

APPENDIX B

GEOTECHNICAL INVESTIGATION



GEOTECHNICAL INVESTIGATION

PRIVATE SAN DIEGUITO DRIVE IMPROVEMENTS

San Dieguito Drive
Del Mar, California

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November 10, 2023



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November 10, 2023

Atlas No. 10939
Report No. 1

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**Subject: Geotechnical Investigation Report
Private San Dieguito Drive Improvements
San Dieguito Drive
Del Mar, California**

Dear Mr. Carns,

In accordance with our contract, dated September 26, 2023, Atlas has performed a geotechnical investigation for the Private San Dieguito Drive Improvements project in Del Mar, California. The purpose of the geotechnical investigation was to assess the geologic conditions in the vicinity of the subject roadway between Racetrack View Drive and Oribia Road and to provide recommendations regarding the proposed retaining wall and roadway reconstruction. Our investigation consisted of reviewing readily available geologic literature, a site reconnaissance, exploratory borings, geotechnical laboratory testing, and preparation of this report.

We appreciate the opportunity to be of service on this project. Should you have any questions, please contact the undersigned at your convenience.

Respectfully submitted,
Atlas Technical Consultants LLC

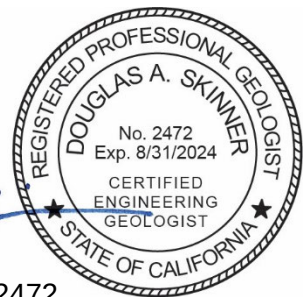
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APPENDICES

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1. INTRODUCTION

This report presents the results of the geotechnical investigation Atlas performed for the subject project. The project site consists of a section of San Dieguito Drive that extends from Racetrack View Drive to Oribia Road in Del Mar, California. The purpose of our work is to provide conclusions and recommendations regarding the geotechnical aspects of the project. Figure 1 presents the site vicinity.

2. SCOPE OF WORK

We conducted this investigation in general accordance with the scope of work presented in our proposal number 21-17582R4 dated September 26, 2023. The scope of our work is described in the following sections.

2.1 Field Investigation

We explored the subsurface conditions by drilling one (1) exploratory boring to a depth of approximately 19½ feet below the existing ground surface (bgs) using a truck-mounted drill rig equipped with a hollow-stem auger. In addition, three (3) hand auger borings were advanced to depths of approximately 5 feet bgs. Boring B-1 was drilled on the slope where the backfill of the proposed retaining wall is anticipated. Boring B-2 was drilled at the toe of the slope within the area of the proposed retaining wall. The pavement was cored at borings B-2 through B-4 locations. Figure 2 presents the approximate locations of the borings. Figure 3 shows the pavement core photographs. An Atlas geologist logged the borings and collected samples of the materials encountered for laboratory testing. Atlas tested selected samples from the borings to evaluate pertinent soil classification and engineering properties to assist in developing geotechnical conclusions and recommendations. Logs of the borings are presented in Appendix I.

2.2 Laboratory Testing

We tested selected samples to evaluate soil classification, soil engineering properties and for use in developing our geotechnical conclusions and recommendations. The laboratory tests consisted of in situ moisture and density, particle-size distribution, expansion index, R-value, corrosivity and direct shear. The results of the laboratory tests and brief explanations of the test procedures are presented in Appendix II.

2.3 Analysis and Report Preparation

This report was prepared to include exploration logs, and a summary of the field exploration findings. The report also includes conclusions and recommendations regarding:

- Subsurface conditions beneath the site, including groundwater levels if encountered.
- Potential geologic hazards.
- Mapped seismic design values in accordance with 2022 California Building Code.
- Site preparation and grading.

- Expansion and collapse potential.
- Excavation/trench characteristics.
- Suitability of on-site materials for use as compacted fill.
- Retaining wall foundation bearing pressure
- Resistance to lateral loads.
- Estimated foundation settlements.
- Lateral pressures for design of retaining walls.
- Corrosion potential.
- Preliminary pavement section recommendations.

3. SITE DESCRIPTION

The project site is a private segment of San Dieguito Drive extending from Racetrack View Drive to Oribia Road. The roadway segment extends approximately 1,000 feet, has an average width of about 18 feet, and slopes from south to north with an approximate elevation of 121 feet above Mean Sea Level (MSL) in the south and 29 feet above MSL to the north. The roadway provides access to the residential properties to the east and west throughout the entire segment. San Dieguito Lagoon is located immediately north of the northern extent of the roadway, and Crest Canyon is located southeast of the project area.

4. PROPOSED CONSTRUCTION

The section of San Dieguito Drive from Oribia Road north to the intersection of the public portion of San Dieguito Drive and Racetrack View Drive is not a publicly maintained road. We understand the City of Del Mar is considering the acceptance of this section of San Dieguito Road into the City's publicly maintained road system. This involves preparation of Roadway Improvement Drawings, review by City staff, physical improvements to the roadway, and a City Council Acceptance Action. We also understand the project will consist of roadway pavement reconstruction, rolled curbs, a catch basin, and a proposed retaining wall at the southwest corner of the intersection of Racetrack View Drive and San Dieguito Drive.

5. GEOLOGY AND SUBSURFACE CONDITIONS

The site is located within the Peninsular Ranges Geomorphic Province of California, which stretches from the Los Angeles basin to the tip of Baja California in Mexico. This province is characterized as a series of northwest-trending mountain ranges separated by subparallel fault zones, and a coastal plain of subdued landforms. The mountain ranges are underlain primarily by Mesozoic metamorphic rocks that were intruded by plutonic rocks of the southern California batholith, while the coastal plain is underlain by subsequently deposited marine and non-marine sedimentary formations. Locally, the site is underlain by fill and old paralic deposits. Descriptions of the materials encountered are presented below. Figures 2 and 4 present the subsurface exploration map and the regional geology in the vicinity of the site, respectively.

- **Fill (Af)**: Fill was observed up to about 2½ feet below ground surface in Boring B-1. As encountered, the fill generally consisted of dry, loose silty sand with trace gravel, roots, and debris. No significant fill was observed in the other borings.
- **Old Paralic Deposits (Qop)**: Old paralic deposits were observed beneath the fill and pavements to the maximum depth explored of approximately 19½ feet. As encountered, the old paralic deposits generally consisted of moist, loose to medium dense silty sand with trace clay and gravel.
- **Groundwater**: No groundwater or seepage was encountered during our investigation. However, groundwater levels may fluctuate due to rainfall, irrigation, broken pipes, or changes in site drainage. Because groundwater rise or seepage are difficult to predict, such conditions are typically mitigated if and when they occur.

6. GEOLOGIC HAZARDS

6.1 Faulting and Surface Rupture

Faulting in San Diego County is dominantly characterized by a series of Quaternary-age and older fault zones that typically consist of several individual echelon faults. Generally striking in a northerly to northwesterly direction. Active fault zones are those that have shown conclusive evidence of faulting during the Holocene Epoch (the most recent 11,700 years) while potentially active fault zones have demonstrated movement during the Pleistocene Epoch (11,700 to 2.6 million years before the present) but no evidence of movement during Holocene time. Faults that can be shown to have experienced no movement within the Holocene or Pleistocene Epochs are generally considered to be inactive.

The closest active fault to the site is the Newport-Inglewood-Rose Canyon Fault Zone which is located approximately 1.1 mile south and 2.2 miles west of the subject site. No active faults are known to underlie or project toward the site. The probability of fault rupture at the site is low. Figure 5 presents the approximate site location overlain on a California fault activity map. Figure 6 shows the San Diego seismic safety map.

6.2 CBC Seismic Design Parameters

A geologic hazard likely to affect the project is ground shaking caused by movements along an active fault zone in the vicinity of the subject site. The mapped shear wave velocity of the site in the upper 30 meters was estimated to be 386 m/s (Site Class C) based on the dataset by Wills et al. (2015). The mapped site coefficients and maximum considered earthquake (MCE_R) spectral response acceleration parameters for a Risk Category II structure in accordance with the ASCE 7-16 are presented below.

