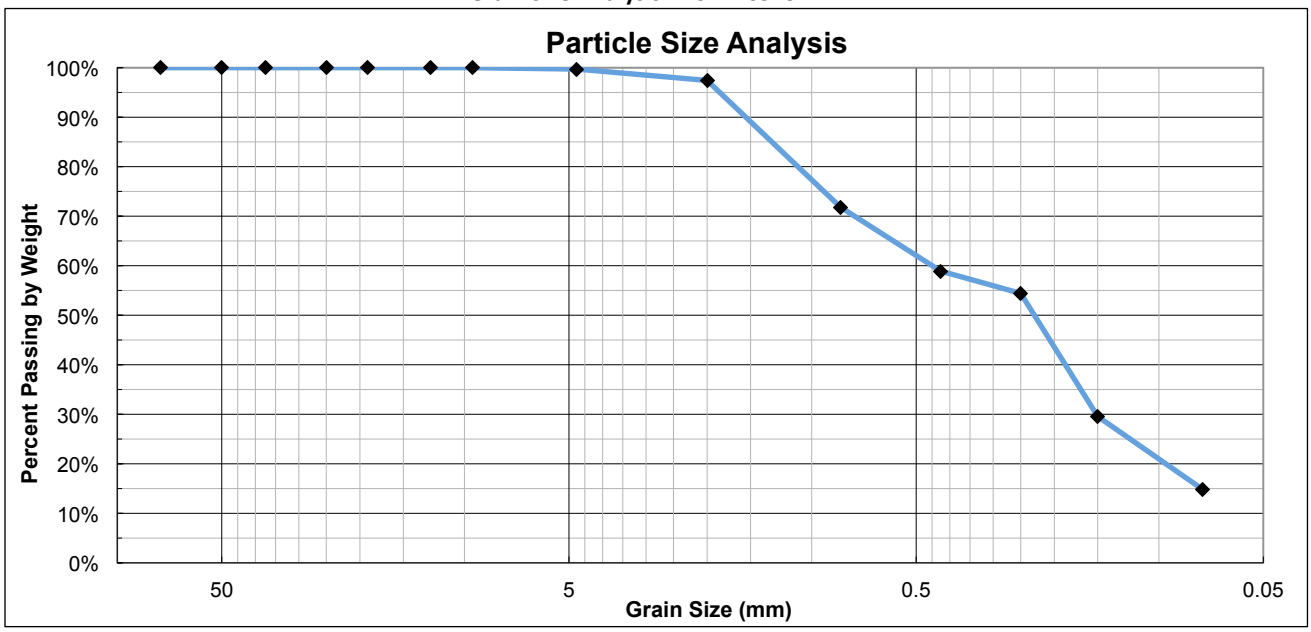

| % Cobble | % Gravel | | % Sand | | | % Fines |
|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt/Clay |
| | 0 | 29 | 13 | 15 | 25 | |
| **0** | **29** | | **53** | | | **18** |

| | | Sieve # | Opening mm | Cummulative Mass Retained (g) | % Passing % |
|---|---|---|---|---|---|
| Cobbles | | **3"** | 75 | 0.0 | 100% |
| Gravel | Coarse | **2"** | 50 | 0.0 | 100% |
| | | **1-1/2"** | 37.5 | 0.0 | 100% |
| | | **1"** | 25.0 | 0.0 | 100% |
| | | **3/4"** | 19.0 | 0.0 | 100% |
| | Fine | **1/2"** | 12.5 | 12.5 | 97% |
| | | **3/8"** | 9.50 | 45.7 | 89% |
| | | **#4** | 4.75 | 116.9 | 71% |
| Sand | Coarse | **#10** | 2.00 | 167.7 | 58% |
| | Medium | **#20** | 0.825 | 203.6 | 50% |
| | | **#40** | 0.425 | 229.9 | 43% |
| | Fine | **#60** | 0.250 | 301.9 | 25% |
| | | **#100** | 0.150 | 326.8 | 19% |
| | | **#200** | 0.075 | 332.1 | 18% |

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

Project Name: Trinadad Rancheria Hotel
CAInc File No: 16-319.1
Date: 10/3/16
Technician: KKL
Sample ID: B2-5
Depth: 23'
USCS Classification: Silty SAND

**Grain Size Analysis - ASTM 6913**



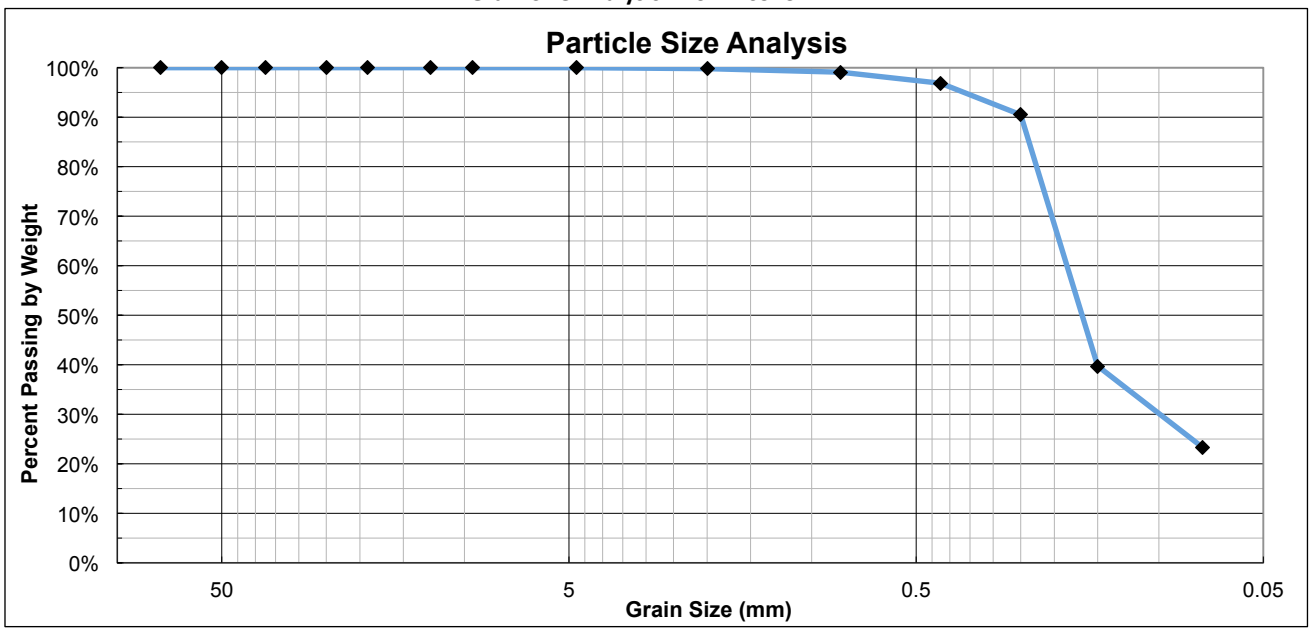

| % Cobble | % Gravel | | % Sand | | | % Fines |
|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt/Clay |
| | 0 | 0 | 3 | 38 | 44 | |
| **0** | **0** | | **85** | | | **15** |

| | | Sieve # | Opening mm | Cummulative Mass Retained (g) | % Passing % |
|---|---|---|---|---|---|
| Cobbles | | **3"** | 75 | 0.0 | 100% |
| Gravel | Coarse | **2"** | 50 | 0.0 | 100% |
| | | **1-1/2"** | 37.5 | 0.0 | 100% |
| | | **1"** | 25.0 | 0.0 | 100% |
| | | **3/4"** | 19.0 | 0.0 | 100% |
| | Fine | **1/2"** | 12.5 | 0.0 | 100% |
| | | **3/8"** | 9.50 | 0.0 | 100% |
| | | **#4** | 4.75 | 0.8 | 100% |
| Sand | Coarse | **#10** | 2.00 | 7.4 | 97% |
| | Medium | **#20** | 0.825 | 80.5 | 72% |
| | | **#40** | 0.425 | 117.3 | 59% |
| | Fine | **#60** | 0.250 | 130.1 | 54% |
| | | **#100** | 0.150 | 201.1 | 30% |
| | | **#200** | 0.075 | 243.0 | 15% |

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

Project Name: Trinadad Rancheria Hotel
CAInc File No: 16-319.1
Date: 10/7/16
Technician: CAP
Sample ID: B2-7
Depth: 33'
USCS Classification: Silty SAND

**Grain Size Analysis - ASTM 6913**




| % Cobble | % Gravel | | % Sand | | | % Fines |
|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt/Clay |
| | 0 | 0 | 0 | 3 | 74 | |
| **0** | **0** | | **77** | | | **23** |

| | | Sieve # | Opening mm | Cummulative Mass Retained (g) | % Passing % |
|---|---|---|---|---|---|
| Cobbles | | **3"** | 75 | 0.0 | 100% |
| Gravel | Coarse | **2"** | 50 | 0.0 | 100% |
| | | **1-1/2"** | 37.5 | 0.0 | 100% |
| | | **1"** | 25.0 | 0.0 | 100% |
| | | **3/4"** | 19.0 | 0.0 | 100% |
| | Fine | **1/2"** | 12.5 | 0.0 | 100% |
| | | **3/8"** | 9.50 | 0.0 | 100% |
| | | **#4** | 4.75 | 0.0 | 100% |
| Sand | Coarse | **#10** | 2.00 | 0.3 | 100% |
| | Medium | **#20** | 0.825 | 1.3 | 99% |
| | | **#40** | 0.425 | 4.5 | 97% |
| | Fine | **#60** | 0.250 | 13.6 | 90% |
| | | **#100** | 0.150 | 86.1 | 40% |
| | | **#200** | 0.075 | 109.5 | 23% |

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

Project Name: Trindad Rancheria Hotel
CAInc File No: 16-319.1
Date: 10/3/16
Technician: KKL

**200 Wash - ASTM D1140**

| Max Particle Size (100% Passing) | Standard Sieve Size | Recommended Min Mass of Test Specimens |
|---|---|---|
| 2 mm or less | No. 10 | 20 g |
| 4.75 mm | No. 4 | 100 g |
| 9.5 mm | 3/8 " | 500 g |
| 19.0 mm | 3/4 " | 2.5 kg |
| 37.5 mm | 1 1/2 " | 10 kg |
| 75.0 mm | 3 " | 50 kg |

Table from 6.2 of ASTM D1140

| Sample No. | B1-3 | B2-4 | | | |
|---|---|---|---|---|---|
| USCS Symbol | SM | SC | | | |
| Depth (ft.) | 16 | 18 | | | |
| Tare No. | P1 | P8 | | | |
| Tare (g) | 131.4 | 127.6 | | | |
| Dry Soil + Tare (g) | 464.4 | 465.8 | | | |
| Dry Mass before (g) | 333.0 | 338.2 | | | |
| Dry Mass after (g) | 281.4 | 265.1 | | | |
| Percent Fines (%) | 15 | 22 | | | |

# EXPANSION INDEX TEST

| | | | | | |
|---|---|---|---|---|---|
| **Project No:** | S9763-05-86 | **JOB** | Crawford 16-319.1 | | ASTM D4829 |
| **Sample** | Bulk 1 | **DATE** | 10/5-7/16 | **BY** | MR |

***Initial Ht =*** 1 inches  **$G_s$ =** 2.7  *Factor =* $\frac{(4)(1728)(2.2046)}{(\pi)(4.01)^2(1000)}$ = 0.3016

$EI_{raw} = \frac{(1000)(\Delta H)}{H}$

*Dry Density (pcf) =* $\gamma_d$ = *(Calc'd Dry Wt, gms) (Factor) / (Sample ht. in inches)*

$EI_{corrected} = EI_{raw} - \frac{(50-S)(65+EI_{raw})}{220-S}$

$Saturation = \frac{(100)(w)(Gs)(\gamma d)}{[(Gs)(62.4)]-\gamma d}$

where: w = % moisture in decimal
S = saturation in percent
H = initial height
ΔH = total change in height

| | |
|---|---|
| 0 - 20 | VERY LOW |
| 21 - 50 | LOW |
| 51 - 90 | MEDIUM |
| 91 - 130 | HIGH |
| > 130 | VERY HIGH |

| TRIAL 1 | | | | | TRIAL 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DATE and TIME | LOAD | DIAL READ | REV COUNT | TOTAL EXPAN | DATE and TIME | LOAD | DIAL READ | REV COUNT | TOTAL EXPAN |
| **DRY** | | | | | **DRY** | | | | |
| | 1 psi | | | | 10/5/2016 1:16 PM | 1 psi | 0.2278 | | |
| | 1 psi | | | 0.0000 | 10/5/2016 1:26 PM | 1 psi | 0.2274 | | -0.0004 |
| **WET** | | | | | | | | | |
| | 1 psi | | | 0.0000 | 10/5/2016 2:06 PM | 1 psi | 0.2104 | | -0.0170 |
| | 1 psi | | | 0.0000 | 10/5/2016 2:32 PM | 1 psi | 0.2304 | | 0.0030 |
| | 1 psi | | | 0.0000 | 10/5/2016 4:07 PM | 1 psi | 0.2302 | | 0.0028 |
| | 1 psi | | | 0.0000 | 10/5/2016 4:32 PM | 1 psi | 0.2307 | | 0.0033 |
| | 1 psi | | | 0.0000 | 10/5/2016 4:50 PM | 1 psi | 0.2307 | | 0.0033 |
| | 1 psi | | | 0.0000 | 10/6/2016 8:05 AM | 1 psi | 0.2303 | | 0.0029 |
| | 1 psi | | | 0.0000 | 10/6/2016 9:27 AM | 1 psi | 0.2303 | | 0.0029 |
| | 1 psi | | | 0.0000 | | 1 psi | | | |

| TRIAL 1 | | | | | | TRIAL 2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Moisture Content | | | Density | | | Moisture Content | | | Density | | |
| | Before | After | | Before | After | | Before | After | | Before | After |
| Tare No. | | | | | | Tare No. | Adj | MT-6 | | | |
| Gross Wet Wt (gm) | 983.7 | | Wet+ring (gms) | 549.5 | | Gross Wet Wt (gm) | | 854.45 | Wet+ring (gms) | 550.7 | 588.65 |
| Gross Dry Wt (gm) | 901.6 | | Ring (gms) | 192.8 | | Gross Dry Wt (gm) | | 771.58 | Ring (gms) | 192.8 | |
| Water Loss (gm) | 82.1 | | Wet Soil (gms) | 356.7 | | Water Loss (gm) | | 82.87 | Wet Soil (gms) | 357.9 | |
| Tare Wt. (gm) | 224 | | Calc'd dry soil (gms) | 318.2 | | Tare Wt. (gm) | | 459.43 | Calc'd dry soil (gms) | 314.5 | 312.8 |
| Net Dry Wt (gm) | 677.6 | | Dry Dens (pcf) | 96.0 | | Net Dry Wt (gm) | | 312.15 | Dry Dens (pcf) | 94.9 | 94.0 |
| % Moisture | 12.1 | | | | | % Moisture | 13.8 | 26.5 | | | |

| | | | | |
|---|---|---|---|---|
| Calculated Saturation (%) | 43.3 | | Calculated Saturation (%) | 48.0 / 90.5 |
| Total Swell (%) | | | Total Swell (%) | 0.3 |
| Expansion Index | | | Expansion Index | 3 |

# EXPANSION INDEX TEST

| | | | | | |
|---|---|---|---|---|---|
| **Project No:** | S9763-05-86 | **JOB** | Crawford 16-319.1 | | ASTM D4829 |
| **Sample** | Bulk 2 | **DATE** | 10/5-7/16 | **BY** | MR |

***Initial Ht =*** 1 inches  **$G_s$ =** 2.7  *Factor =* $\frac{(4)(1728)(2.2046)}{(\pi)(4.01)^2(1000)}$ = 0.3016

$E\,I_{raw} = \frac{(1000)(\Delta H)}{H}$

*Dry Density (pcf) =* $\gamma_d$ = *(Calc'd Dry Wt, gms) (Factor) / (Sample ht. in inches)*

$E\,I_{corrected} = E\,I_{raw} - \frac{(50-S)(65+E\,I_{raw})}{220-S}$

$Saturation = \frac{(100)(w)(Gs)(\gamma d)}{[(Gs)(62.4)]-\gamma d}$

where: w = % moisture in decimal
S = saturation in percent
H = initial height
ΔH = total change in height

| | |
|---|---|
| 0 - 20 | VERY LOW |
| 21 - 50 | LOW |
| 51 - 90 | MEDIUM |
| 91 - 130 | HIGH |
| > 130 | VERY HIGH |

## TRIAL 1

| DATE and TIME | LOAD | DIAL READ | REV COUNT | TOTAL EXPAN |
|---|---|---|---|---|
| **DRY** | | | | |
| | 1 psi | | | |
| | 1 psi | | | 0.0000 |
| **WET** | | | | |
| | 1 psi | | | 0.0000 |
| | 1 psi | | | 0.0000 |
| | 1 psi | | | 0.0000 |
| | 1 psi | | | 0.0000 |
| | 1 psi | | | 0.0000 |
| | 1 psi | | | 0.0000 |
| | 1 psi | | | 0.0000 |
| | 1 psi | | | 0.0000 |

## TRIAL 2

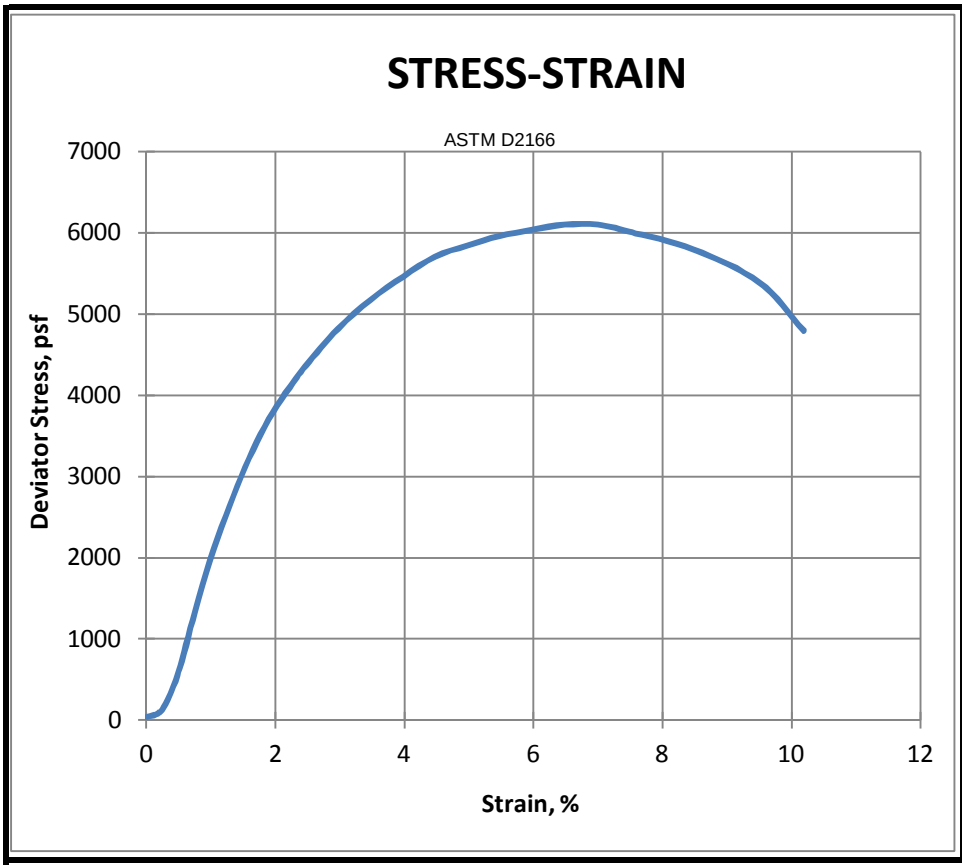
| DATE and TIME | LOAD | DIAL READ | REV COUNT | TOTAL EXPAN |
|---|---|---|---|---|
| **DRY** | | | | |
| 10/5/2016 2:19 PM | 1 psi | 0.2706 | | |
| 10/5/2016 2:29 PM | 1 psi | 0.2711 | | 0.0005 |
| **WET** | | | | |
| 10/5/2016 4:05 PM | 1 psi | 0.3075 | | 0.0364 |
| 10/5/2016 4:30 PM | 1 psi | 0.3110 | | 0.0399 |
| 10/5/2016 4:52 PM | 1 psi | 0.3121 | | 0.0410 |
| 10/6/2016 8:04 AM | 1 psi | 0.3245 | | 0.0534 |
| 10/6/2016 9:26 AM | 1 psi | 0.3246 | | 0.0535 |
| | | | | |
| | | | | |
| | | | | |

## TRIAL 1

| Moisture Content | Before | After | Density | Before | After |
|---|---|---|---|---|---|
| Tare No. | | | | | |
| Gross Wet Wt (gm) | 734.19 | | Wet+ring (gms) | | |
| Gross Dry Wt (gm) | 686.5 | | Ring (gms) | | |
| Water Loss (gm) | 47.69 | | Wet Soil (gms) | 0 | |
| Tare Wt. (gm) | 111.4 | | Calc'd dry soil (gms) | 0.0 | |
| Net Dry Wt (gm) | 575.1 | | Dry Dens (pcf) | 0.0 | |
| % Moisture | 8.3 | | | | |
| Calculated Saturation (%) | | | | 0.0 | |
| Total Swell (%) | | | | | |
| Expansion Index | | | | | |

## TRIAL 2

| Moisture Content | Before | After | Density | Before | After |
|---|---|---|---|---|---|
| Tare No. | Adj | MT-6 | | | |
| Gross Wet Wt (gm) | | 661.45 | Wet+ring (gms) | 624.3 | 657.18 |
| Gross Dry Wt (gm) | | 593.57 | Ring (gms) | 199.6 | |
| Water Loss (gm) | | 67.88 | Wet Soil (gms) | 424.7 | |
| Tare Wt. (gm) | | 205.1 | Calc'd dry soil (gms) | 393.2 | 389.5 |
| Net Dry Wt (gm) | | 388.47 | Dry Dens (pcf) | 118.6 | 111.5 |
| % Moisture | 8.0 | 17.5 | | | |
| Calculated Saturation (%) | | | | 51.4 | 92.4 |
| Total Swell (%) | | | | 5.4 | |
| Expansion Index | | | | 54 | |




**Failure Photo**

| **Sample Description** Gravel up to 1/2" removed and patched as possible | |
|---|---|
| Sample ID | B3-2 |
| Sample Depth (feet) | 11.00 |
| Material Description | Black lean CLAY with gravel (shale) |
| **Initial Conditions at Start of Test** | |
| Height (inch) average of 3 | 4.97 |
| Diameter (inch) average of 3 | 2.39 |
| Moisture Content (%) | 8.5 |
| Dry Density (pcf) | 133.0 |
| Estimated Specific Gravity | 2.7 |
| Saturation (%) | 86.5 |
| **Shear Test Conditions** | |
| Strain Rate (%/min) | 0.9925 |
| Major Principal Stress at Failure (psf) | 6100 |
| Strain at Failure (%) | 6.5 |
| **Test Results** | |
| Unconfined Compressive Strength (tons/ft$^2$) | 3.1 |
| Unconfined Compressive Strength (lbs/ft$^2$) | 6101 |
| Shear Strength (tons/ft$^2$) | 1.5 |
| Shear Strength (lbs/ft$^2$) | 3051 |

GEOCON CONSULTANTS, INC.
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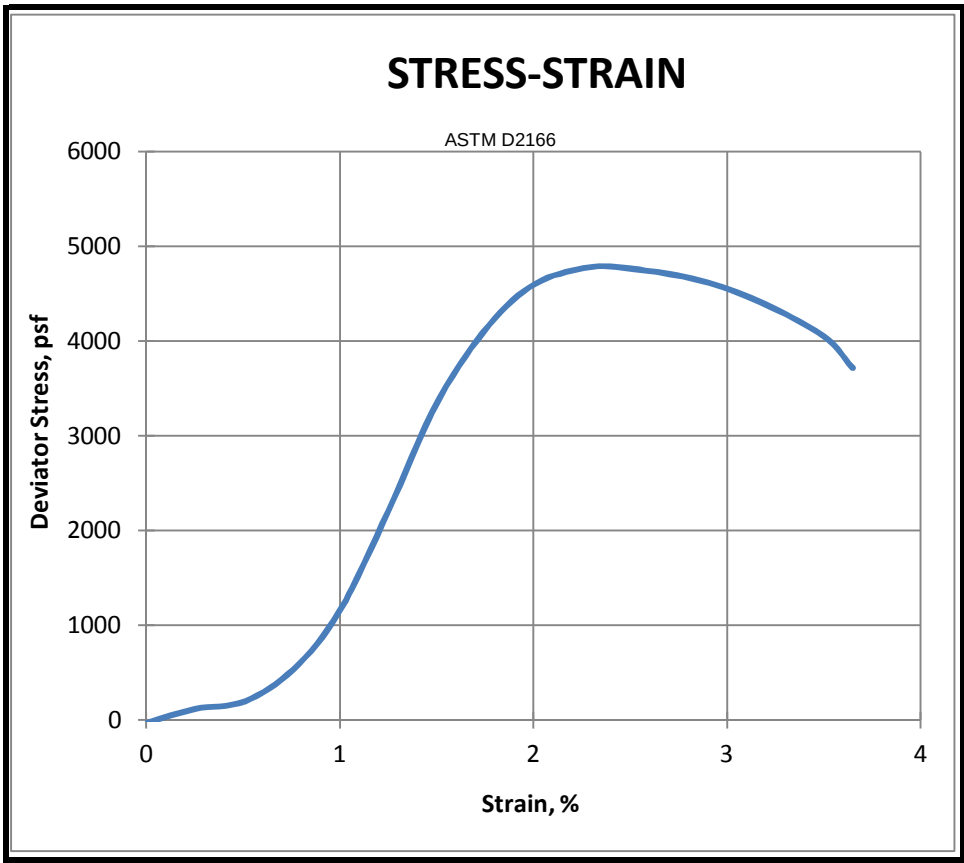
3160 Gold Valley Drive, Suite 800
Rancho Cordova, California 95742
Telephone: (916) 852-9118
Fax: (916) 852-9132

**Unconfined Compressive Strength (ASTM D2166)**

**Project:** Crawford 16-319.1
**Location:**
**Number:** S9763-05-86
**Figure:**




**Failure Photo**

| **Sample Description** Sample partially remolded in order to perform test (1/2" gravel) | |
|---|---|
| Sample ID | B3-3 |
| Sample Depth (feet) | 16.00 |
| Material Description | Black lean CLAY with gravel (shale) |
| **Initial Conditions at Start of Test** | |
| Height (inch) average of 3 | 4.69 |
| Diameter (inch) average of 3 | 2.42 |
| Moisture Content (%) | 4.9 |
| Dry Density (pcf) | 138.2 |
| Estimated Specific Gravity | 2.7 |
| Saturation (%) | 60.4 |
| **Shear Test Conditions** | |
| Strain Rate (%/min) | 0.9872 |
| Major Principal Stress at Failure (psf) | 4770 |
| Strain at Failure (%) | 2.5 |
| **Test Results** | |
| Unconfined Compressive Strength (tons/ft$^2$) | 2.4 |
| Unconfined Compressive Strength (lbs/ft$^2$) | 4774 |
| Shear Strength (tons/ft$^2$) | 1.2 |
| Shear Strength (lbs/ft$^2$) | 2387 |

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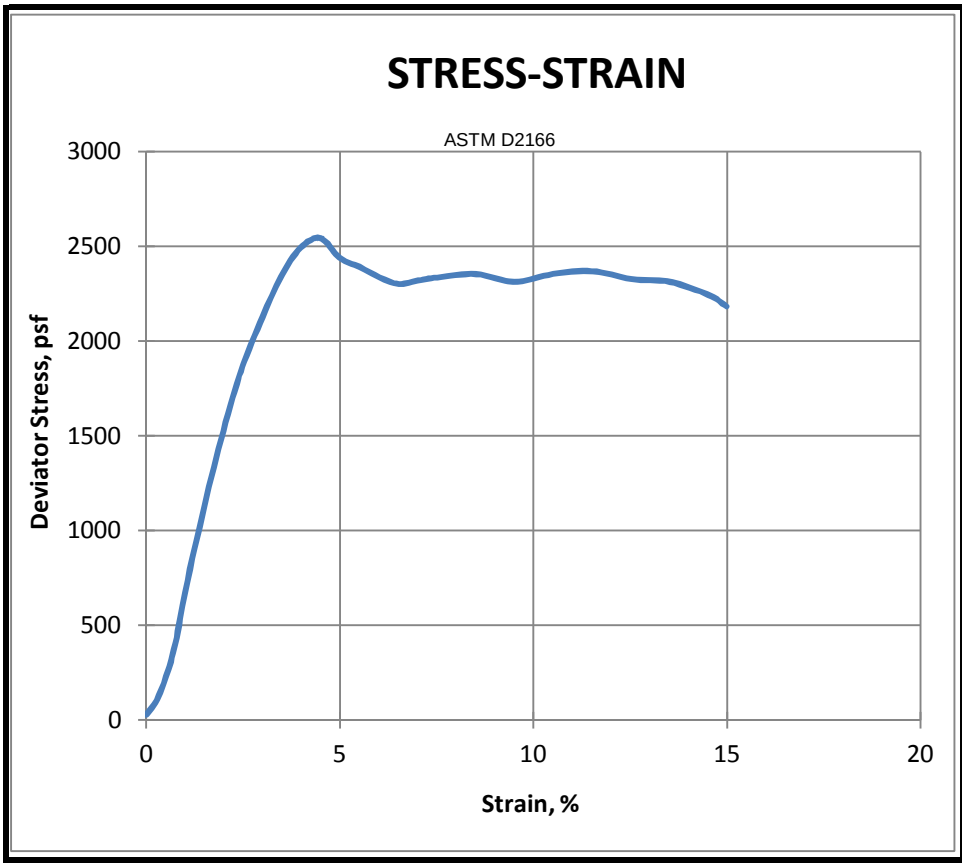
Geocon Consultants, Inc.
3160 Gold Valley Drive, Suite 800
Rancho Cordova, California 95742
Telephone: (916) 852-9118
Fax: (916) 852-9132

**Unconfined Compressive Strength (ASTM D2166)**

**Project:** Crawford 16-319.1
**Location:**
**Number:** S9763-05-86
**Figure:**




**Failure Photo**

| **Sample Description** Sample partially remolded in order to perform test | |
|---|---|
| Sample ID | B4-1 |
| Sample Depth (feet) | 6.00 |
| Material Description | Black lean CLAY with gravel (shale) |
| **Initial Conditions at Start of Test** | |
| Height (inch) average of 3 | 4.94 |
| Diameter (inch) average of 3 | 2.39 |
| Moisture Content (%) | 8.8 |
| Dry Density (pcf) | 129.6 |
| Estimated Specific Gravity | 2.7 |
| Saturation (%) | 79.6 |
| **Shear Test Conditions** | |
| Strain Rate (%/min) | 0.9967 |
| Major Principal Stress at Failure (psf) | 2540 |
| Strain at Failure (%) | 4.5 |
| **Test Results** | |
| Unconfined Compressive Strength (tons/ft$^2$) | 1.3 |
| Unconfined Compressive Strength (lbs/ft$^2$) | 2544 |
| Shear Strength (tons/ft$^2$) | 0.6 |
| Shear Strength (lbs/ft$^2$) | 1272 |