Table 1: 2022 CBC/ASCE 7-16 Mapped Site Coefficients

Site Coordinates	
Latitude: 32.963337°	Longitude: -117.256130°
Site Coefficients and Spectral Response Acceleration Parameters	Value
Mapped Shear Wave Velocity in the Upper 30 Meters, $V_{s,30}$ ⁽¹⁾	386 m/s (1266 ft/s)
Site Class	C
Site Coefficients, F_a	1.2
Site Coefficients, F_v	1.5
Mapped Spectral Response Acceleration at Short Period, S_s	1.188 g
Mapped Spectral Response Acceleration at 1-Second Period, S_1	0.422 g
Mapped Design Spectral Acceleration at Short Period, S_{DS}	0.951 g
Design Spectral Acceleration at 1-Second Period, S_{D1}	0.422 g
Site Peak Ground Acceleration, PGA_M	0.64 g

⁽¹⁾ Based on Wills et al. (2015) and SEAOC (2023)

6.3 Landslides and Slope Stability

The project site is not within a mapped landslide area (CGS, 2022). Evidence of landslides or slope instabilities were not observed. The potential for landslides or slope instabilities to occur at the site is considered low.

6.4 Liquefaction and Dynamic Settlement

Liquefaction is the loss of soil strength or stiffness due to a buildup of pore-water pressure during severe ground shaking. Liquefaction is associated primarily with loose, saturated, fine to medium grained, cohesionless soils. Effects of severe liquefaction can include sand boils, excessive settlement, bearing capacity failures, and lateral spreading. Additionally, reversal of surface drainage or gravity flow is possible after significant seismic events.

Given the relatively deep groundwater at the site, the potential for liquefaction-induced settlement to occur is considered low. Dynamic settlement of the sand deposits above the groundwater is still considered possible.

6.5 Tsunamis, Seiches, and Flooding

The project site is not located within a mapped area on the State of California Tsunami Inundation Maps (Graehl and Wilson, 2022); however, it is approximately 300 feet east of the tsunami hazard area. The damage due to tsunamis is considered low. Seiches are periodic oscillations in large bodies of water such as lakes, harbors, bays, or reservoirs. San Dieguito Lagoon is located immediately north of the northern extent of the roadway; therefore, the potential for a seiche to affect the site is considered high. The site is located within Zone X, an area having minimal flood hazard (FEMA, 2019). The site is not located within a dam inundation area (DWR, 2022).

6.6 Subsidence

The site is not located in an area of known subsidence associated with fluid withdrawal (groundwater or petroleum); therefore, the potential for subsidence due to the extraction of fluids is considered low (CWSC, 2023).

6.7 Hydro-Consolidation

Hydro-consolidation can occur in recently deposited sediments (less than 10,000 years old) that were deposited in a semi-arid environment. Examples of such sediments are eolian sands, axial-channel deposits, and mudflow sediments deposited during flash floods. The pore spaces between the particle grains can re-adjust when inundated by groundwater, causing the material to consolidate. Considering the existing old paralic deposits at the site, and the proposed retaining wall and roadway will be founded on compacted fill or competent old paralic deposits, the potential for the proposed improvements to be affected by hydro-consolidation is low.

7. CONCLUSIONS

Based on the results of our investigation, we consider the proposed construction feasible from a geotechnical standpoint provided that the recommendations of this report are followed. The main geotechnical consideration affecting the planned development is the presence of potentially loose compressible soils and strong ground motions from the nearby Newport-Inglewood-Rose Canyon Fault Zone. Existing fill should be removed in the vicinity of structural improvements such as the proposed retaining wall. The planned retaining wall can be supported on shallow spread footings founded in old paralic deposits or newly compacted fill. The recommendations presented herein may need to be updated once final plans are developed.

8. RECOMMENDATIONS

The remainder of this report presents recommendations regarding earthwork construction as well as preliminary geotechnical recommendations for the design of the proposed improvements. These recommendations are based on empirical and analytical methods typical of the standard-of-practice in southern California. If these recommendations appear not to address a specific feature of the project, please contact our office for additions or revisions to the recommendations.

8.1 Earthwork and Grading

Grading and earthwork should be conducted in accordance with the local design standards and the recommendations of this report. The following recommendations are provided regarding specific aspects of the proposed earthwork construction. These recommendations should be considered subject to revision based on field conditions observed by our offices during grading.

8.1.1 Site Preparation

Site preparation should begin with the removal of existing improvements, vegetation, and debris. Subsurface improvements that are to be abandoned should be removed, and the resulting

excavations should be backfilled and compacted in accordance with the recommendations of this report. Pipeline abandonment can consist of capping or rerouting at the project perimeter and removal within the project perimeter. If appropriate, abandoned pipelines can be filled with grout or slurry, as recommended by, and observed by the geotechnical consultant.

8.1.2 Remedial Grading

Beneath planned hardscape areas and retaining wall footings, the foundations should be supported entirely on geotechnically approved, competent old alluvial deposits. If existing fill or loose soil is encountered at the foundation elevation, the soils should be overexcavated to a depth of at least 1 foot below the planned subgrade elevation for hardscaping and 2 feet below the retaining wall, or deeper if loose material is encountered.

Overexcavation areas should be and backfilled with compacted fill. Horizontally, the excavations should extend at least 1 foot outside the planned hardscape or within a 1:1 projection outward from the bottom of the footing. Atlas should observe the conditions exposed in the bottom of excavations to evaluate whether additional excavation is recommended. The resulting surface should then be scarified to a depth of 6 inches, moisture conditioned to near optimum moisture content, and compacted to at least 90% maximum dry density (ASTM D1557). The excavation should be backfilled with compacted fill having an Expansion Index (EI) of 20 or less.

Beneath planned pavement areas, the existing soils should be excavated to a depth of at least 1 foot below planned subgrade elevation or deeper if loose material is encountered and backfilled with compacted fill. Horizontally, the excavations should extend at least 2 feet outside the planned pavement or up to existing improvements, whichever is less. Atlas should observe the conditions exposed in the bottom of excavations to evaluate whether additional excavation is recommended. The resulting surface should then be scarified to a depth of 6 inches, moisture conditioned to near optimum moisture content, and compacted to at least 90% of maximum dry density (ASTM D1557).

8.1.3 Compacted Fill

Compacted fill should be granular materials, free of organic matter and other deleterious material, and finer than 4 inches in diameter with an expansion index of 20 or less and should be placed in horizontal lifts at a thickness appropriate for the equipment spreading, mixing, and compacting the material, but generally should not exceed 8 inches in loose thickness. The existing on-site soils are anticipated to be suitable as compacted fill pending approval from Atlas. Engineered fill should be compacted to at least 90% relative compaction for proposed hardscapes and utility trench backfill and 95% relative compaction for foundation subgrades. Additionally, the upper 1 foot of subgrade beneath the new pavements should be compacted to at least 95% relative compaction. Maximum dry density and optimum moisture content for evaluating compaction should be obtained in accordance with ASTM D1557.

8.1.4 Expansive Soils

The on-site materials were observed to be non-cohesive, having low percentage of fines, and tested to have a very low expansion potential; The recommendations provided in this report are for materials with a very low expansion potential.

8.1.5 Imported Soil

Imported soil should consist of predominately granular soil free of organic matter and rocks greater than 3 inches. Imported soil should have an expansion index of 20 or less and should be inspected and, if appropriate, tested by Atlas prior to transport to the site.

8.1.6 Excavation Characteristics

It is anticipated that excavations can be achieved with conventional earthwork equipment in good working order.

8.1.7 Temporary Excavations

Temporary excavations should be performed per Cal-OSHA requirements. Temporary excavations 3 feet deep or less can be made vertically. Deeper temporary excavations up to 20 feet should be laid back no steeper than 1½:1 (horizontal:vertical). Excavations deeper than 20 feet should be designed by a registered professional engineer.

The faces of temporary slopes should be inspected daily by the contractor's competent person before personnel are allowed to enter the excavation. Zones of potential instability, sloughing, or raveling should be brought to the attention of the engineer and corrective action implemented before personnel begin working in the excavation. Excavated soils should not be stockpiled behind temporary excavations within a distance equal to the depth of the excavation. Atlas should be notified if other surcharge loads are anticipated so that lateral load criteria can be developed for the specific situation.

If temporary slopes are to be maintained during the rainy season, berms are recommended along the tops of slopes to reduce the potential for runoff water from entering the excavation and eroding the slope faces. Slopes steeper than those described above will require shoring. Additionally, temporary excavations that extend below a plane inclined at 1½:1 (horizontal:vertical) downward from the outside bottom edge of existing structures or improvements will require shoring.