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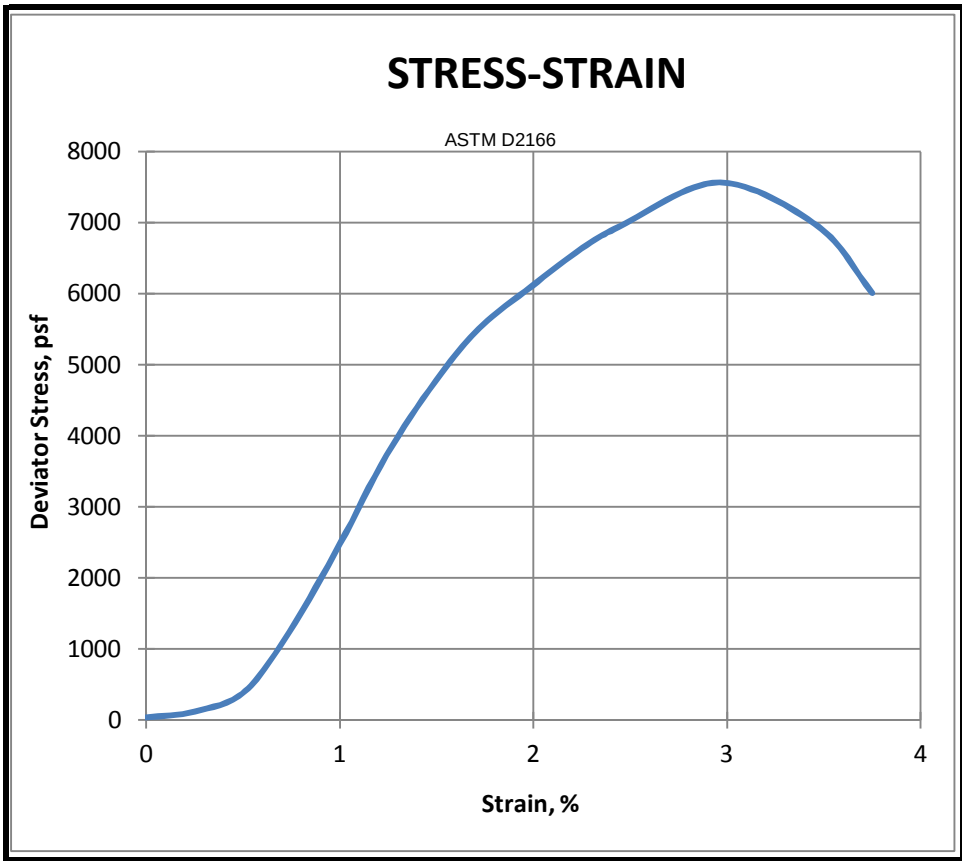
**Unconfined Compressive Strength (ASTM D2166)**

**Project:** Crawford 16-319.1
**Location:**
**Number:** S9763-05-86
**Figure:**




**Failure Photo**

| | |
|---|---|
| **Sample Description** | |
| Sample ID | B6-2 |
| Sample Depth (feet) | 11.00 |
| Material Description | Dark gray lean CLAY |
| **Initial Conditions at Start of Test** | |
| Height (inch) average of 3 | 4.97 |
| Diameter (inch) average of 3 | 2.39 |
| Moisture Content (%) | 6.6 |
| Dry Density (pcf) | 123.6 |
| Estimated Specific Gravity | 2.7 |
| Saturation (%) | 49.3 |
| **Shear Test Conditions** | |
| Strain Rate (%/min) | 1.0151 |
| Major Principal Stress at Failure (psf) | 7570 |
| Strain at Failure (%) | 3.0 |
| **Test Results** | |
| Unconfined Compressive Strength (tons/ft$^2$) | 3.8 |
| Unconfined Compressive Strength (lbs/ft$^2$) | 7566 |
| Shear Strength (tons/ft$^2$) | 1.9 |
| Shear Strength (lbs/ft$^2$) | 3783 |

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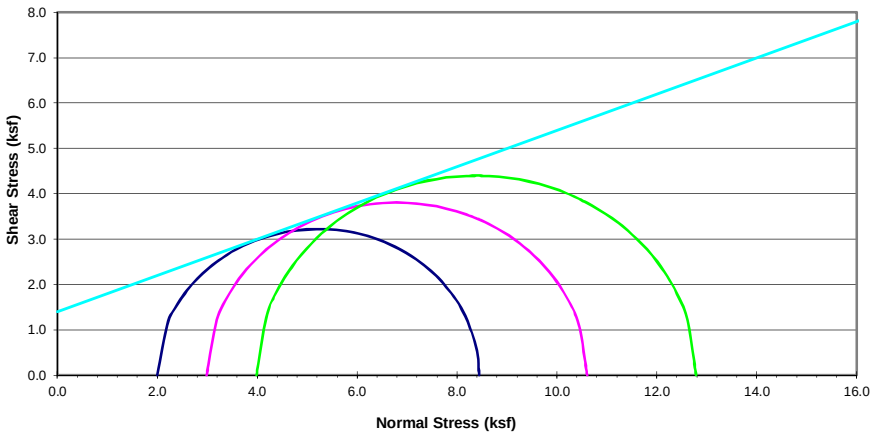
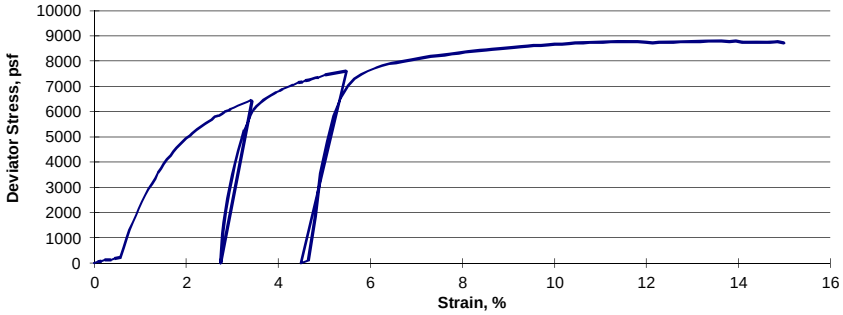
**Unconfined Compressive Strength (ASTM D2166)**

**Project:** Crawford 16-319.1
**Location:**
**Number:** S9763-05-86
**Figure:**

## MOHR'S CIRCLES




## STRESS-STRAIN




## Failure Photo

| Test Results | | |
|---|---|---|
| | ϕ, degrees | **21.8** |
| | c, psf | **1400** |

| Sample Description | | |
|---|---|---|
| | Sample ID | B4-7 |
| | Sample Depth (feet) | 36 |
| | Material Description | Black lean CLAY (Shale) |

| Initial Conditions at Start of Stage | | | | |
|---|---|---|---|---|
| Sample ID (psf), minor principal stress | | **2000** | **3000** | **4000** |
| | Height (inch) | 4.970 | 4.831 | 4.593 |
| | Diameter (inch) | 2.396 | 2.430 | 2.456 |
| | Moisture Content (%) | 6.2 | 6.2 | 6.2 |
| | Dry Density (pcf) | 143.0 | 143.0 | 143.0 |
| | Saturation (%) | 93.7 | 93.7 | 93.7 |

| Shear Test Conditions | | | | |
|---|---|---|---|---|
| | Strain Rate (%/min) | 0.2956 | 0.2941 | 0.2990 |
| | Major Principal Stress at Failure (psf) | 8440 | 10610 | 12790 |
| | Strain at failure (%) | 3.39 | 5.47 | 13.50 |
| | Deviator Stress and Fail (psf) | 6440 | 7620 | 8800 |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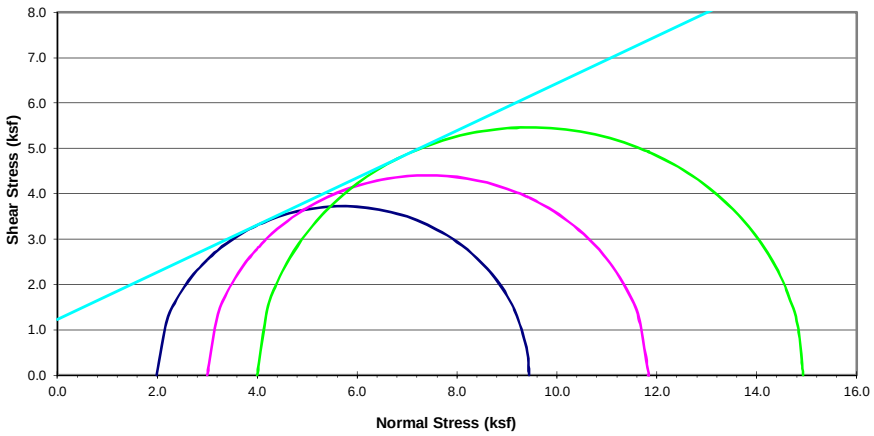
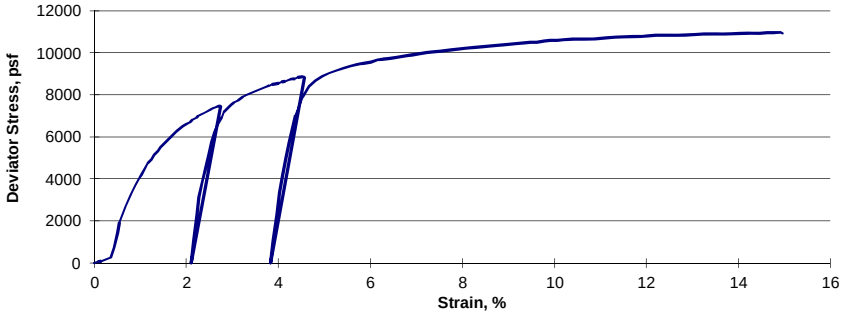
**Triaxial Shear Strength - UU Test (staged)**

**Project:** Crawford 16-319.1
**Location:**
**Number:** S9763-05-86
**Figure:**

## MOHR'S CIRCLES




## STRESS-STRAIN




## Failure Photo

| Test Results | | |
|---|---|---|
| | ϕ, degrees | **27.5** |
| | c, psf | **1225** |

| Sample Description | | |
|---|---|---|
| | Sample ID | B5-8 |
| | Sample Depth (feet) | 41 |
| | Material Description | Black lean CLAY (Shale) |

| Initial Conditions at Start of Stage | | | | |
|---|---|---|---|---|
| Sample ID (psf), minor principal stress | | **2000** | **3000** | **4000** |
| | Height (inch) | 4.800 | 4.697 | 4.510 |
| | Diameter (inch) | 2.403 | 2.429 | 2.451 |
| | Moisture Content (%) | 6.2 | 6.2 | 6.2 |
| | Dry Density (pcf) | 141.0 | 141.0 | 141.0 |
| | Saturation (%) | 86.7 | 86.7 | 86.7 |

| Shear Test Conditions | | | | |
|---|---|---|---|---|
| | Strain Rate (%/min) | 0.2940 | 0.2946 | 0.2984 |
| | Major Principal Stress at Failure (psf) | 9440 | 11820 | 14930 |
| | Strain at failure (%) | 2.70 | 4.56 | 14.32 |
| | Deviator Stress and Fail (psf) | 7450 | 8820 | 10930 |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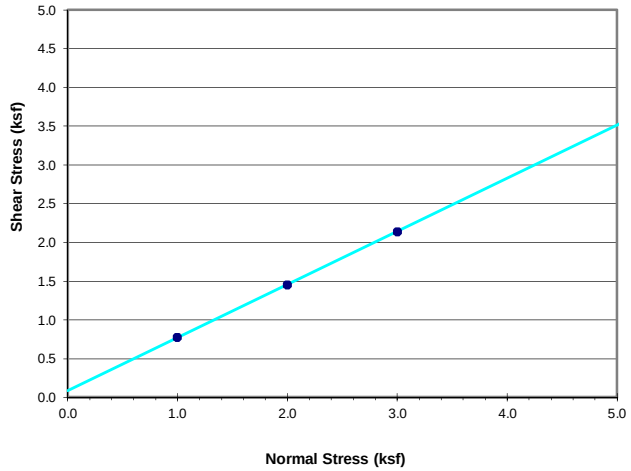
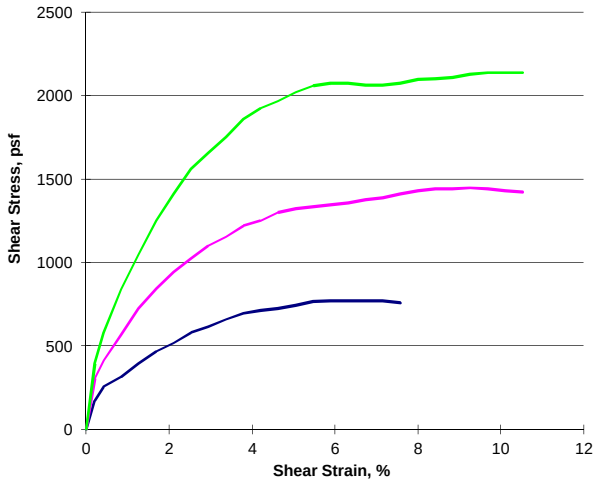
**Triaxial Shear Strength - UU Test (staged)**

**Project:** Crawford 16-319.1
**Location:**
**Number:** S9763-05-86
**Figure:**

**SHEAR STRENGTH**




**STRESS-STRAIN**




| **Sample Description** | | | |
|---|---|---|---|
| Boring Number | B1-4 | | |
| Sample Depth (feet) | | | |
| Material Description | Olive Silty SAND | | |
| **Initial Conditions at Start of Test** | | | |
| **Sample ID (psf)** | **1000** | **2000** | **3000** |
| Height (inch) | 1.00 | 1.00 | 1.00 |
| Diameter (inch) | 2.375 | 2.375 | 2.375 |
| Moisture Content (%) | 14.1 | 13.0 | 13.1 |
| Dry Density (pcf) | 93.9 | 93.7 | 95.8 |
| Estimated Specific Gravity | 2.70 | 2.70 | 2.70 |
| Saturation (%) | 47.9 | 43.9 | 46.7 |
| **Shear Test Conditions** | | | |
| Strain Rate (%/min) | 1.004 | 1.049 | 1.026 |
| Major Principle Stress at Failure (psf) | 769 | 1447 | 2138 |
| Strain at Failure (%) | 5.89 | 9.26 | 9.68 |
| **Test Results** | | | |
| $\phi$, degrees **34.4** | | | |
| c, psf **85** | | | |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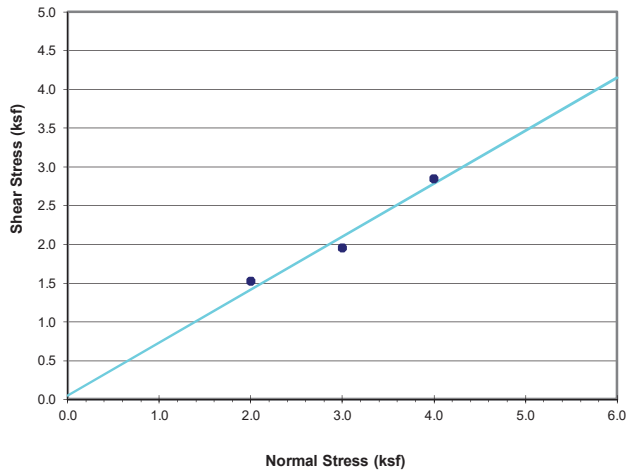
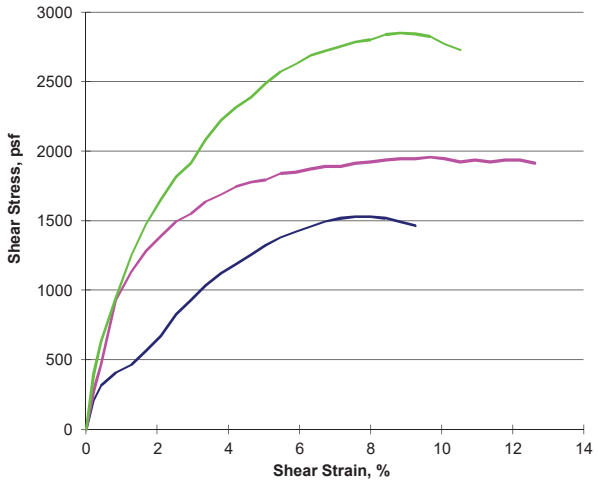
**Direct Shear Strength Test (ASTM D3080)**