8.1.8 Slopes

Permanent slopes should be constructed no steeper than 2:1 (horizontal:vertical). Faces of fill slopes should be compacted either by rolling with a sheep-foot roller or other suitable equipment, or by overfilling and cutting back to design grade. Site slopes are potentially susceptible to surficial slope failure and erosion. Water should not be allowed to flow over the top of slopes. Additionally, slopes should be planted with vegetation that will reduce the potential for erosion.

8.1.9 Surface Drainage

Final surface grades around structures should be designed to collect and direct surface water away from the structure and toward appropriate drainage facilities. The ground around the structure should be graded so that surface water flows rapidly away from the structure without ponding. In general, we recommend that the ground adjacent to the structure slope away at a gradient of at least 2%. Densely vegetated areas where runoff can be impaired should have a minimum gradient of at least 5% within the first 5 feet from the structure. Roof gutters with downspouts that discharge directly into a closed drainage system are recommended on structures. Drainage patterns established at the time of fine grading should be maintained throughout the life of the proposed structures. Site irrigation should be limited to the minimum necessary to sustain landscape growth. Should excessive irrigation, impaired drainage, or unusually high rainfall occur, saturated zones of perched groundwater can develop.

8.1.10 Grading Plans and Earthwork Specifications

Atlas should review the grading plans and earthwork specifications to ascertain whether the intent of the recommendations contained in this report have been implemented, and that no revised recommendations are needed due to changes in the development scheme.

8.2 Conventional Retaining Walls

8.2.1 Foundations

The foundation recommendations provided herein are considered generally consistent with methods typically used in southern California. Other alternatives may be available. Our recommendations are only minimum criteria based on geotechnical factors and should not be considered a structural design, or to preclude more restrictive criteria of governing agencies or by the structural engineer. The design of the foundation system should be performed by the project structural engineer, incorporating the geotechnical parameters described herein and the requirements of applicable building codes.

Retaining walls can be supported on shallow spread footings founded entirely on competent approved old alluvial deposits or on newly compacted fill. Footings should extend at least 24 inches below lowest adjacent finished grade. Continuous footings should be at least 12 inches wide. Isolated or wall footings should be at least 24 inches wide. An allowable bearing capacity of 2,000 pounds per square foot (psf) can be used for design. When considering the total of all loads, including wind or seismic forces, the bearing capacity can be increased by $\frac{1}{3}$.

Lateral loads will be resisted by friction between the bottoms of footings and passive pressure on the faces of footings and other structural elements below grade. A coefficient of friction of 0.3 can be used. Passive pressure can be computed using a lateral pressure of 300 psf per foot of depth below the finished grade. Passive earth pressures should be reduced by $\frac{1}{2}$ when used in conjunction with the coefficient of friction. The passive pressure can be increased by $\frac{1}{3}$ when considering the total of all loads, including wind or seismic forces. The upper 1 foot of soil should not be relied on for passive support unless the ground is covered with pavements or slabs.

8.2.2 Total Static Settlement Characteristics

Total static settlements are estimated to be about 1 inch. Differential settlements across continuous footings are estimated to be about $\frac{3}{4}$ inch over 40 feet. Settlements should be completed shortly after structural loads are applied.

8.2.3 Foundation Excavation Observations

A representative from Atlas should observe the foundation excavations prior to forming or placing reinforcing steel.

8.2.4 Wall Backfill

Wall backfill should consist of granular, free-draining material having an expansion index of 20 or less. The backfill zone is defined by a 1:1 plane projected upward from the heel of the wall. Expansive or clayey soil should not be used. We anticipate that the on-site soils will be suitable for wall backfill. Additionally, backfill within 3 feet from the back of the wall should not contain rocks greater than 3 inches in dimension. Backfill should be compacted to at least 90% relative compaction. Backfill should not be placed until walls have achieved adequate structural strength. Compaction of wall backfill will be necessary to reduce settlement of the backfill and overlying settlement sensitive improvements. However, some settlement should still be anticipated. Provisions should be made for some settlement of concrete slabs and pavements supported on backfill. Additionally, utilities supported on backfill should be designed to tolerate differential settlement.

8.2.5 Wall Backdrain

Retaining walls should be designed to resist hydrostatic pressures or be provided with a backdrain to reduce the accumulation of hydrostatic pressures. Backdrains can consist of a 1-foot-wide zone of $\frac{3}{4}$ inch crushed rock. The backdrain should be separated from the adjacent soils using a non-woven filter fabric, such as Mirafi 140N or equivalent. Weep holes should be provided, or a perforated pipe should be installed at the base of the backdrain and sloped to discharge to a suitable storm drain facility. As an alternative, a geocomposite drainage system such as Miradrain 6000 or equivalent placed behind the wall and connected to a suitable storm drain facility can be used. The project design consultant should provide waterproofing specifications and details. Figure 7 presents typical conventional retaining wall backdrain details.

8.2.6 Lateral Earth Pressures

The active earth pressure for the design of unrestrained retaining walls with a level backfill can be taken as equivalent to the pressure of a fluid weighing 40 pounds per cubic foot (pcf). An equivalent fluid pressure of 60 pcf should be considered for a 2H:1V backfill. These values assume a granular and drained backfill condition. An increase in earth pressure equal to 100 psf applied uniformly along the walls can be used to account for surcharge loads from light traffic. The wall designer may increase the traffic surcharge load or add additional surcharge loads, as appropriate. The above values do not include a load factor (i.e., a factor of safety).

Walls with heights less than 6 feet do not need to be designed for seismic lateral earth pressures. Where applicable, the seismic lateral earth pressure on cantilever retaining walls with level and 2:1 (horizontal:vertical) sloping backfill can be taken as equivalent to the pressure of a fluid weighing 30 pcf and 40 pcf, respectively. The seismic lateral earth pressure is in addition to the un-factored, static active earth pressure. If any other surcharge loads are anticipated, Atlas should be contacted for the necessary increase in soil pressure.

8.3 Preliminary Pavement Section Recommendations

Atlas utilized the California Department of Transportation Highway Design Manual (Caltrans, 2020) to prepare preliminary recommendations for flexible and rigid pavements. The pavement support characteristics of the soils encountered during our investigation are considered good. Laboratory testing was performed on a select sample, and results indicate an R-Value of 67. An R-value of 50 was used for the design of preliminary pavement sections. The support characteristics of actual subgrade soils should be determined after grading and final pavement sections are provided. Table 2 provides recommended flexible and rigid pavement structural sections for the assumed Traffic Indexes and subgrade R-value.

Table 2: Preliminary Rigid and Flexible Pavement Sections

Traffic Type	Traffic Index	AC ⁽¹⁾ over AB ⁽²⁾ (inches)	Full-Depth AC ⁽¹⁾ (inches)	PCC ⁽³⁾ over AB ⁽²⁾ (inches)
Drive Lanes	7.5	4½ over 5	7½	5 over 4

⁽¹⁾ AC – Asphalt Concrete

⁽²⁾ AB – Caltrans Class II Aggregate Base

⁽³⁾ PCC – Portland Cement Concrete

The top 12 inches of subgrade should be scarified, moisture conditioned to near optimum moisture content and compacted to at least 95% relative compaction. Aggregate base and asphalt concrete should be compacted to at least 95% relative compaction. Soft or yielding areas should be stabilized or removed and replaced with compacted fill or aggregate base. Materials and methods of construction should conform to good engineering practices and the minimum local standards.

8.4 Soil Corrosivity

A representative sample of the on-site soils was tested to evaluate corrosion potential. The test results are presented in Appendix II. The project design engineer can use the sulfate results in conjunction with ACI 318 to specify the water/cement ratio, compressive strength, and cementitious material types for concrete exposed to soil. For structural elements, the California Department of Transportation considers a site to be corrosive if one or more of the following conditions exist for the representative soil and/or water samples taken at the site: Chloride concentration is 500 ppm or greater, sulfate concentration is 1,500 ppm or greater, or the pH is 5.5 or less. Based on these criteria the tested on-site soil is not considered corrosive to structural

elements. A corrosion engineer should be contacted to provide specific corrosion control recommendations.

9. GEOTECHNICAL ENGINEERING DURING CONSTRUCTION

Atlas should review project plans and specifications prior to bidding and construction to confirm the intent of the recommendations within this report have been incorporated. Observations and tests should be performed during construction. If the conditions encountered during construction differ from those anticipated based on the subsurface exploration program, the presence of personnel from our offices during construction will enable an evaluation of the exposed conditions and modifications of the recommendations within this report or development of additional recommendations in a timely manner.