**Project:** Crawford Lab 16-319.1
**Location:**
**Number:** S9763-05-86
**Figure:**

**SHEAR STRENGTH**




**STRESS-STRAIN**




| **Sample Description** | | | |
|---|---|---|---|
| Boring Number | B2-6 | | |
| Sample Depth (feet) | 28 | | |
| Material Description | Olive Brown Silty SAND | | |
| **Initial Conditions at Start of Test** | | | |
| **Sample ID (psf)** | **2000** | **3000** | **4000** |
| Height (inch) | 1.00 | 1.00 | 1.00 |
| Diameter (inch) | 2.375 | 2.375 | 2.375 |
| Moisture Content (%) | 13.2 | 13.5 | 14.4 |
| Dry Density (pcf) | 94.2 | 92.8 | 97.9 |
| Estimated Specific Gravity | 2.70 | 2.70 | 2.70 |
| Saturation (%) | 45.3 | 44.8 | 53.8 |
| **Shear Test Conditions** | | | |
| Strain Rate (%/min) | 0.802 | 0.842 | 0.833 |
| Major Principle Stress at Failure (psf) | 1527 | 1956 | 2848 |
| Strain at Failure (%) | 7.58 | 9.68 | 8.84 |
| **Test Results** | | | |
| $\phi$, degrees | **34.3** | | |
| c, psf | **50** | | |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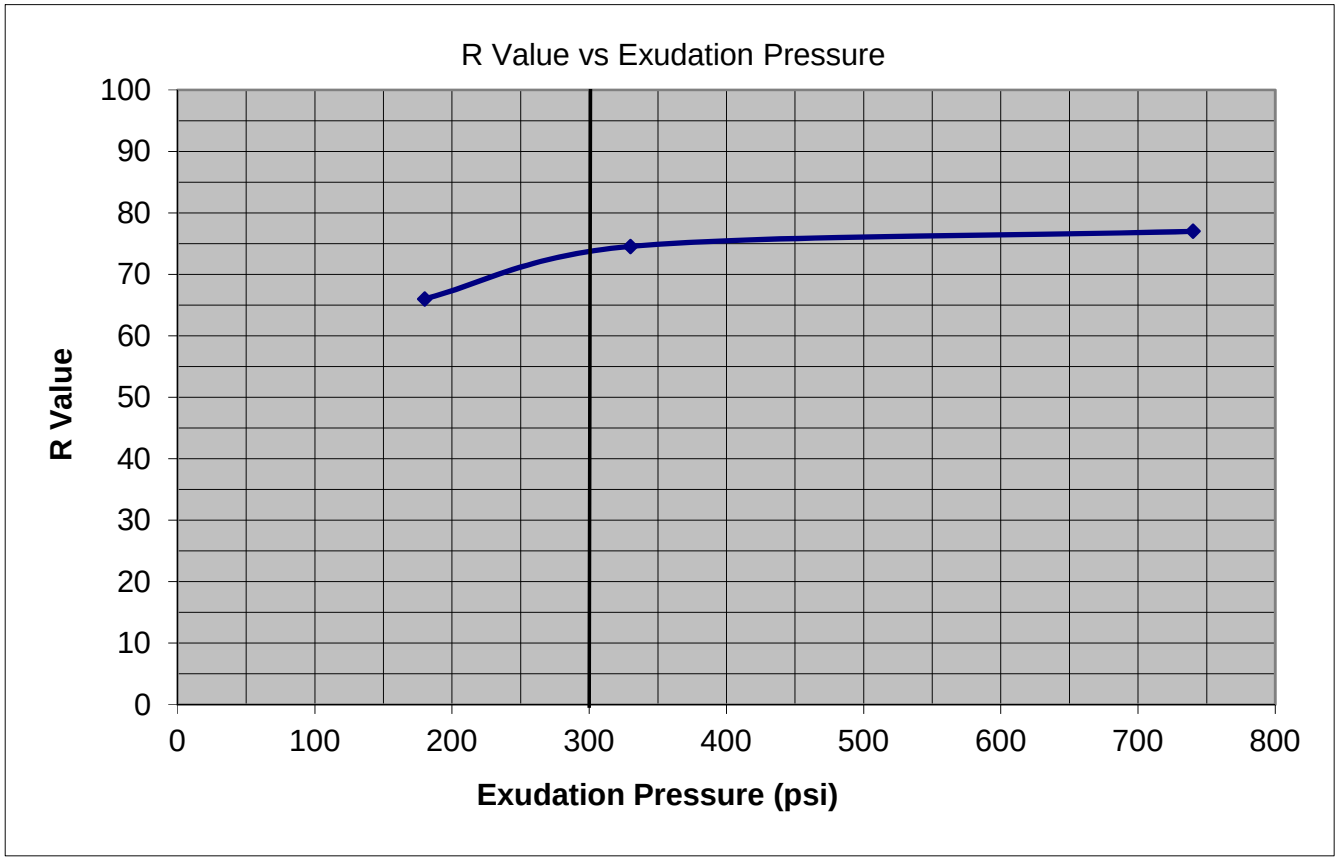
**Direct Shear Strength Test (ASTM D3080)**

**Project:** Crawford Lab 16-319.1
**Location:**
**Number:** S9763-05-86
**Figure:**




| **Sample ID & Description** | | | | |
|---|---|---|---|---|
| | Boring Number | Bulk-1 | | |
| | Sample Depth (feet) | -- | | |
| | Material Description | Dark reddish brown Silty SAND with gravel | | |
| **Test Data** | | | | |
| | Specimen | D | E | F |
| | Exudation Pressure (psi) | 180 | 330 | 740 |
| | Expansion Dial (.0001") | 22 | 25 | 38 |
| | Expansion Pressure (psf) | 95 | 108 | 165 |
| | Resistance 'R' Value | 66 | 75 | 77 |
| | Moisture at test (%) | 16.5 | 15.6 | 14.7 |
| | Dry density at test (pcf) | 106.7 | 104.2 | 110.0 |
| | R Value at 300 psi exudation pressure | | **74** | |
| | R Value by expansion pressure (TI=5.0) | | 63 | |

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**R Value By Exudation**

Project: Crawford 16-319.1
Location:
Number: S9763-05-86
Figure:

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


Date Reported 09/28/16
Date Submitted 09/23/16

To: Nick Anderson
Crawford and Associates
5701 Lonetree Blvd, Suite 110
Rocklin, CA, 95765

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

The reported analysis was requested for the following:
Location : 16-319.1 Site ID: B6-1
Thank you for your business.

* For future reference to this analysis please use SUN # 72899 - 152178

---

## EVALUATION FOR SOIL CORROSION

| | | |
|---|---|---|
| Soil pH | 7.72 | |
| Minimum Resistivity | 1.72 | ohm-cm (x1000) |
| Chloride | 6.9 ppm | 0.0007 % |
| Sulfate-S | 100.4 ppm | 0.01 % |

METHODS:
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

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


Date Reported 09/28/16
Date Submitted 09/23/16

To: Nick Anderson
Crawford and Associates
5701 Lonetree Blvd, Suite 110
Rocklin, CA, 95765

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

The reported analysis was requested for the following:
Location : 16-319.1 Site ID: B5-9
Thank you for your business.

* For future reference to this analysis please use SUN # 72899 - 152177

---

EVALUATION FOR SOIL CORROSION

| | | |
|---|---|---|
| Soil pH | 8.55 | |
| Minimum Resistivity | 0.80 | ohm-cm (x1000) |
| Chloride | 12.9 ppm | 0.0013 % |
| Sulfate-S | 131.8 ppm | 0.0132 % |

METHODS:
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

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


Date Reported 09/28/16
Date Submitted 09/23/16

To: Nick Anderson
Crawford and Associates
5701 Lonetree Blvd, Suite 110
Rocklin, CA, 95765

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

The reported analysis was requested for the following:
Location : 16-319.1 Site ID: B4-8
Thank you for your business.

* For future reference to this analysis please use SUN # 72899 - 152176

---

EVALUATION FOR SOIL CORROSION

| | | |
|---|---|---|
| Soil pH | 8.54 | |
| Minimum Resistivity | 1.85 | ohm-cm (x1000) |
| Chloride | 3.7 ppm | 0.0004 % |
| Sulfate-S | 19.4 ppm | 0.0019 % |

METHODS:
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

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


Date Reported 09/28/16
Date Submitted 09/23/16

To: Nick Anderson
Crawford and Associates
5701 Lonetree Blvd, Suite 110
Rocklin, CA, 95765

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

The reported analysis was requested for the following:
Location : 16-319.1 Site ID: B4-4
Thank you for your business.

* For future reference to this analysis please use SUN # 72899 - 152175

---

EVALUATION FOR SOIL CORROSION

| | | | | |
|---|---|---|---|---|
| Soil pH | 8.18 | | | |
| Minimum Resistivity | 1.15 | ohm-cm (x1000) | | |
| Chloride | 12.0 | ppm | 0.0012 | % |
| Sulfate-S | 175.2 | ppm | 0.0175 | % |

METHODS:
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

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


Date Reported 09/28/16
Date Submitted 09/23/16

To: Nick Anderson
Crawford and Associates
5701 Lonetree Blvd, Suite 110
Rocklin, CA, 95765

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

The reported analysis was requested for the following:
Location : 16-319.1 Site ID: B3-7
Thank you for your business.

* For future reference to this analysis please use SUN # 72899 - 152174

---

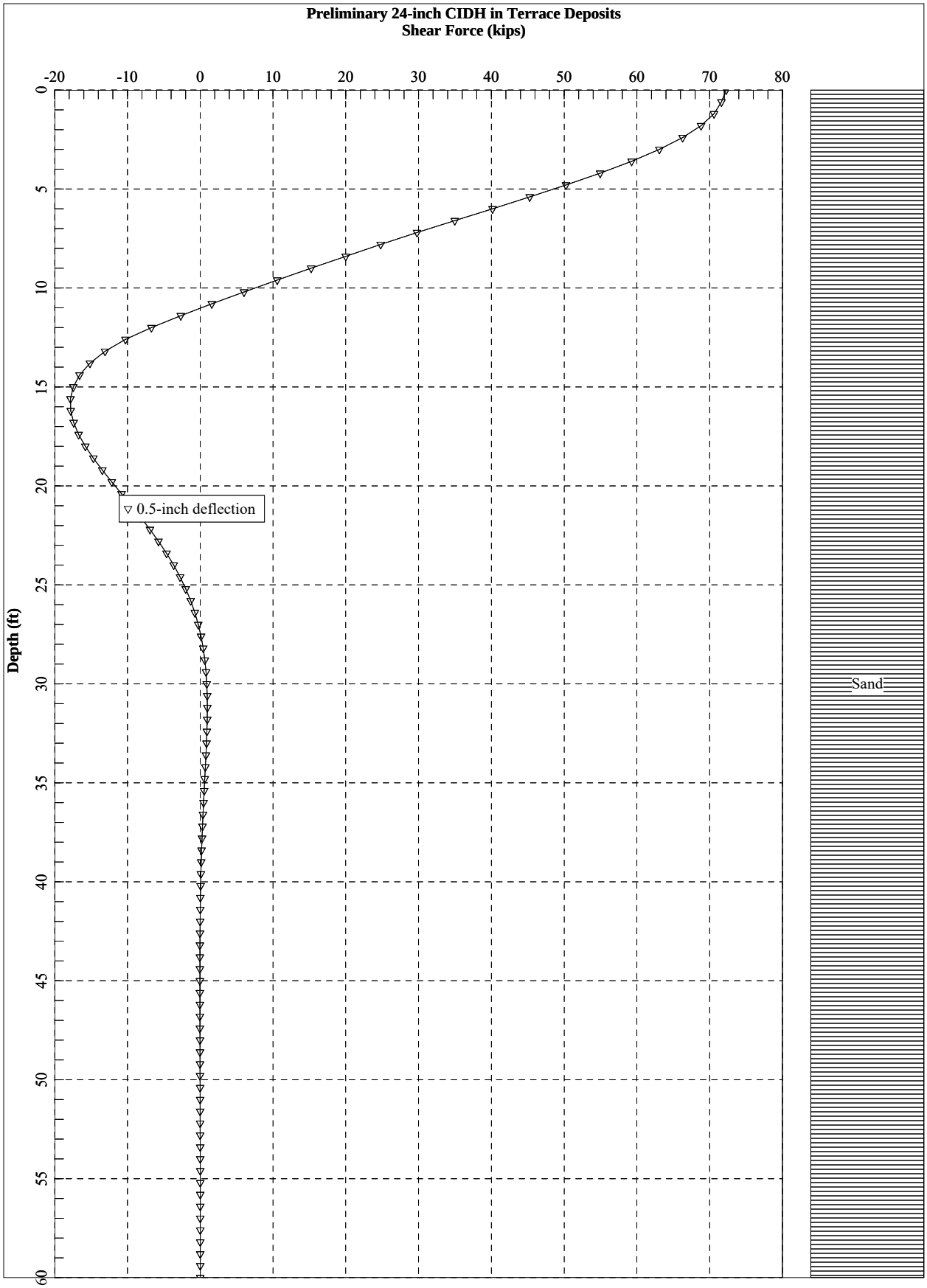
EVALUATION FOR SOIL CORROSION

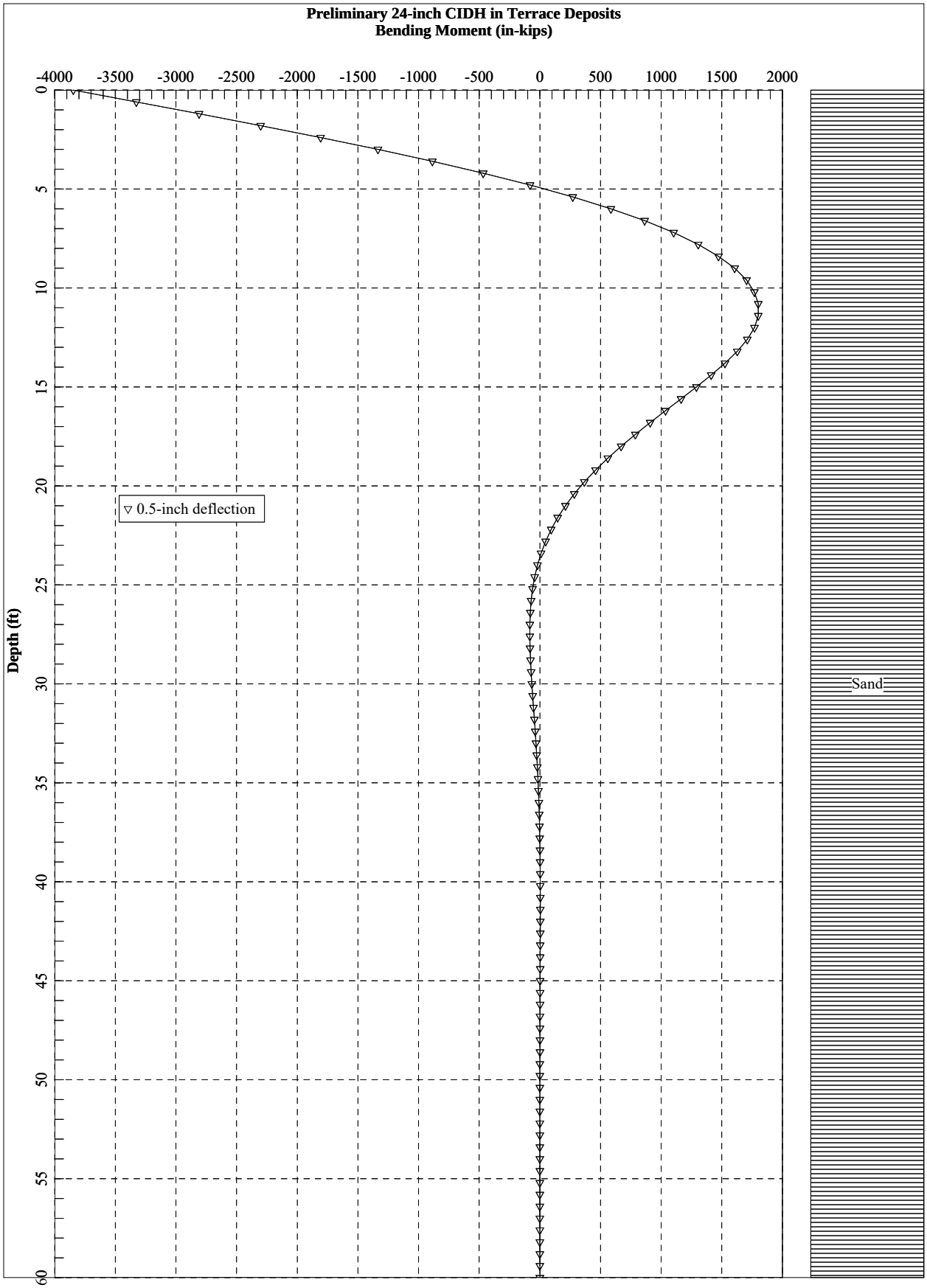
| | | |
|---|---|---|
| Soil pH | 8.57 | |
| Minimum Resistivity | 1.07 | ohm-cm (x1000) |
| Chloride | 12.1 ppm | 0.0012 % |
| Sulfate-S | 225.9 ppm | 0.0226 % |