10. CLOSURE

Atlas should be advised of changes in the project scope so that the recommendations contained in this report can be evaluated with respect to the revised plans. Changes in recommendations will be verified in writing. The findings in this report are valid as of the date of this report. Changes in the condition of the site can occur with the passage of time, whether they are due to natural processes or work on this or adjacent areas. In addition, changes in the standards of practice and government regulations can occur. Thus, the findings in this report may be invalidated wholly or in part by changes beyond our control. This report should not be relied upon after a period of two years without a review by us verifying the suitability of the conclusions and recommendations to site conditions at that time.

In the performance of our professional services, we comply with that level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions and in the same locality. The client recognizes that subsurface conditions may vary from those encountered at boring locations and that our data, interpretations, and recommendations are based solely on the information obtained by us. We will be responsible for those data, interpretations, and recommendations, but shall not be responsible for interpretations by others of the information developed. Our services consist of professional consultation and observation only, and no warranty whatsoever, express or implied, is made or intended in connection with the work performed or to be performed by us, or by our proposal for consulting or other services, or by our furnishing of oral or written reports or findings.

11. REFERENCES

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

California Department of Conservation, Geological Survey (CGS), 2022, CGS Information Warehouse: Tsunami, accessed October 2023 at maps.conservation.ca.gov/cgs/informationwarehouse/index.html?map=regulatorymaps.

California Department of Conservation, Geological Survey (CGS), 2022, CGS Information Warehouse: Landslide Inventory, accessed October 2023 at <https://maps.conservation.ca.gov/cgs/lsi/>.

California Department of Conservation, Geological Survey (CGS), 2022, 2010 Fault Activity Map of California, accessed October 2023 at <https://maps.conservation.ca.gov/cgs/fam/>.

California Department of Transportation (Caltrans), 2020, Highway Design Manual.

California Water Science Center (CWSC), 2023, Areas of Land Subsidence in California, accessed October 2023 at https://ca.water.usgs.gov/land_subsidence/california-subsidence-areas.html.

City of San Diego, 2018, Seismic Safety Study, Geologic Hazards and Faults, Grid Tile 42, dated April 3.

California Department of Water Resources (DWR), 2022, Division of Safety of Dams, Dam Inundation Hazard Tools, accessed November 2023.

Federal Emergency Management Agency (FEMA), 2019, FIRM Flood Insurance Rate Map, San Diego County, Firm Panel 06073C1309H, dated December 20, accessed October 2023 at <https://msc.fema.gov/portal/search>.

Graehl, N.G., and Wilson, R.I., 2022, Tsunami Hazard Area Map, San Diego County; produced by the California Geological Survey and the California Governor's Office of Emergency Services; dated 2022, displayed at multiple scales, accessed October 2023.

International Code Council (ICC), 2021, 2022 California Building Code, California Code of Regulations, Title 24, Part 2, Volume 2 of 2, Based on the 2021 International Building Code, effective January 1, 2022.

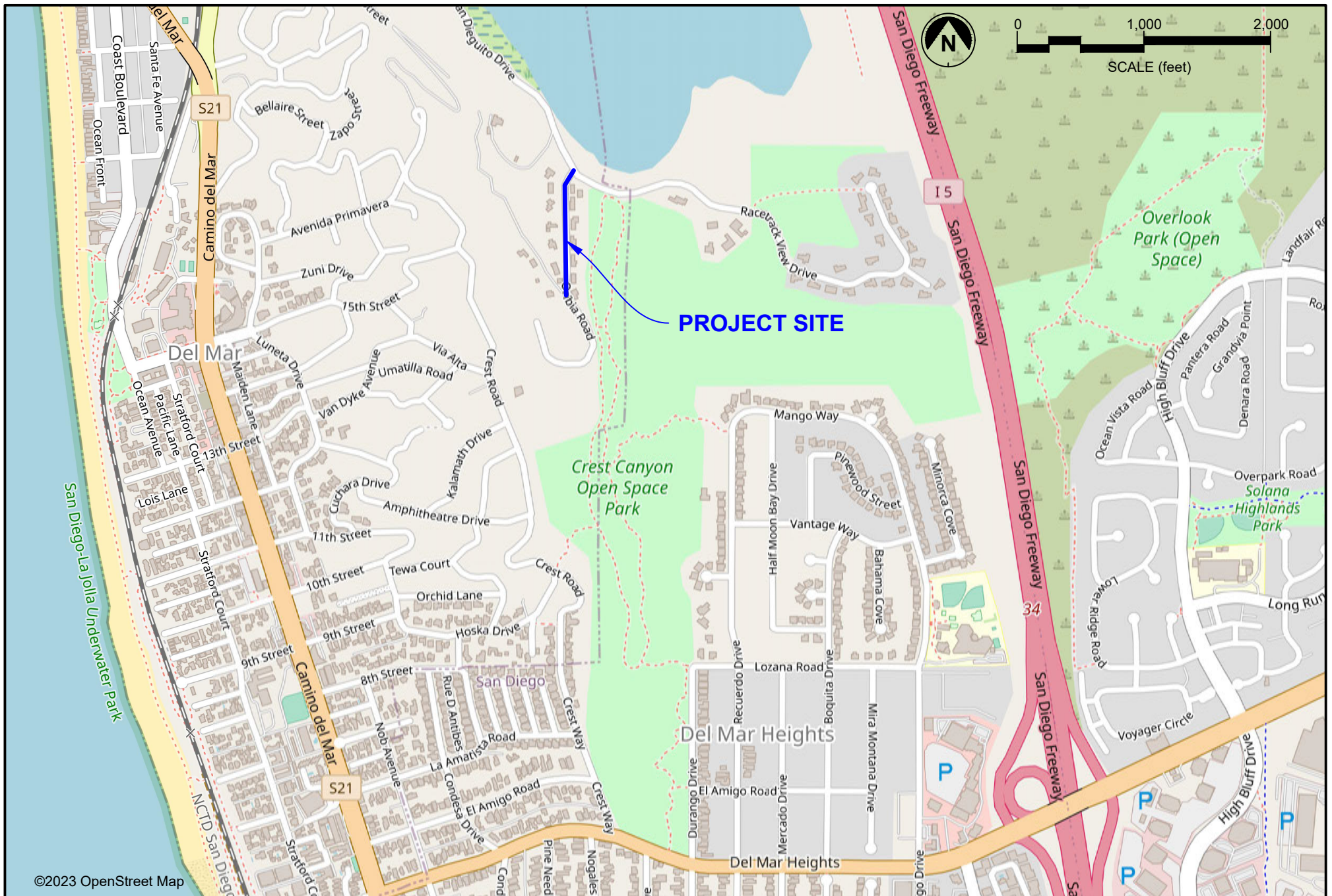
Jennings, C.W., Bryant W.A., 2010, Fault Activity Map of California, accessed October 2023 at <https://maps.conservation.ca.gov/cgs/fam/>.

Public Works Standards, Inc., 2018, "Greenbook" Standard Specifications for Public Works Construction, 2018 Edition.

Structural Engineers Association of California (SEAOC), 2023, OSHPD Seismic Design Maps, accessed October 2023 at <https://www.seismicmaps.org>.

U.S. Geological Survey (USGS), 2023, Geologic Hazards Science Center, U.S. Quaternary Faults, accessed October 2023 at <https://usgs.maps.arcgis.com/apps/webappviewer/>.

Wills, C.J., Gutierrez, C.I., Perez, F.G., and Branum, D.B., 2015, A next-generation Vs30 map for California based on geology and topography: Bulletin of the Seismological Society of America, July 14.



	SITE VICINITY MAP Private San Dieguito Drive Improvements Del Mar, California	Date: November, 2023 By: CGI Job No.: 10939.000	Figure: 1
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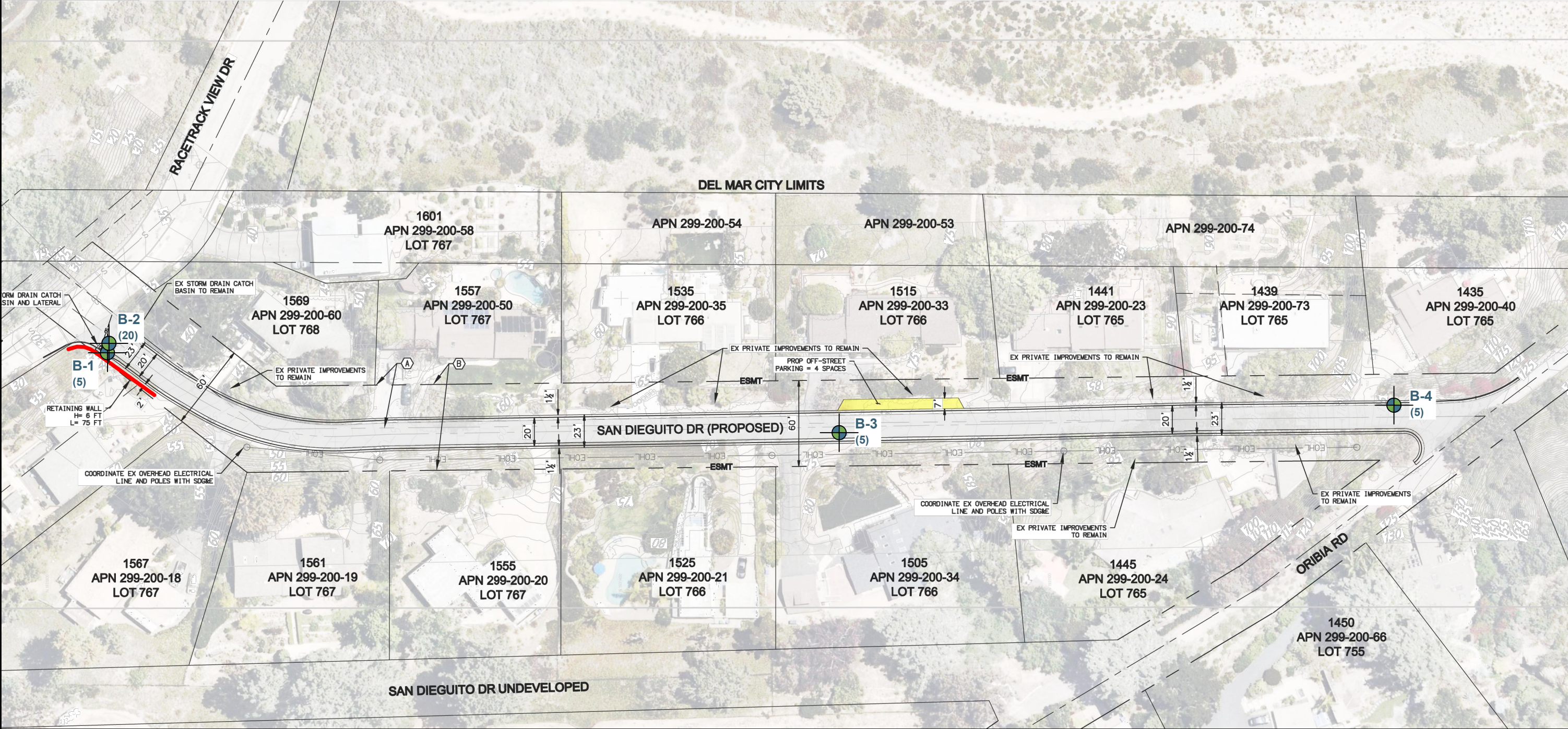
EXHIBIT 3
MINIMAL SECTION WITH ROLLED CURB

Date: November, 2023
By: CGI
Job No.: 10939,000

SUBSURFACE EXPLORATION MAP
Private San Dieguito Drive Improvements
Del Mar, California



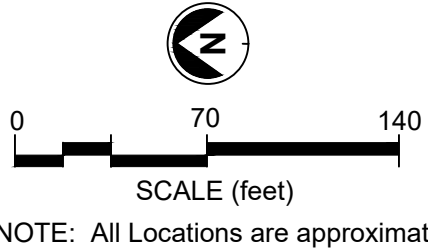
Figure:
2



LEGEND:

- Approximate Location of Boring (Depth in feet)
- Proposed Retaining Wall

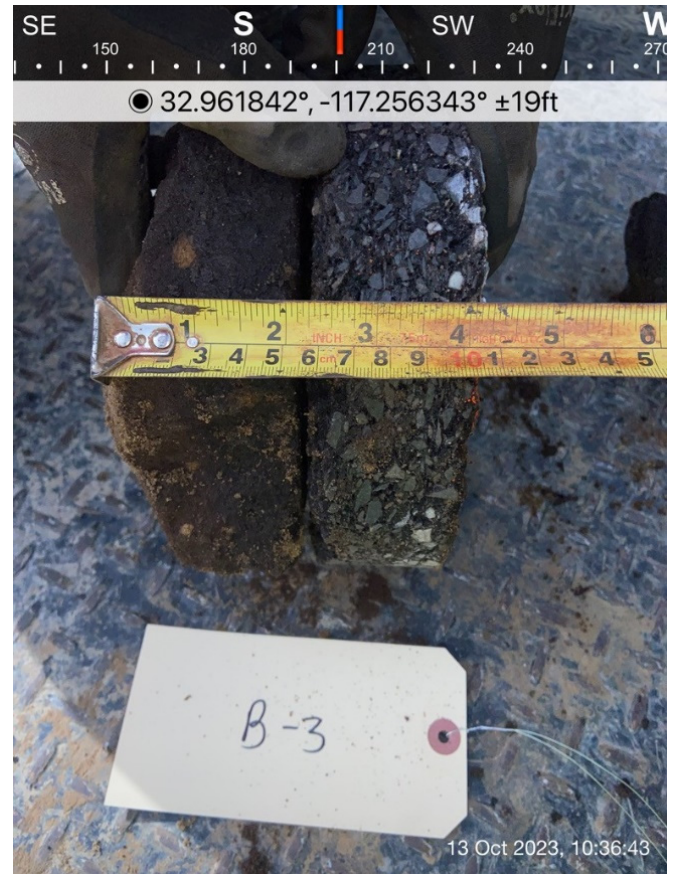
Reference:
Plans: Michael Baker, International. (2023), Improvement Option 3.