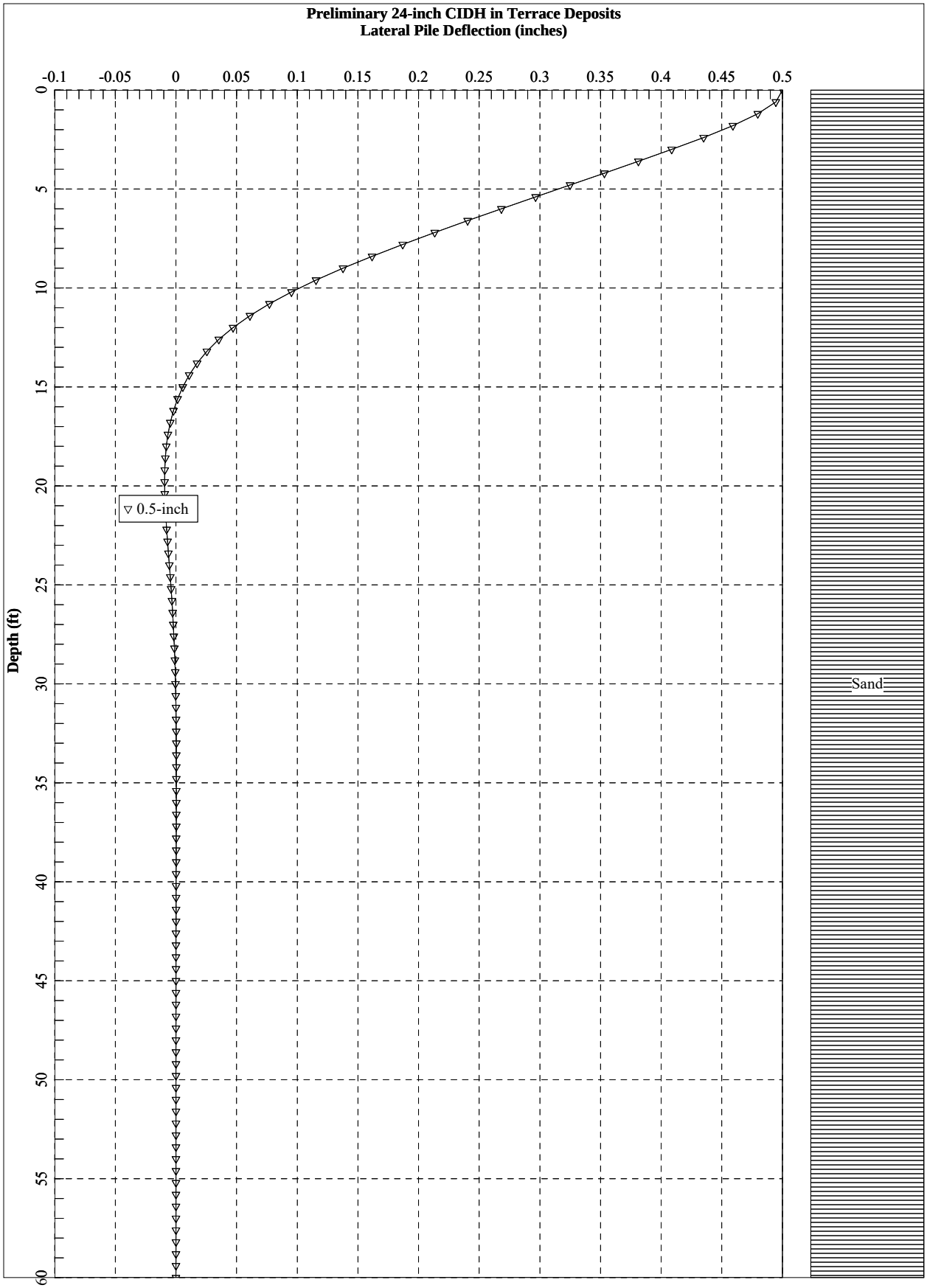
METHODS:
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

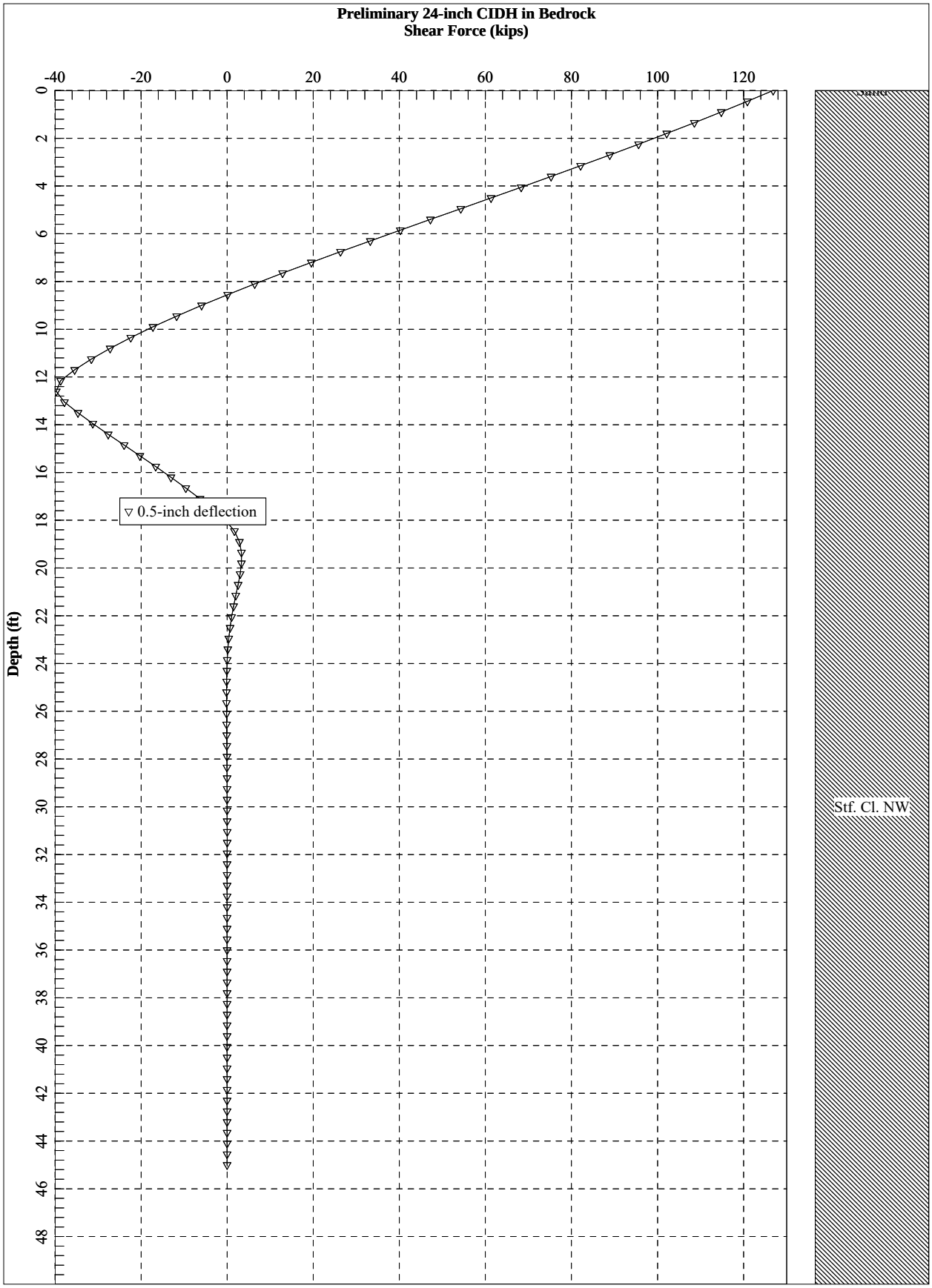
# APPENDIX C

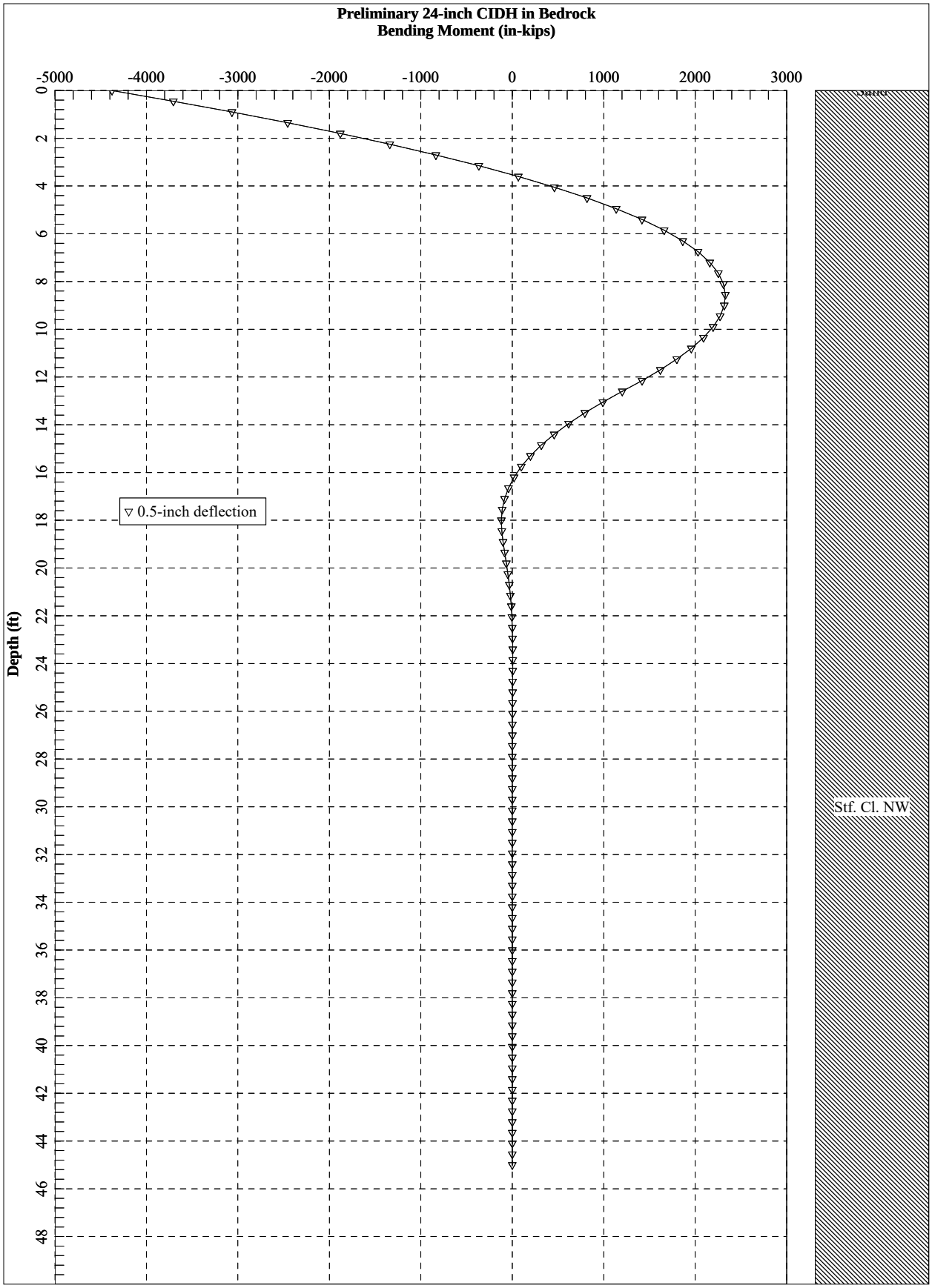
**LPile Outputs**

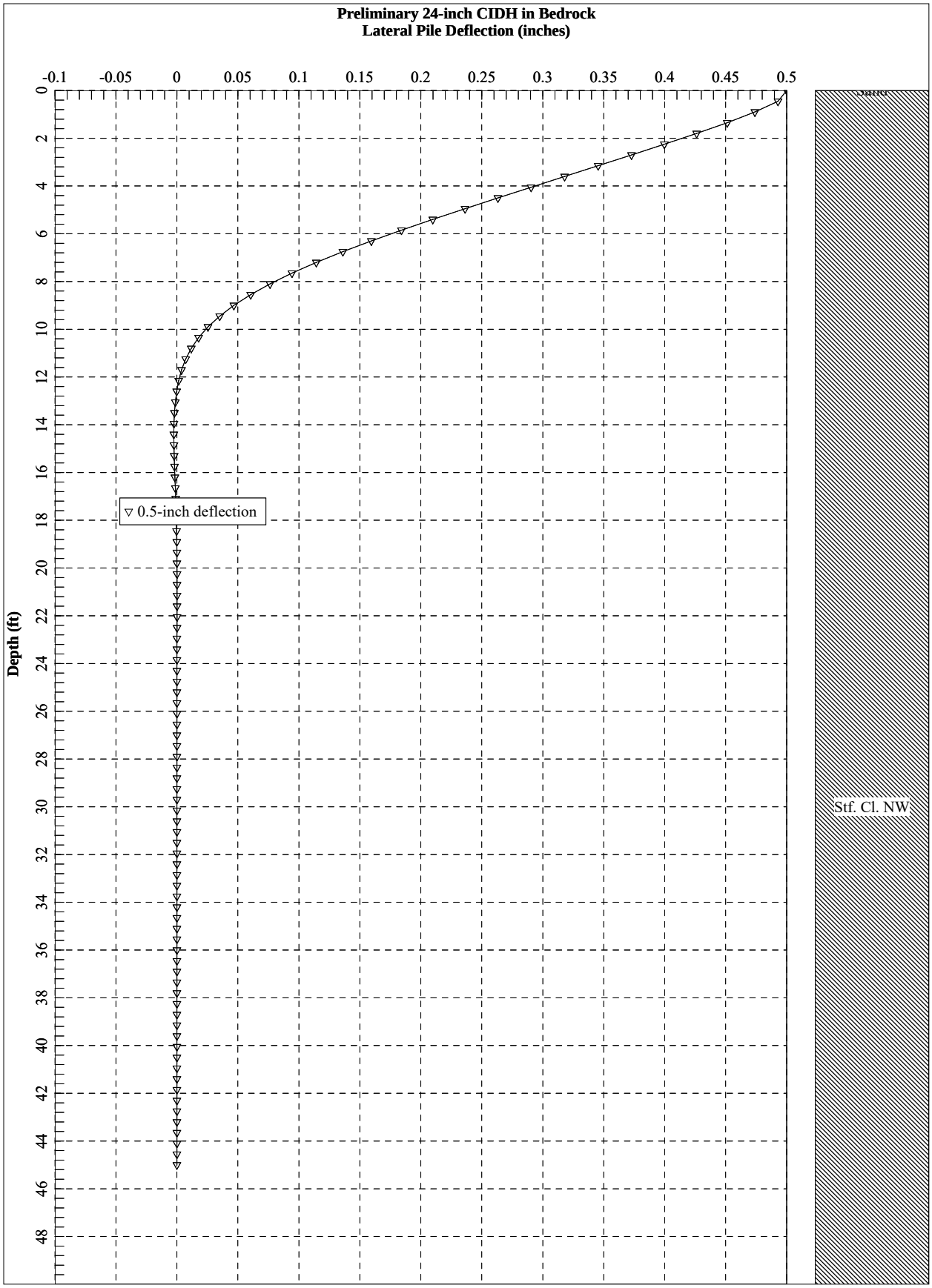

Preliminary 24-inch CIDH in Terrace Deposits
Shear Force (kips)
-20
-10
0
10
20
30
40
50
60
70
80
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
0.5-inch deflection
Sand