B-2



B-3



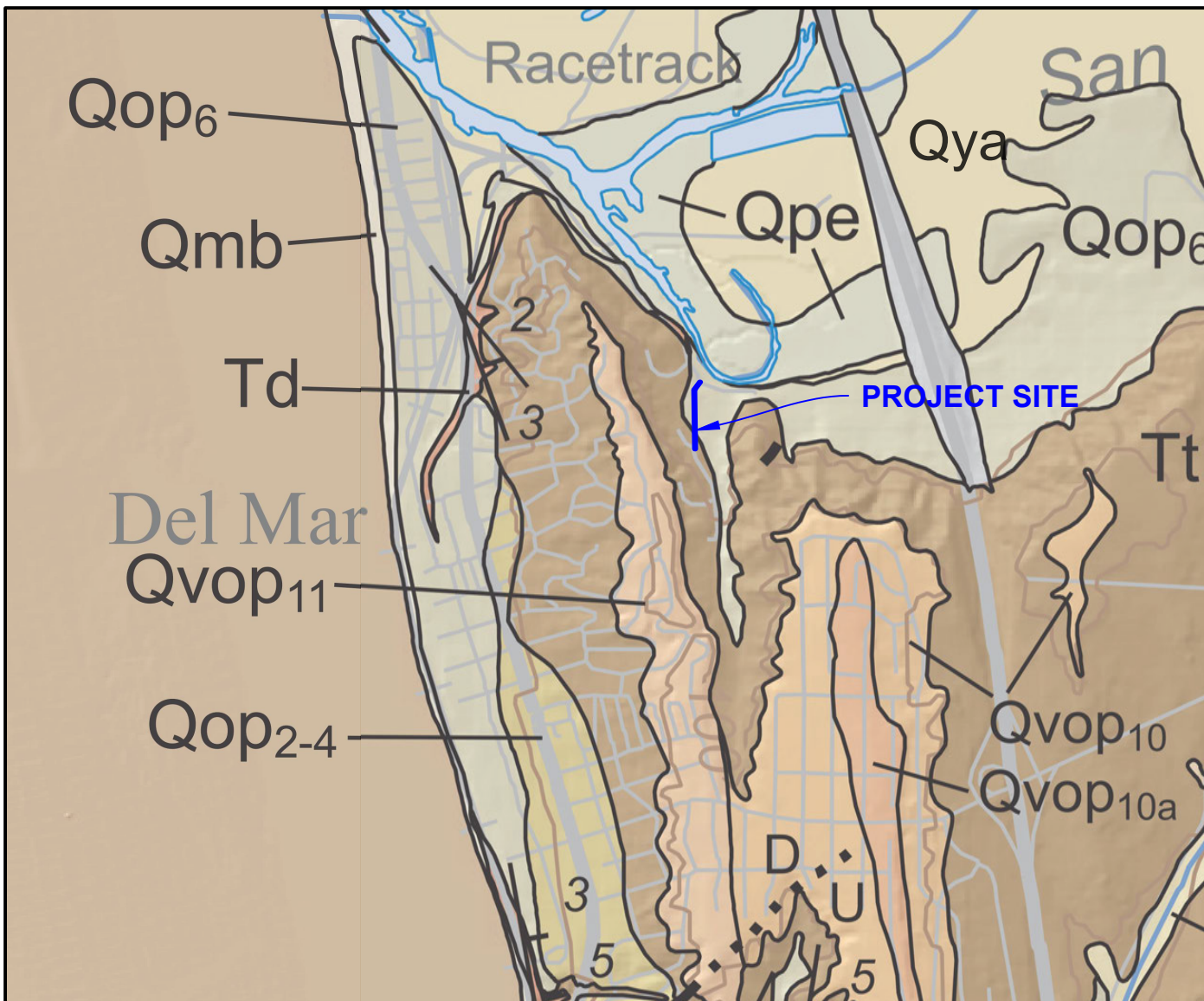
B-4



PAVEMENT CORE PHOTOGRAPHS
Private San Dieguito Drive Improvements
Del Mar, California

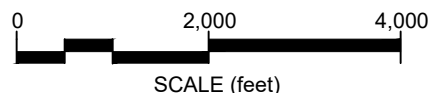
Date: November, 2023
Job No.: 10939

Figure:
3



EXPLANATION:

Qmb	Marine beach deposits
Qpe	Paralic estuarine deposits
Qya	Young alluvial flood-plain deposits
Qop ₆	Old paralic deposits, undivided Unit 6
Qop ₂₋₄	Old paralic deposits, undivided Unit 2-4
Qvop ₁₁	Very old paralic deposits, undivided Unit 11
Qvop ₁₀	Unit 10
Qvop _{10a}	Unit 10a
Tt	Torrey Sandstone



NOTE: All locations are approximate.

Reference:

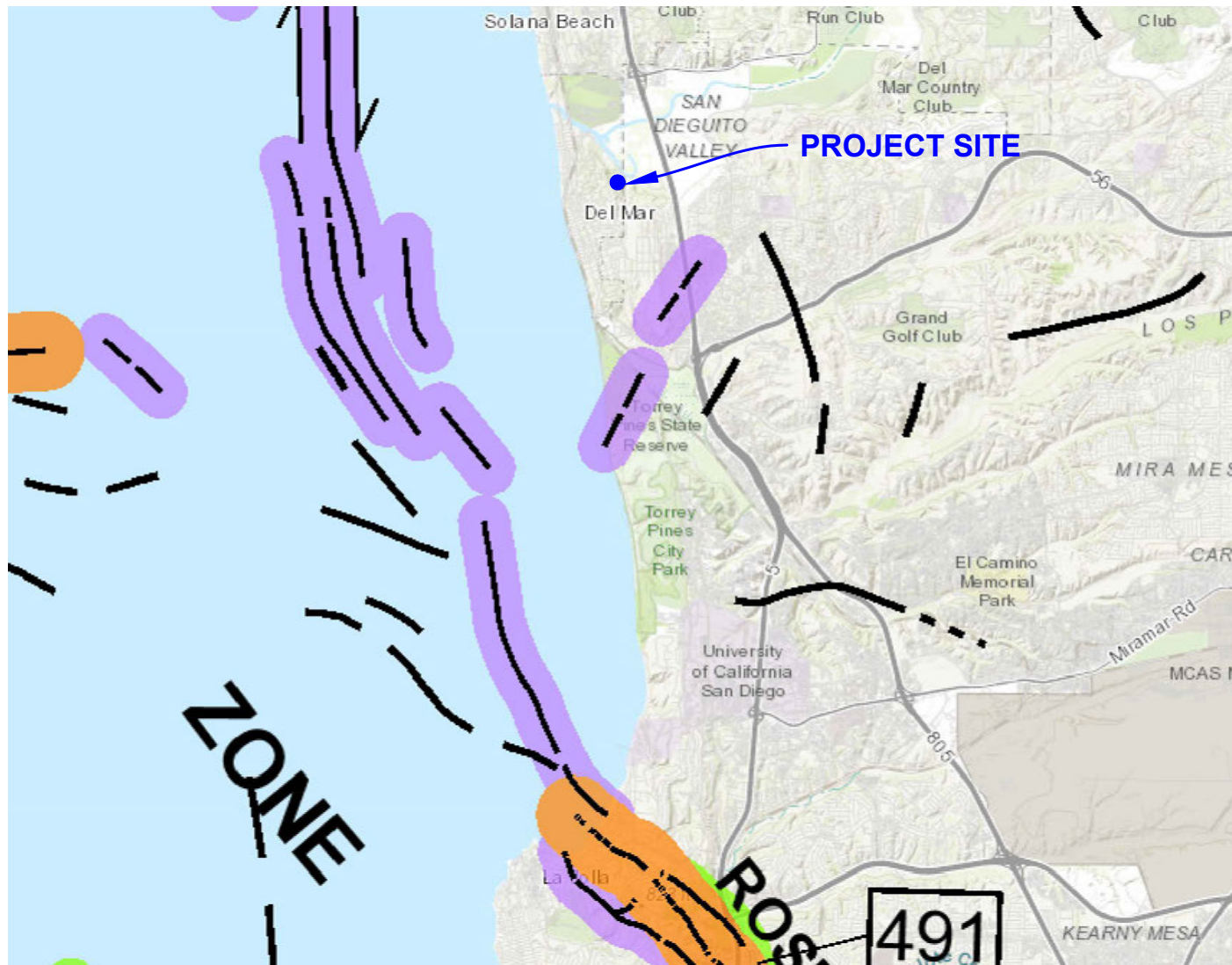
Kennedy, M.P. and Tan, S.S. (2008), Geologic map of the San Diego 30' x 60' quadrangle, California, California Geological Survey, Scale 1:100,000.

ATLAS

REGIONAL GEOLOGY MAP Private San Dieguito Drive Improvements Del Mar, California

Date: November, 2023
By: CGI
Job No.: 10939.000

Figure:
4



EXPLANATION:

Holocene fault displacement
(during past 11,700 years) without
historic record.

Late Quaternary fault displacement
(during past 700,000 years).

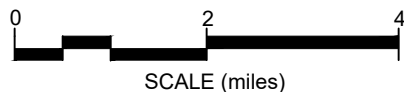
Quaternary fault (age undifferentiated).

Pre-Quaternary fault (older than 1.6 million
years) or fault without recognized Quaternary
displacement.

Low angle fault (barbs on upper plate).

491

Rose Canyon Fault -
Newport-Inglewood-Rose Canyon
fault zone (concealed)



Reference:

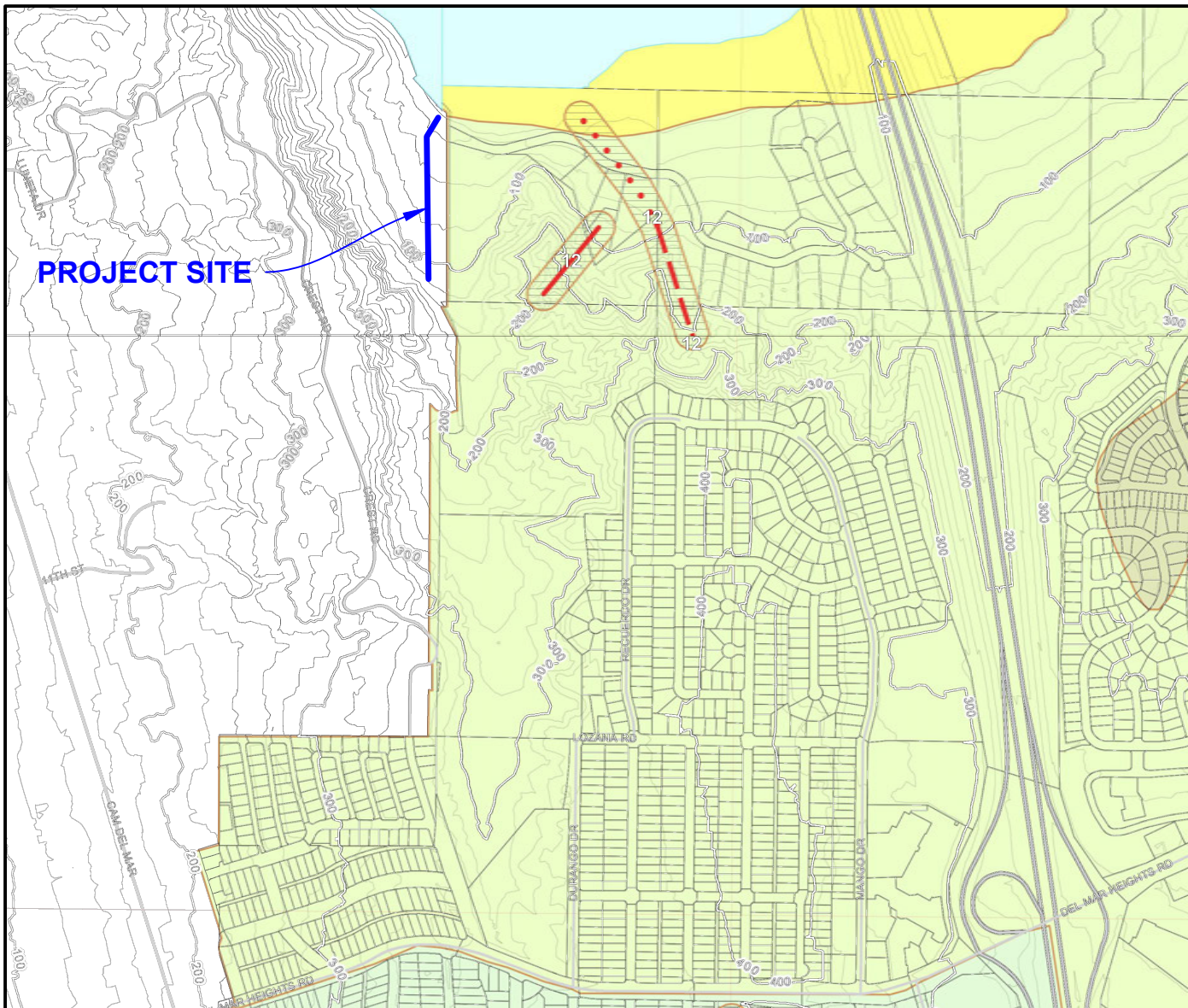
Jennings, C.W., Bryant W.A., Fault Activity Map of California (2010),
maps.conservation.ca.gov/cgs/fam; Accessed October, 2023

ATLAS

CALIFORNIA FAULT ACTIVITY MAP
Private San Dieguito Drive Improvements
Del Mar, California

Date: November, 2023
By: CGI
Job No.: 10939.000

Figure:
5



EXPLANATION:

FAULT ZONES

- 12 Potentially Active, Inactive, Presumed Inactive, or Activity Unknown

LIQUEFACTION

- 31 High Potential -- shallow groundwater major drainages, hydraulic fills

OTHER TERRAIN

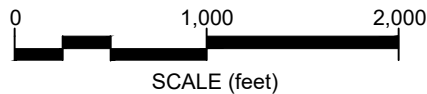
- 52 Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk
- 53 Level or sloping terrain, unfavorable geologic structure, Low to moderate risk

Water (Bays and Lakes)



FAULTS

- Fault
- Inferred Fault
- Concealed Fault
- Shear Zone



Reference:
City of San Diego (2008), Seismic Safety Study, Geologic Hazards and Faults,
Grid Tile: 38,42 Development Services Department, April 3, Scale 1:800.



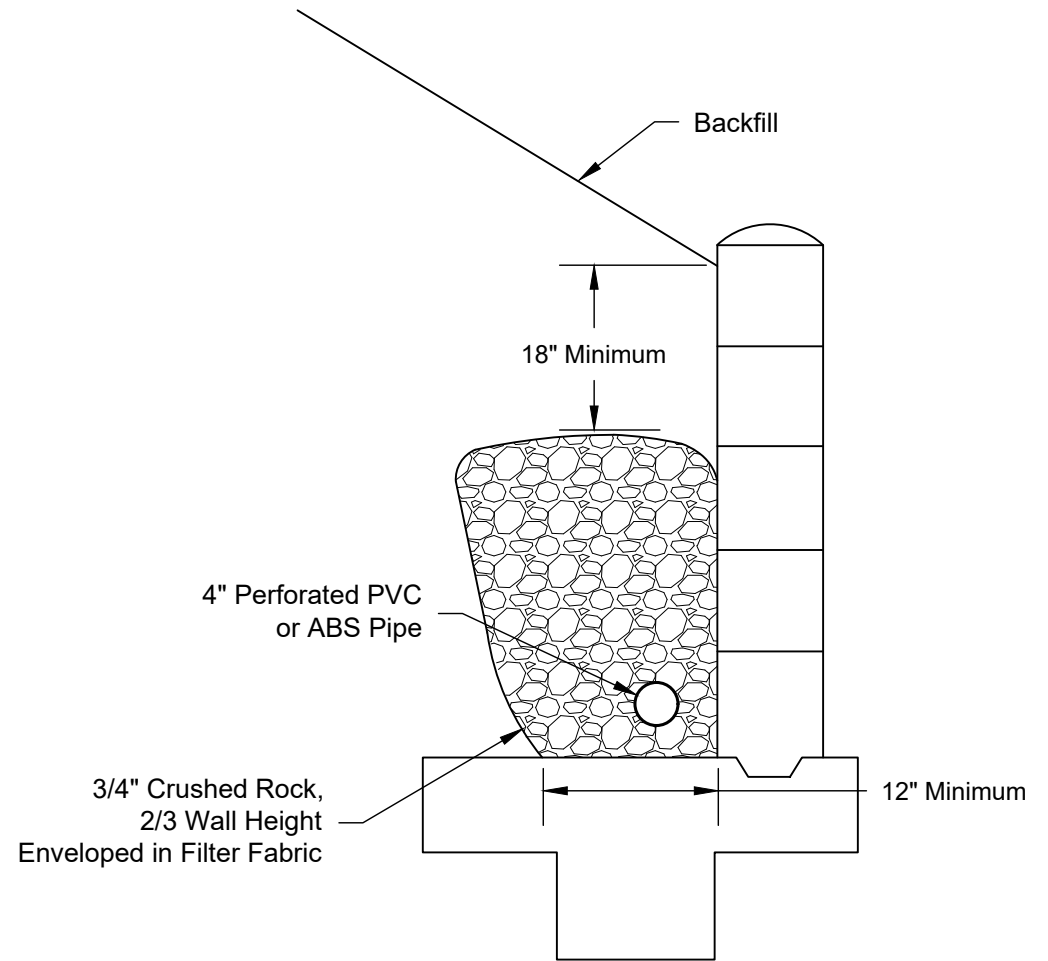
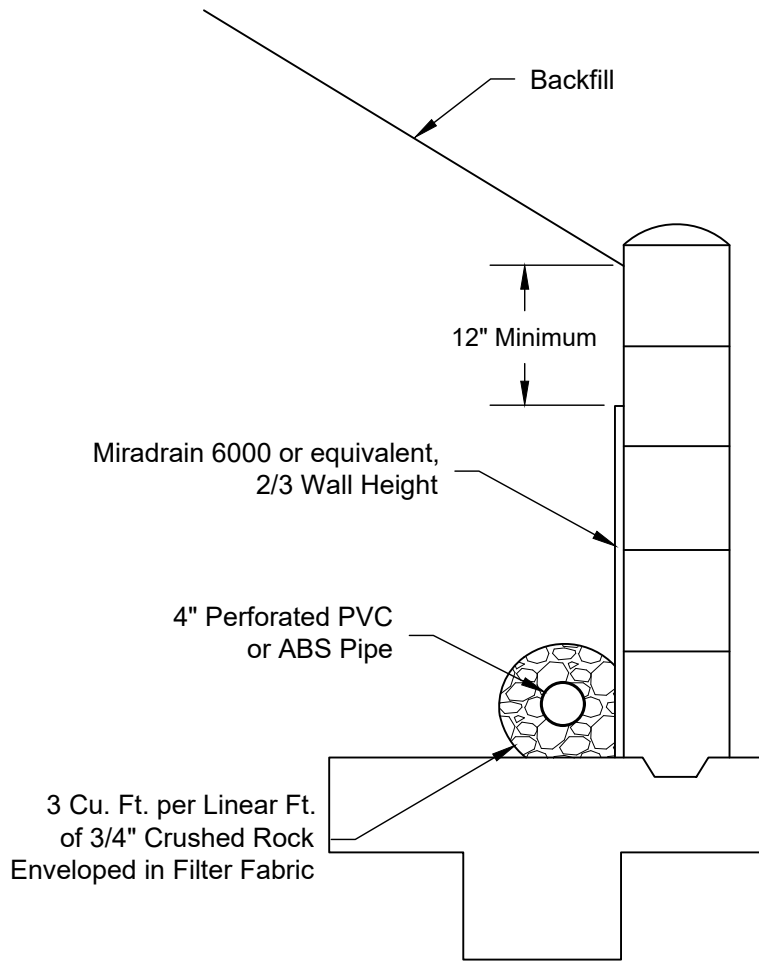
CITY OF SAN DIEGO SEISMIC SAFETY STUDY MAP