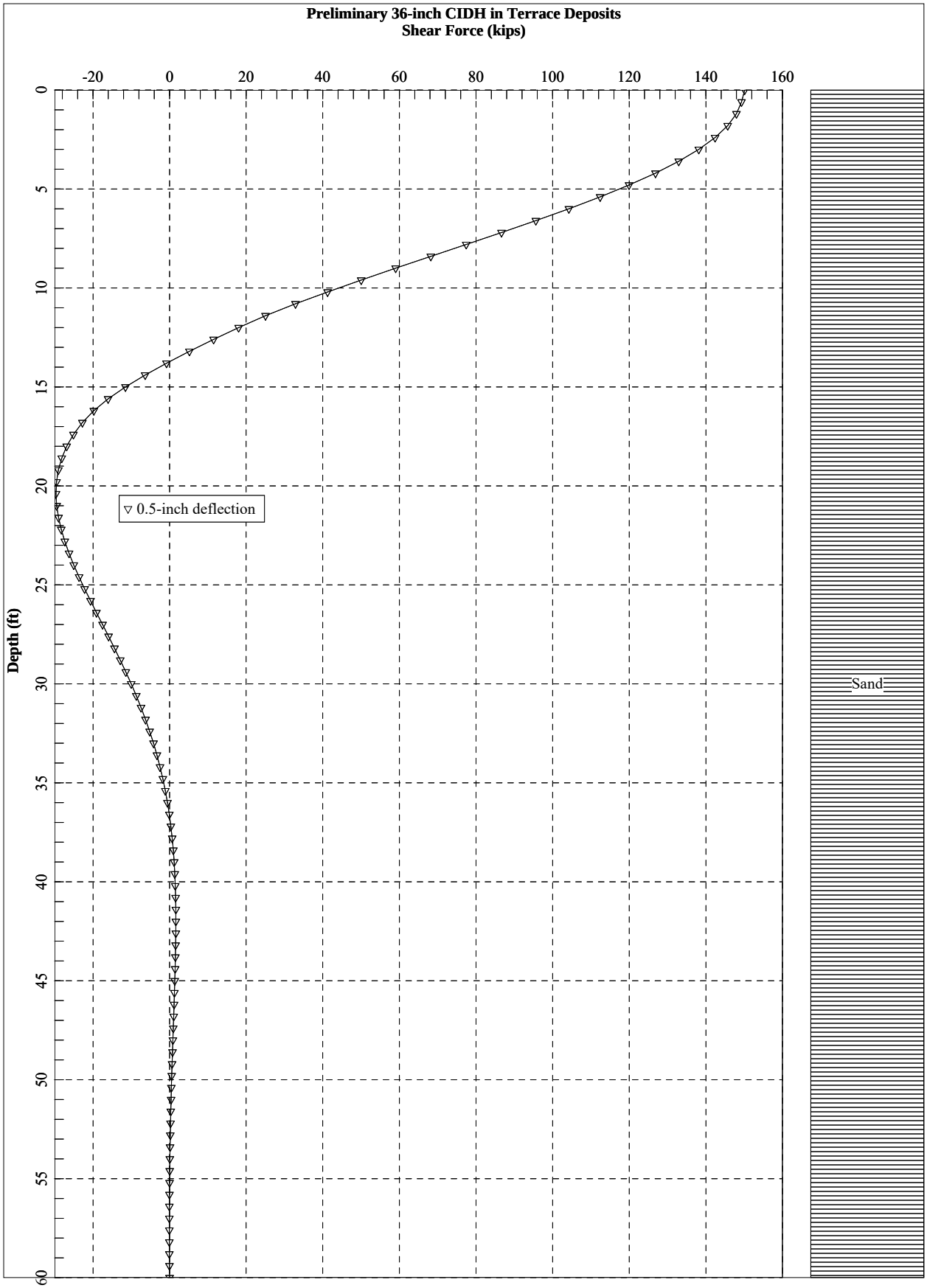

Preliminary 24-inch CIDH in Terrace Deposits
Bending Moment (in-kips)
-4000
-3500
-3000
-2500
-2000
-1500
-1000
-500
0
500
1000
1500
2000
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
▽ 0.5-inch deflection
Sand

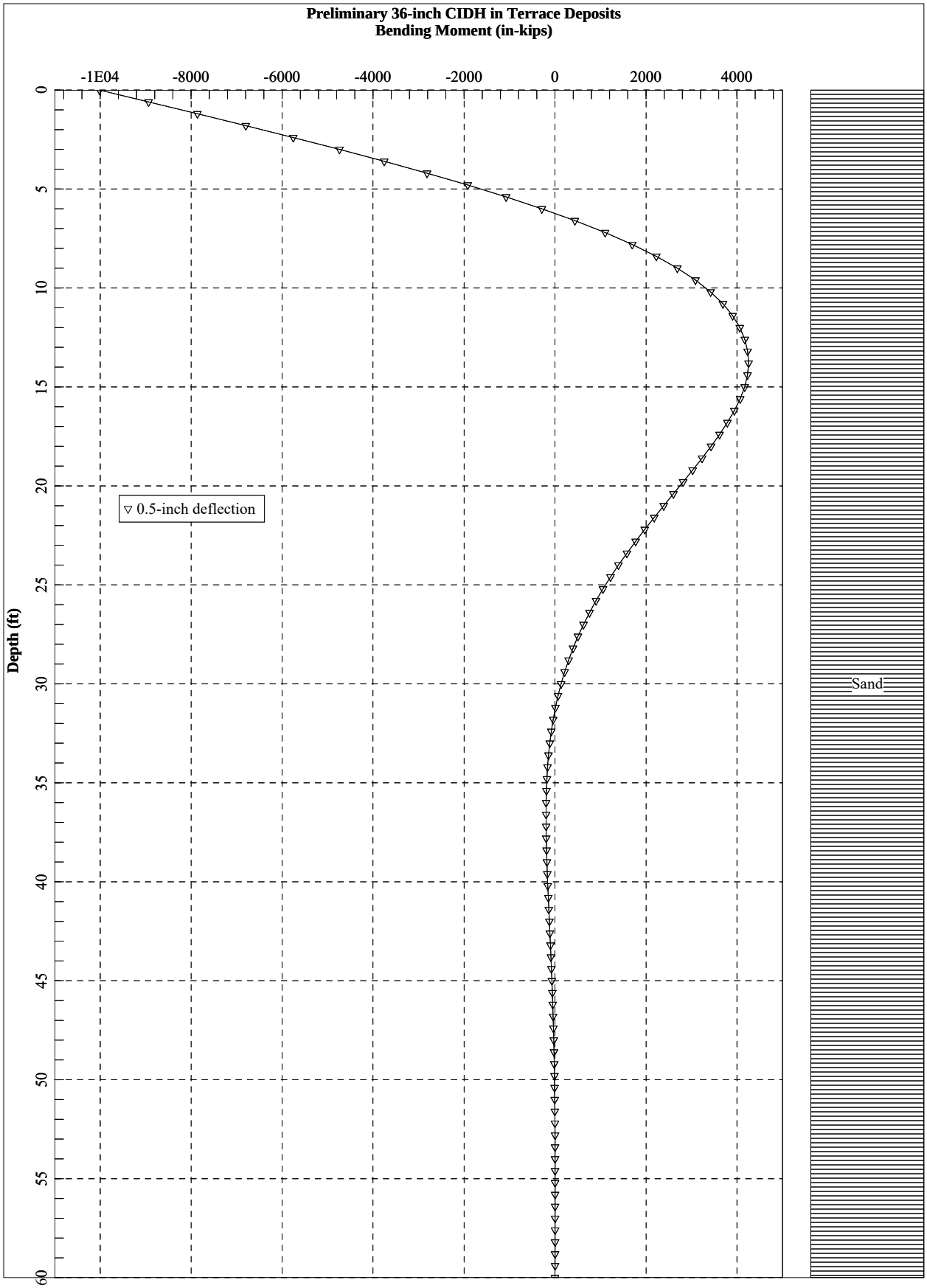

Preliminary 24-inch CIDH in Terrace Deposits
Lateral Pile Deflection (inches)
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
0.5-inch
Sand

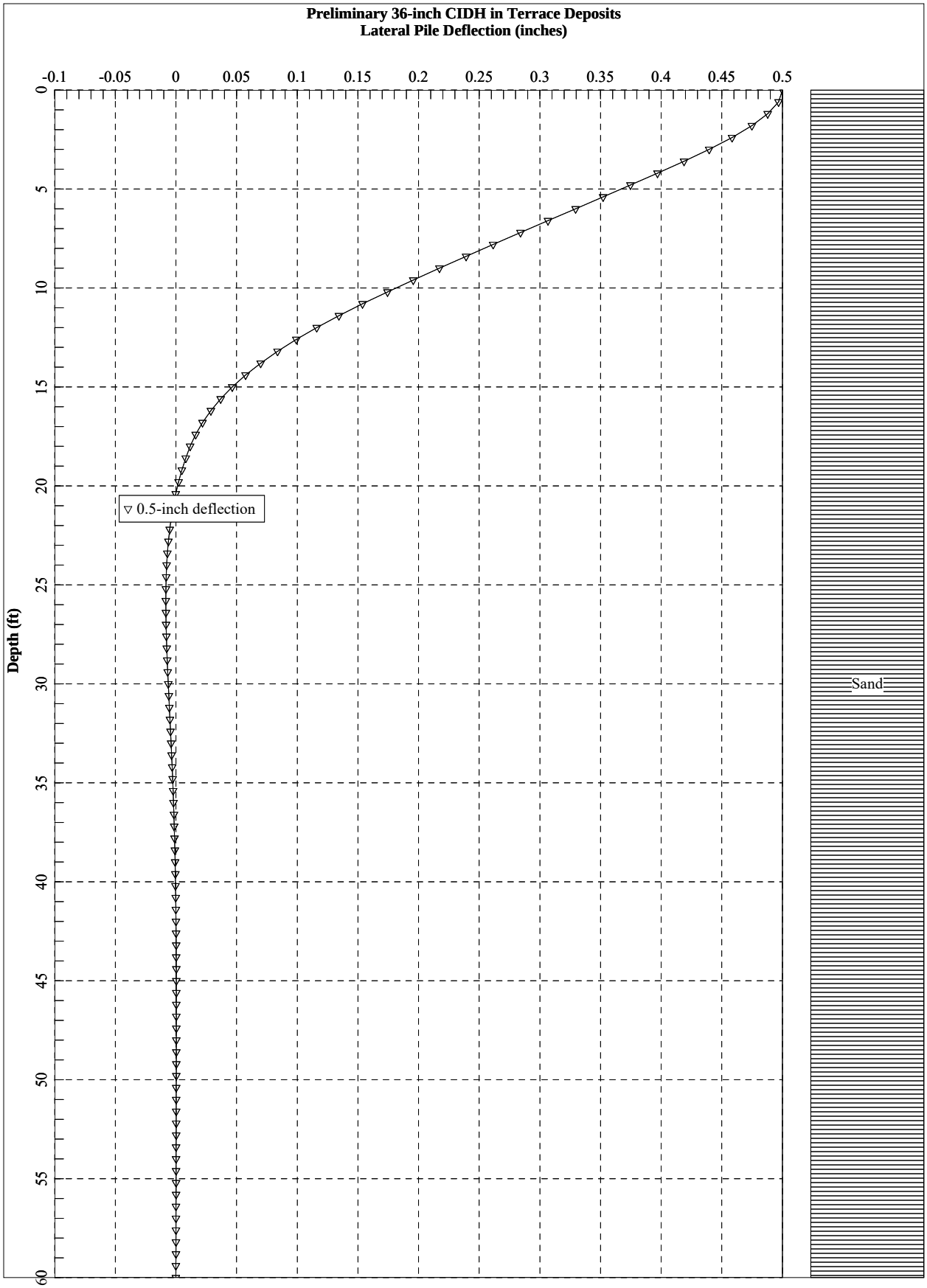

Preliminary 24-inch CIDH in Bedrock
Shear Force (kips)
-40
-20
0
20
40
60
80
100
120
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
0.5-inch deflection
Stf. Cl. NW


Preliminary 24-inch CIDH in Bedrock
Bending Moment (in-kips)
-5000
-4000
-3000
-2000
-1000
0
1000
2000
3000
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
▽ 0.5-inch deflection
Stf. Cl. NW

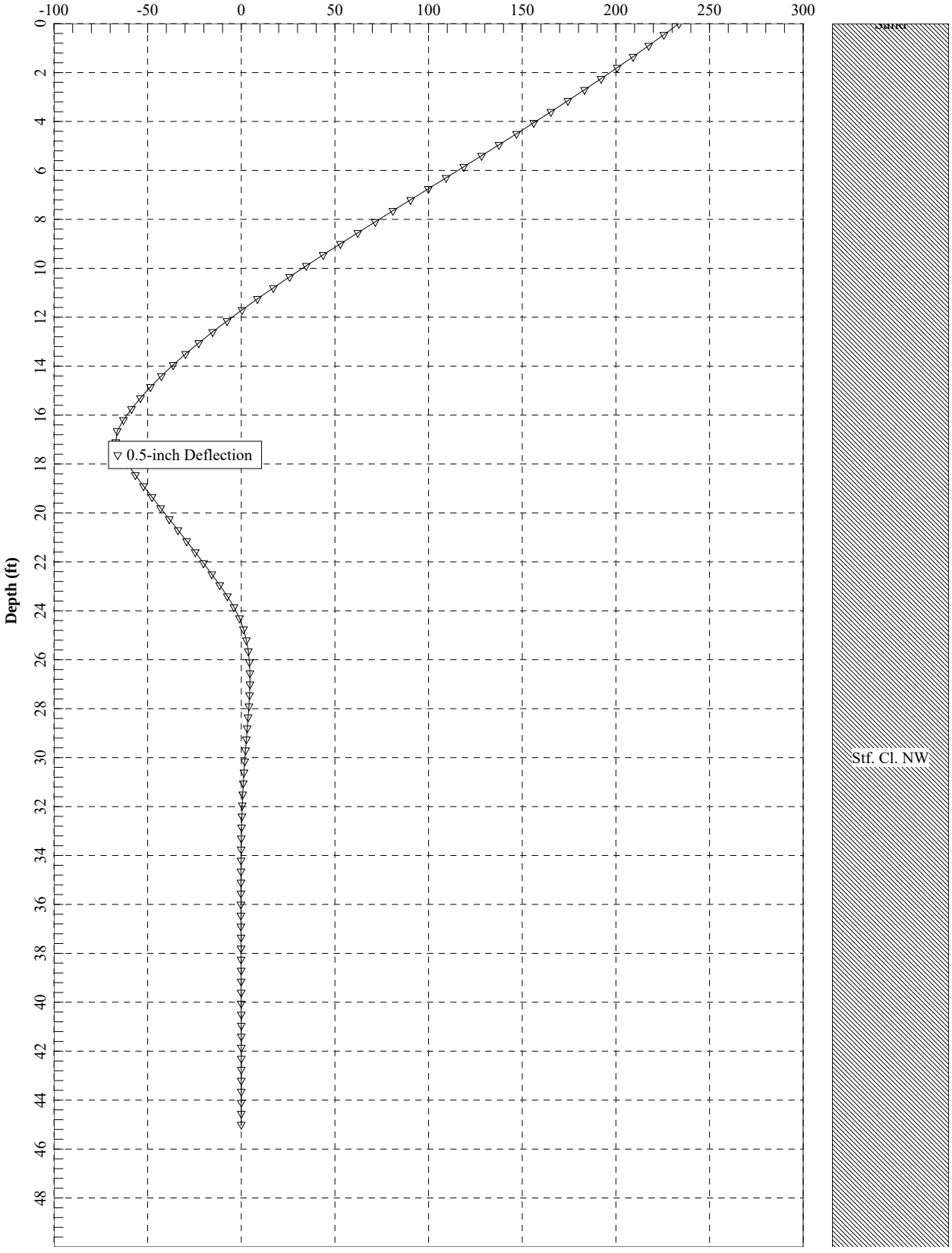

Preliminary 24-inch CIDH in Bedrock
Lateral Pile Deflection (inches)
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
▽ 0.5-inch deflection
Stf. Cl. NW

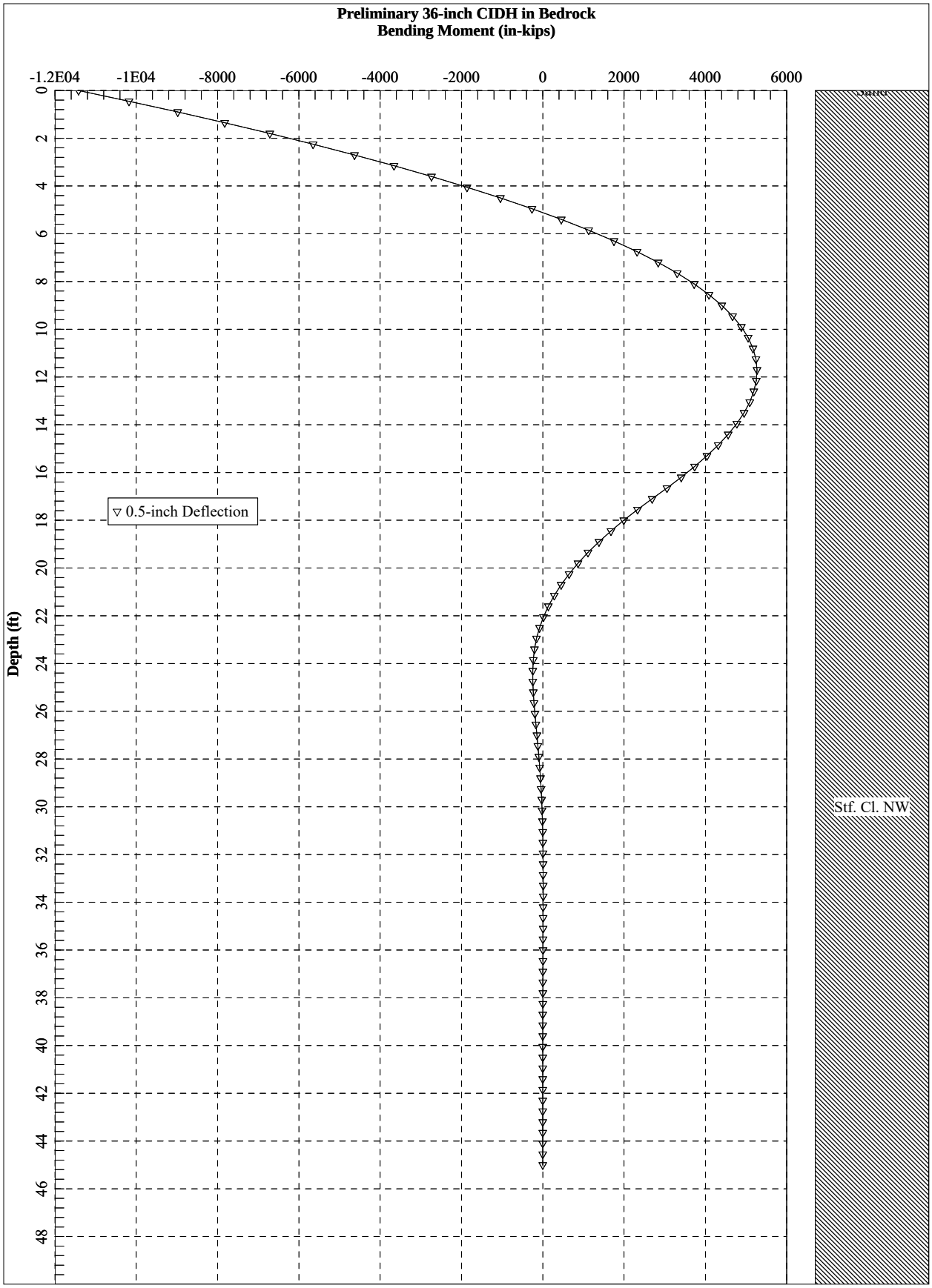

Preliminary 36-inch CIDH in Terrace Deposits
Shear Force (kips)
-20
0
20
40
60
80
100
120
140
160
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
0.5-inch deflection
Sand

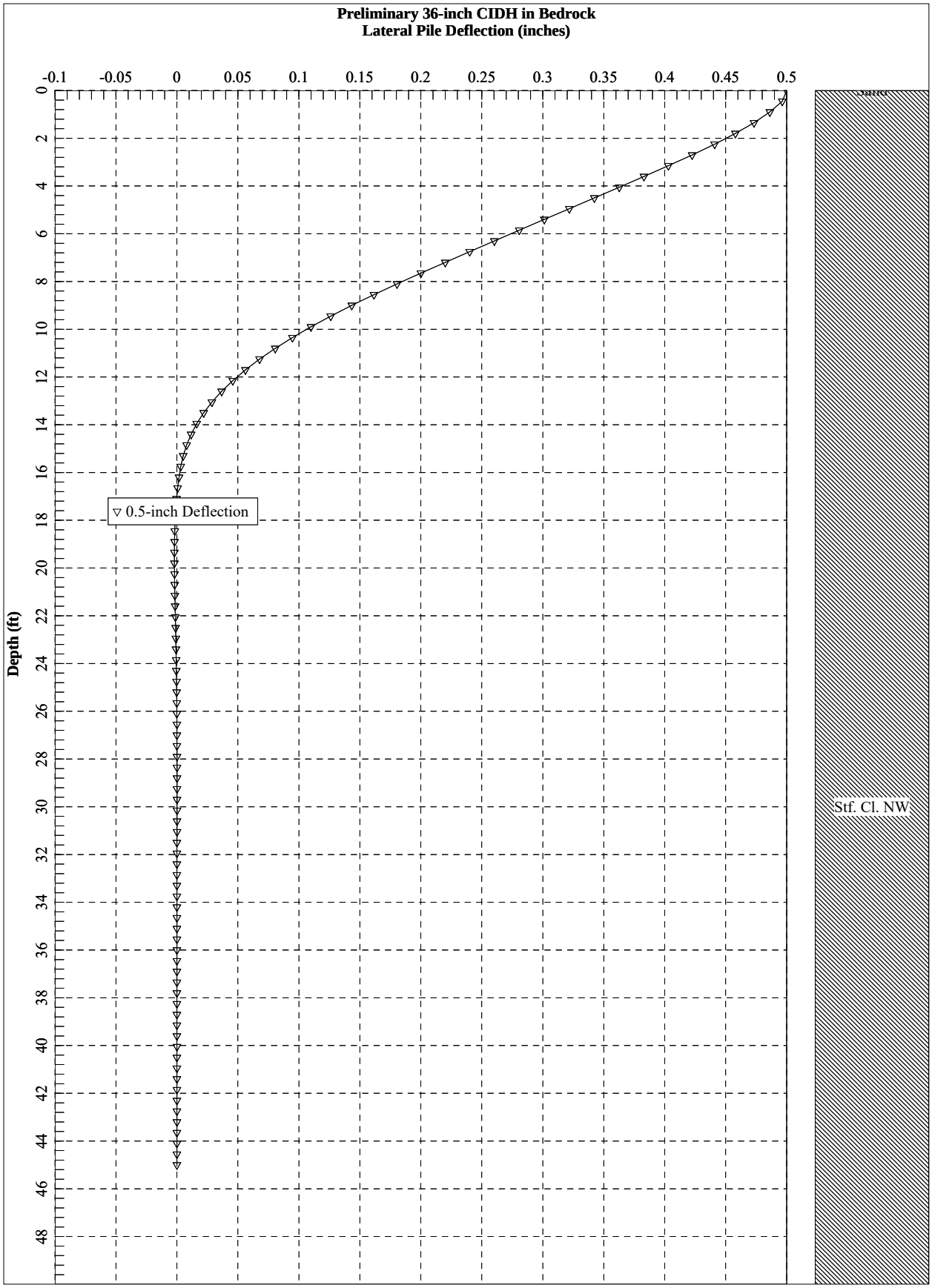

Preliminary 36-inch CIDH in Terrace Deposits
Bending Moment (in-kips)
-1E04
-8000
-6000
-4000
-2000
0
2000
4000
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
▽ 0.5-inch deflection
Sand


Preliminary 36-inch CIDH in Terrace Deposits
Lateral Pile Deflection (inches)
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
0.5-inch deflection
Sand

**Preliminary 36-inch CIDH in Bedrock**
**Shear Force (kips)**




Preliminary 36-inch CIDH in Bedrock
Bending Moment (in-kips)
-1.2E04
-1E04
-8000
-6000
-4000
-2000
0
2000
4000
6000
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
▽ 0.5-inch Deflection
Stf. Cl. NW


Preliminary 36-inch CIDH in Bedrock
Lateral Pile Deflection (inches)
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
0.5-inch Deflection
Sand
Stf. Cl. NW

# APPENDIX D

**SHN Geotechnical Report – Proposed Expansion Cher-Ae Heights Gaming Building Boring Logs**
**Taber Geotechnical Report – Trinidad Rancheria Expansion Project Test Pit Logs**

# BORING LOG KEY

## SAMPLE TYPES

DISTURBED SAMPLE (BULK)

HAND DRIVEN TUBE SAMPLE

1.4" I.D. STANDARD PENETRATION TEXT SAMPLE (SPT)

2.5" I.D. MODIFIED CALIFORNIA SAMPLE (NOT RETAINED)

MODIFIED CALIFORNIA SAMPLE (RETAINED)

CORE BARREL SAMPLE (NOT RETAINED)

CORE BARREL SAMPLE (RETAINED)

## SYMBOLS

INITIAL WATER LEVEL

STABILIZED WATER LEVEL

GRADATIONAL CONTACT

WELL DEFINED CONTACT

SS SPLIT SPOON

SHN CONSULTING ENGINEERS & GEOLOGISTS

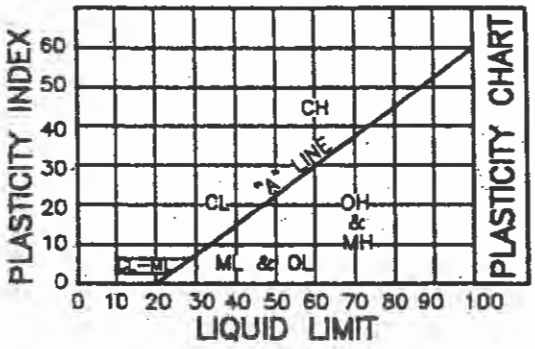
# METHOD OF SOIL CLASSIFICATION

| MAJOR DIVISIONS | | SYMBOLS | TYPICAL NAMES |
|---|---|---|---|
| COARSE GRAINED SOILS (MORE THAN 1/2 OF SOIL > NO. 200 SIEVE SIZE) | GRAVELS (MORE THAN 1/2 OF COARSE FRACTION > NO.4 SIEVE SIZE) | GW | WELL GRADED GRAVELS OR GRAVEL–SAND MIXTURES, LITTLE OR NO FINES |
| | | GP | POORLY GRADED GRAVELS OR GRAVEL–SAND MIXTURES, LITTLE OR NO FINES |
| | | GM | SILTY GRAVELS, GRAVEL–SAND–SILT MIXTURES |
| | | GC | CLAYEY GRAVELS, GRAVEL–SAND–CLAY MIXTURES |
| | SANDS (MORE THAN 1/2 OF COARSE FRACTION < NO.4 SIEVE SIZE) | SW | WELL GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES |
| | | SP | POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES |
| | | SM | SILTY SANDS, SAND–SILT MIXTURES |
| | | SC | CLAYEY SANDS, SAND–CLAY MIXTURES |
| FINE GRAINED SOILS (MORE THAN 1/2 OF SOIL < NO. 200 SIEVE SIZE) | SILTS & CLAYS LIQUID LIMIT LESS THAN 50 | ML | INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY |
| | | CL | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS |
| | | OL | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY |
| | SILTS & CLAYS LIQUID LIMIT GREATER THAN 50 | MH | INORGANIC LILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS |
| | | CH | INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS |
| | | OH | ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTY CLAYS, ORGANIC SILTS |
| HIGHLY ORGANIC SOILS | | PT | PEAT AND OTHER HIGHLY ORGANIC SOILS |

CLASSIFICATION CHART

| CLASSIFICATION | U.S. STANDARD SIEVE SIZE |
|---|---|
| BOULDERS | ABOVE 12" |
| COBBLES | 12" TO 3" |
| GRAVEL | 3" TO NO. 4 |
| COARSE | 3" TO 3/4" |
| FINE | 3/4" TO NO. 4 |
| SAND | NO. 4 TO NO. 200 |
| COARSE | NO. 4 TO NO. 10 |
| MEDIUM | NO. 10 TO NO. 40 |
| FINE | NO. 40 TO NO. 200 |
| SILT & CLAY | BELOW NO. 200 |

GRAIN SIZE CHART




| CONSISTANCY OF FINE GRAINED SOILS | | DENSITY OF COARSE GRAINED SOILS | |
|---|---|---|---|
| CLASSIFICATION | COHESION (PSF) | CLASSIFICATION | STANDARD PENETRATION (BLOW COUNT) |
| VERY SOFT | 0–250 | VERY LOOSE | 0–4 |
| SOFT | 250–500 | LOOSE | 4–10 |
| MEDIUM STIFF | 500–1000 | MEDIUM | 10–30 |
| STIFF | 1000–2000 | DENSE | 30–50 |
| VERY STIFF | 2000–4000 | VERY DENSE | 50+ |
| HARD | 4000+ | | |

| MOISTURE CLASIFICATIONS |
|---|
| DRY |
| DAMP |
| MOIST |
| WET |

BASED ON UNIFIED SOILS CLASSIFICATION SYSTEM

# HOLE NUMBER B-1

PROJECT Cher-Ae Heights
JOB NUMBER 098210
LOCATION Trinidad, California
DATE DRILLED 9/17/98
GROUND SURFACE ELEVATION 286 ft.
SAMPLER TYPE 2.5" ID Mod. CA; 1.4" SPT w/ no liners; downhole 130 lb hammer, rope & pulley
EXCAVATION METHOD 8.5" Hollow Stem Auger
LOGGED BY CC
TOTAL DEPTH OF HOLE 19.5 ft.

| MOISTURE (%) | DRY DEN (PCF) | UNC CMP (PSF) | UNC CMP (PSF) BY POCKET PEN | DEPTH (ft.) | SAMPLES | BLOWS/6 IN | GRAPHIC LOG | USGS CLASS | MATERIALS DESCRIPTION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 0 | | | | | ASPHALT/CONCRETE | |
| | | | | 1 | | | | | FILL, GRAVEL, aggragate base, rounded to 3/4" maximum dimension. | |
| | | | | 2 | | | | | | |
| | | | | 3 | | 7 | | | FILL, SILT, sandy, clayey, very stiff, damp, light brown, with angular gravel fragments to 1/4" maximum dimension. | fairly cohesive |
| 24.1 | 87 | 1050 | — | 4 | | 9<br>19 | | | | |
| | | | | 5 | | | | | | |
| | | | | 6 | | | | | | |
| | | | | 7 | | 14 | | | SANDSTONE, fractured to 2.5" maximum dimension, with minor gray clay. | Very fine sand particle seen under lens. |
| 11.5 | 117 | — | >5000 | 8 | | 31<br>27 | | | | Becomes denser per driller |
| | | | | 9 | | | | | | |
| | | | | 10 | | 17 | | | MUDSTONE, fractured to larger than 2.5" maximum dimension, with moisture in fractures, minor clayey silt, plastic. | |
| 7.2 | 123 | — | >5000 | 11 | | 25<br>50/5" | | | | |
| | | | | 12 | | | | | | |
| | | | | 13 | | 50/3" | | | | No recovery. Increasing gravel per driller |
| | | | | 14 | | | | | | |
| | | | | 15 | | | | | | Very dry, gray cuttings |
| | | | | 16 | | | | | | Hard drilling |
| | | | | 17 | | | | | | |
| | | | | 18 | | 11 | | | MUDSTONE, bedded. | |
| | | | | 19 | | 27<br>50/5" | | | | |
| | | | | 20 | | | | | Bottom of boring at 19.5 feet. No free goundwater observed. | |
| | | | | 21 | | | | | | |
| | | | | 22 | | | | | | |
| | | | | 23 | | | | | | |
| | | | | 24 | | | | | | |
| | | | | 25 | | | | | | |
| | | | | 26 | | | | | | |
| | | | | 27 | | | | | | |
| | | | | 28 | | | | | | |

# HOLE NUMBER B-3

PROJECT Cher-Ae Heights
LOCATION Trinidad, California
GROUND SURFACE ELEVATION 289.3 ft.
EXCAVATION METHOD 8.5" Hollow Stem Auger
LOGGED BY CC

JOB NUMBER 098210
DATE DRILLED 9/17/98
SAMPLER TYPE 2.5" ID Mod. CA; 1.4" SPT w/ no liners; downhole 130 lb hammer, rope & pulley
TOTAL DEPTH OF HOLE 26.0 ft.

| MOISTURE (%) | DRY DEN (PCF) | UNC CMP (PSF) | UNC CMP (PSF) BY POCKET PEN | DEPTH (ft.) | SAMPLES | BLOWS/6 IN | GRAPHIC LOG | USGS CLASS | MATERIALS DESCRIPTION | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | | | | | ASPHALT/CONCRETE | |
| | | | | 2 | | | | ML | FILL, GRAVEL, aggragate base, rounded to 3/4" maximum dimension. | |
| | | | | 3 | | 37 | | SM | SILT, gravelly, soft, damp to dry, light brown, roots, with gravel to 1/2" maximum dimension, topsoil. | Colluvium? |
| | | | | 4 | | 50/3" | | | SAND, silty, very dense, damp, light brown and reddish brown, with angular weathered gravel to 2" maximum dimension. | |
| | | | | 5 | | | | | | |
| | | | | 6 | | | | | | |
| | | | | 7 | | 50/5" | | | SANDSTONE, fractured, weathered, very fine grained, dry, greenish brown. | |
| | | | | 8 | | | | | | |
| | | | | 9 | | | | | | |
| | | | | 10 | | 8 | | | MUDSTONE, highly weathered, stiff, damp, gray, with silt and clay. | |
| | | | | 11 | | 22 | | | | |
| | | | | 12 | | 24 | | | | |
| | | | | 13 | | 18 | | | MUDSTONE, highly weathered, stiff, damp, gray, with silt and clay, with minor rounded mudstone gravel, with quartz vein. | |
| | | | | 14 | | 35 | | | | |
| | | | | 15 | | 41 | | | | |
| | | | | 16 | | | | | | |
| | | | | 17 | | | | | | Very hard drilling. Dry cuttings with rounded gravel. |
| | | | | 18 | | 10 | | | | |
| 10.1 | 131 | — | — | 19 | | 11 | | | SILTSTONE, highly weathered, very stiff, damp, gray. | |
| | | | | 20 | | 13 | | | | |
| | | | | 21 | | | | | | |
| | | | | 22 | | | | | | |
| | | | | 23 | | 15 | | | MUDSTONE, highly weathered, fractured, damp, gray. | |
| | | | | 24 | | 27 | | | | |
| | | | | 25 | | 40 | | | | |
| | | | | 26 | | 19 | | | | |
| | | | | 27 | | 50/6" | | | Bottom of boring at 26.0 feet. No free groundwater observed. | Auger refusal |
| | | | | 28 | | | | | | |

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West Sacramento, CA 95691
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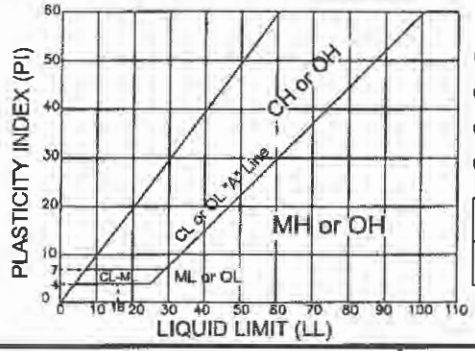
# UNIFIED SOIL CLASSIFICATION SUMMARY

(ASTM D 2487-90)

| Pt | OH | CH | MH | OL | CL | ML | SC | SM | SP | SW | GC | GM | GP | GW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Highly organic soils | Silts and clays Liquid limit 50 or more | | | Silts and clays Liquid limit less than 50 | | | Sands with fines >12% fines | | Clean sands < 5% fines | | Gravels with fines > 12% fines | | Clean gravels < 5% fines | |
| | | | | | | | Sands—50% or more of coarse fraction is smaller than No. 4 Sieve | | | | Gravels—more than 50% of coarse fraction is larger than No. 4 sieve | | | |
| Fine grained soils (50% or more is smaller than No. 200 sieve) | | | | | | | Coarse grained soils (More than 50% is larger than No. 200 sieve) | | | | | | | |




## LABORATORY CLASSIFICATION CRITERIA

GW and SW – Cu ≥ 4 for GW and 6 FOR SW; 1 ≤ Cc ≤ 3

GP and SP—Clean gravel or sand not meeting requirements for GW and SW.

GM and SM—Atterberg limits of fines below "A" line or P.I. less thon 4.

GC and SC—Atterberg limits of fines above "A" line with P.I. greater than 7.

| Fines (silt or clay) | Sand | | | Gravel | | Cobbles | Boulders |
|---|---|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse | | |
| Sieve sizes | 200 | 40 | 10 | 4 | 3/4" | 3" | 10" |

**Classification of earth materials shown on the test boring logs is based on field inspection and should not be construed to imply laboratory analysis unless so stated.**

## MATERIAL SYMBOLS

- Gravel
- Sand
- Silt
- Clay
- Sandy clay or clayey sand
- Sandy silt or silty sand
- Silty clay or clayey silt
- Peat or organic matter
- Fill material
- Shale
- Sandstone
- Limestone
- Metamorphic rock
- Igneous rock

## CONSISTENCY CLASSIFICATION FOR SOILS

| No. of Blows* | Granular | Cohesive |
|---|---|---|
| 0–5 | Very loose | Very soft |
| 6–10 | Loose | Soft |
| 11–20 | Semicompact | Stiff |
| 21–35 | Compact | Very stiff |
| 36–70 | Dense | Hard |
| > 70 | Very dense | Very hard |

* According to the Standard Penetration Test (ASTM D 1586)

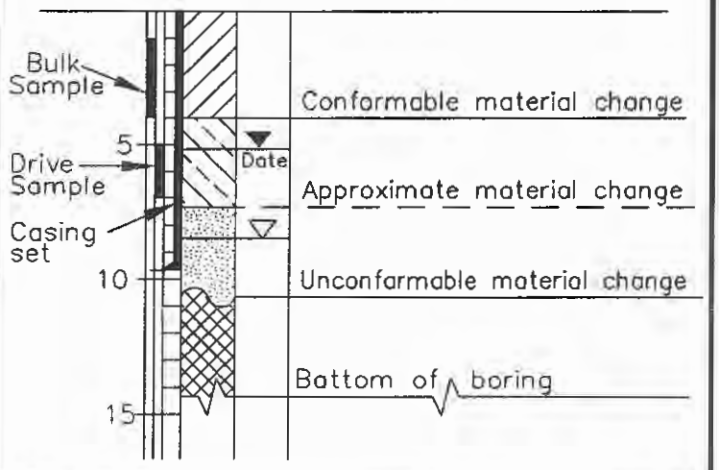
"+" indicates extrapolated blow count

Where standard penetration test has not been performed, consistencies shown on logs are estimated.

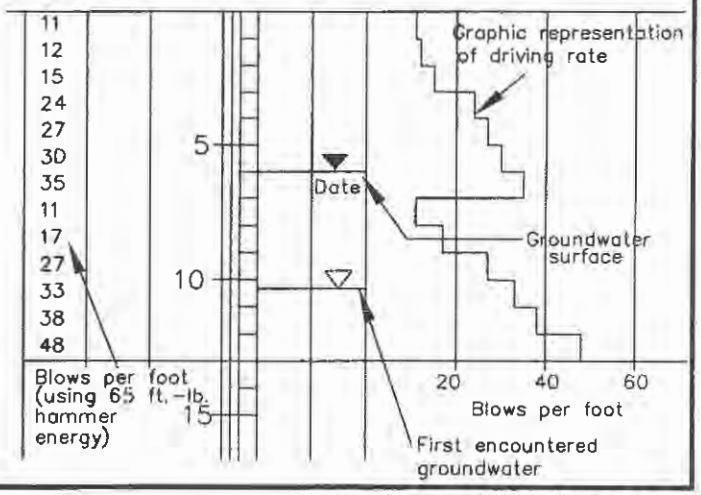
## KEY TO "OTHER TESTS" LABORATORY

- H – Hydrometer
- E – Expansion Index
- A – Atterberg Limits
- G – Gradation
- SE – Sand Equivalent
- C – Consolidation
- M – Maximum Dry Density Determination
- R – Stabilometer Resistance Value
- S – Direct Shear
- T – Triaxial Shear
- P – Permeability
- Ch – Corrosivity Testing
- SG – Specific Gravity

## LEGEND OF BORING




## LEGEND OF PENETRATION TEST



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# TEST PIT LOG

2P2/398/231

TYPE: Case 490 with 18-Inch Bucket — ELEVATION: 304± — Test Pit No. 1

| OTHER TESTS | DRY DENSITY (lbs/cu. ft.) | Moisture (%) | BLOWS/FOOT 350 ft-lb | SAMPLE SIZE (inches) | SAMPLE No. | DEPTH IN FEET | MATERIAL SYMBOL | UNIFIED SOIL CLASS | |
|---|---|---|---|---|---|---|---|---|---|
| | 84 | 27 | | 2.5 | 1 | | | CL | (Stiff) Red brown CLAYEY SILT with very fine SAND and ROOTS/ROOTLETS |
| S | 88 | 29 | | 2.5 | 2 | | | SC / SM | (Semicompact-compact) orange brown and brown SILTY very fine-fine SAND with thin lenses of CLAYEY SILT and fine-coarse SANDY GRAVEL |
| R,G,E | | | | Bag | A | 5 | | | |
| | | | | | | | | | 12-22-98 |
| | | | | | | | | | (Very hard) blue gray gravelly rock fragments in CLAYEY matrix (completely weathered and fractured and sheared sedimentary ROCK-SHALE) |
| | | | | | | 10 | | | |
| | | | | | | | | | Groundwater measured at 6.3ft. depth; Test pit backfilled with spoils, tamped/wheel rolled 12-22-98 |
| | | | | | | 15 | | | |
| | | | | | | 20 | | | |

TYPE: Case 490 with 18-Inch Bucket — ELEVATION: 308.5± — Test Pit No. 2

| OTHER TESTS | DRY DENSITY (lbs/cu. ft.) | Moisture (%) | BLOWS/FOOT 350 ft-lb | SAMPLE SIZE (inches) | SAMPLE No. | DEPTH IN FEET | MATERIAL SYMBOL | UNIFIED SOIL CLASS | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | SM | (Loose) red brown SILTY very fine-fine SAND with ROOTS/ROOTLETS |
| | 80 | 23 | | 2.5 | 1 | | | SM | (Semicompact) light brown SILTY very fine-fine SAND |
| | | | | | | 5 | | | |
| S,G | | | | Bag | B | | | SC / SM | (Compact-dense) light brown and oronge brown SILTY and CLAYEY fine SAND with thin SILTY layers |
| | 97 | 25 | | 2.5 | 2 | | | | |
| | | | | | | | | | 12-22-98 (Very hard) dark brown/black weathered and completely fractured sedimentary ROCK-SHALE |
| | | | | | | 10 | | | |
| | | | | | | | | | Groundwater measured at 9.0ft. depth; Test pit backfilled with spoils, tamped/wheel rolled 12-22-98 |
| | | | | | | 15 | | | |
| | | | | | | 20 | | | |

UNCONFINED COMPRESSIVE STRENGTH (tsf)

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

LOGGED BY: W.E.N. | DATE: 12-22-98

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# TEST PIT LOG

2P2/398/231

TYPE: Case 490 with 18-Inch Bucket

ELEVATION: 305.5±

Test Pit No. 3

| UNCONFINED COMPRESSIVE STRENGTH (tsf) | OTHER TESTS | DRY DENSITY (lbs/cu. ft.) | Moisture (%) | BLOWS/FOOT 350 ft-lb | SAMPLE SIZE (inches) | SAMPLE No. | DEPTH IN FEET | MATERIAL SYMBOL | UNIFIED SOIL CLASS | |
|---|---|---|---|---|---|---|---|---|---|---|
| | R,E | | | | Bag | C | 5 | | SM | (Loose) gray coarse GRAVEL cover over (compact-dense) orange brown to gray weakly cemented SILTY very fine-fine SAND to fine-medium SAND |
| | | | | | | | | | | 12-22-98 |
| | | | | | | | | | | (Very hard) dark blue gray CLAY with fine-coarse ROCK fragments (completed weothered ond fractured/sheared sedimentary ROCK-SHALE) |
| | | | | | | | 10 | | | Groundwater measured at 6.3ft. depth; Test pit backfilled with spoils, tamped/wheel rolled on 12-22-98 |
| | | | | | | | 15 | | | |
| | | | | | | | 20 | | | |

TYPE: Case 490 with 18-Inch Bucket

ELEVATION: 308±

Test Pit No. 4

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 5 | | SM | (Compact to dense) orange brown to light brown weakly cemented SILTY very fine-fine SAND |
| | | | | | | | | | SP | (Semicompact-compact) gray fine SAND grading to coarse SAND |
| | | | | | | | | | | 12-22-98 |
| | | | | | | | 10 | | GP | (Compact-dense) gray fine-coarse SANDY GRAVEL/GRAVELLY SAND and COBBLES |
| | | | | | | | | | | (Very stiff-hard) dark gray CLAY with ROCK fragments (completely weathered and fractured/ sheared sedimentary ROCK-SHALE |
| | | | | | | | 15 | | | Groundwater measured at 8.5ft. depth; Test pit bockfilled with spoils, tamped/wheel rolled on 12-22-98 |
| | | | | | | | 20 | | | |

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

LOGGED BY: W.E.N.

DATE: 12-22-98

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Since 1954

# TEST PIT LOG

2P2/398/231

TYPE: Case 490 with 18-Inch Bucket | ELEVATION: 301± | Test Pit No. 5

| SAMPLE No. | SAMPLE SIZE (inches) | BLOWS/FOOT 350 ft-lb | Moisture (%) | DRY DENSITY (lbs/cu. ft.) | OTHER TESTS | UNCONFINED COMPRESSIVE STRENGTH (tsf) | DEPTH IN FEET | MATERIAL SYMBOL | UNIFIED SOIL CLASS | |
|---|---|---|---|---|---|---|---|---|---|---|
| S 1 | 2.5 | | 23 | 103 | | | 0 | | SM | (Loose-semicompact) orange brown SILTY SAND with ROOTS/ROOTLETS |
| | | | | | | | | | CL | (Stiff) gray CLAY |
| Bag D | | | | | | | 5 | | | (Very hard) gray GRAVELLY ROCK fragments in CLAYEY matrix (completely weathered and fractured/sheared sedimentary ROCK-SHALE) |
| | | | | | | | 10 | | | No free groundwater encountered. Test pit backfilled with spoils, tamped with bucket on 12-22-98. |
| | | | | | | | 15 | | | |
| | | | | | | | 20 | | | |

TYPE: Case 490 with 18-Inch Bucket | ELEVATION: 305± | Test Pit No. 6

| SAMPLE No. | SAMPLE SIZE (inches) | BLOWS/FOOT 350 ft-lb | Moisture (%) | DRY DENSITY (lbs/cu. ft.) | OTHER TESTS | UNCONFINED COMPRESSIVE STRENGTH (tsf) | DEPTH IN FEET | MATERIAL SYMBOL | UNIFIED SOIL CLASS | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 0 | | ML | (Loose) gray fine-coarse GRAVEL (fill) over (semicompact) orange brown fine SANDY SILT |
| | | | | | | | | | | (Very hard) black highly weathered and completely fractured sedimentary ROCK-SHALE |
| | | | | | | | 5 | | | 12-22-98 |
| | | | | | | | 10 | | | Groundwater measured at 6.5ft. depth; Test pit backfilled with spoils, tamped/wheel rolled on 12-22-98 |
| | | | | | | | 15 | | | |
| | | | | | | | 20 | | | |

THE BORING LOGS SHOW SUBSURFACE CONDITIONS AT THE DATES AND LOCATIONS INDICATED AND IT IS NOT WARRANTED THAT THEY ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES

LOGGED BY: W.E.N. | DATE: 12-22-98

# APPENDIX E

**Site Photos**

**Photo 1: Looking east at head of landslide**

**Photo 2: "Water loving plants" beneath landslide at Scenic Drive**

**Photo 3: Vertical drop at landslide scarp**


**Photo 4: Exposed bedrock at Casino Entrance**

**Photo 5: Sea stacks at beach west of Scenic Drive**

**Photo 6: Weathered bedrock**

# Retaining Wall Diagram - Not to Scale

EXISTING CASINO

NEW HOTEL

Area of cast-in-drilled-hole piles per Geo-report.

Approximate area of existing slide to be stabilized

1'*
10'*
16'*
17'*
1'*
20'*
14'*
*1'
*8'
14'*
*2'
10'*
12'*
*1'
*0'
*3'
*1'
5'*
1'*
*1'
*6'
0'*
*5'

+170
+216
+210
+195
+201

11.5%
4%
4%

SCENIC DRIVE

N

Legend

- Concrete Retaining wall
- Hilflker or Similar Retaining wall
- Side of visible wall
- *10' Approximate height in feet of visible face of wall.