Private San Dieguito Drive Improvements

Del Mar, California

Date: November, 2023
By: CGI
Job No.: 10939.000

Figure:
6



NOT TO SCALE

NOTES:

- 1) Dampproof or waterproof back of wall following architect's specifications.
- 2) 4" minimum perforated pipe, SDR35 or equivalent, holes down, 1% fall to outlet. Provide solid outlet pipe at suitable locations.
- 3) Drain installation and outlet connection should be observed by the geotechnical consultant.



TYPICAL RETAINING WALL BACKDRAIN DETAILS
Private San Dieguito Drive Improvements
Del Mar, California

Date: November, 2023
By: CGI
Job No.: 10939.000

Figure:
7



APPENDIX I FIELD INVESTIGATION

Relatively undisturbed samples were obtained using a modified California (CAL) sampler in general accordance with ASTM D3550, which is a ring-lined split tube sampler with a 3-inch outer diameter and 2½-inch inner diameter. Standard Penetration Tests (SPT) were performed in general accordance with ASTM D1586, using a 2-inch outer diameter and 1⅜-inch inner diameter split tube sampler. The CAL and SPT samplers were driven with a 140-pound weight dropping 30 inches. The number of blows needed to drive the samplers the final 12 inches of an 18-inch drive is noted on the borings logs as "Driving Resistance (blows/foot of drive)." SPT and CAL sampler refusal was encountered when 50 blows were applied during any one of the three 6-inch intervals, a total of 100 blows was applied, or there was no discernible sampler advancement during the application of 10 successive blows. The SPT penetration resistance was normalized to a safety hammer (cathead and rope) with a 60 percent energy transfer ratio in accordance with ASTM D6066. The normalized SPT penetration resistance is noted on the boring logs as "N60." If sampler refusal was encountered during the first 6-inch interval, the blows per foot and N60 values are noted on the logs as refusal (REF). Disturbed bulk samples were obtained from the SPT sampler and the drill cuttings. The soils are classified in accordance with the Unified Soil Classification System as illustrated on the following Subsurface Exploration Legend. Logs of the borings are presented in this appendix.

MAJOR DIVISIONS					TYPICAL NAMES
COARSE-GRAINED SOILS MORE THAN HALF IS COARSER THAN NO. 200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS WITH LESS THAN 15% FINES	GW		WELL-GRADED GRAVELS WITH OR WITHOUT SAND
			GP		POORLY GRADED GRAVELS WITH OR WITHOUT SAND
		GRAVELS WITH 15% OR MORE FINES	GM		SILTY GRAVELS WITH OR WITHOUT SAND
			GC		CLAYEY GRAVELS WITH OR WITHOUT SAND
	SANDS MORE THAN HALF COARSE FRACTION IS FINER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LESS THAN 15% FINES	SW		WELL-GRADED SANDS WITH OR WITHOUT GRAVEL
			SP		POORLY GRADED SANDS WITH OR WITHOUT GRAVEL
		SANDS WITH 15% OR MORE FINES	SM		SILTY SANDS WITH OR WITHOUT GRAVEL
			SC		CLAYEY SANDS WITH OR WITHOUT GRAVEL
FINE-GRAINED SOILS MORE THAN HALF IS FINER THAN NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50% OR LESS		ML		INORGANIC SILTS OF LOW TO MEDIUM PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
			CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
			OL		ORGANIC SILTS OR CLAYS OF LOW TO MEDIUM PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50%		MH		INORGANIC SILTS OF HIGH PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
			CH		INORGANIC CLAYS OF HIGH PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
			OH		ORGANIC SILTS OR CLAYS OF HIGH PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
	HIGHLY ORGANIC SOILS		PT		PEAT AND OTHER HIGHLY ORGANIC SOILS

SAMPLE SYMBOLS

SAMPLE TYPES

	Bulk Sample
	Modified California Sampler
	Standard Penetration Test

CAI - CERCHAR ABRASIVITY

PLSI - POINT LOAD STRENGTH INDEX

STS - SPLITTING TENSILE STRENGTH

LABORATORY SYMBOLS

AL	- ATTERBERG LIMITS
CON	- CONSOLIDATION
COR	- CORROSIVITY TESTING
DS	- DIRECT SHEAR
EI	- EXPANSION INDEX
MAX	- MAXIMUM DENSITY
RV	- R-VALUE
PD	- PARTICLE-SIZE DISTRIBUTION
UC	- UNCONFINED COMPRESSIVE STRENGTH
WA	- No. 200 WASH (% PASSING No. 200 SIEVE)

GROUNDWATER SYMBOLS

	WATER LEVEL AT TIME OF EXCAVATION OR AS INDICATED
---	---

WHERE AN ASTERISK * EXISTS
NEXT TO ROD VALUE- MEASURED
INTACT PIECES DID NOT PASS
FIELD SOUNDNESS TEST

RELATIVE DENSITY OF COHESIONLESS SOILS		CONSISTENCY OF COHESIVE SOILS		
RELATIVE DENSITY	SPT N60 BLOWS/FOOT	CONSISTENCY	SPT N60 BLOWS/FOOT	POCKET PENETROMETER MEASUREMENT (TSF)
VERY LOOSE	0 - 4	VERY SOFT	0 - 2	0 - 0.25
LOOSE	4 - 10	SOFT	2 - 4	0.25 - 0.50
MEDIUM DENSE	10 - 30	MEDIUM STIFF	4 - 8	0.50 - 1.0
DENSE	30 - 50	STIFF	8 - 15	1.0 - 2.0
VERY DENSE	OVER 50	VERY STIFF	15 - 30	2.0 - 4.0
		HARD	OVER 30	OVER 4.0

NUMBER OF BLOWS OF 140 LB HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1-3/8 INCH I.D.) SPLIT-BARREL SAMPLER THE LAST 12 INCHES OF AN 18-INCH DRIVE (ASTM-1586 STANDARD PENETRATION TEST).
IF THE SEATING INTERVAL (1st 6 INCH INTERVAL) IS NOT ACHIEVED, N IS REPORTED AS REF.



Atlas Technical Consultants
6280 Riverdale Street
San Diego, California 92120
Telephone: (619) 280-4321

SUBSURFACE EXPLORATION LEGEND

LOG OF TEST BORING					ATLAS PROJECT NAME Private San Dieguito Drive Improvements			ATLAS PROJECT NUMBER 10939.000		B-1		
SITE Del Mar, California							START 10/13/23		END 10/13/23		SHEET NO. 1	
DRILLING COMPANY Baja Exploration					DRILL METHOD Hand Auger			LOGGED BY KBH		REVIEWED BY		
DRILLING EQUIPMENT Hand Auger					BORING DIA. (in.) 6		TOTAL DEPTH (ft) 5		GROUND ELEV. (ft) 40		DEPTH/ELEV. GROUND WATER (ft) ∇ AT TIME OF DRILLING --- ∇ AT END OF DRILLING --- ∇ AFTER DRILLING ---	
SAMPLING METHOD Manual					NOTES Elevation approximated using Google Earth.							

ELEVATION (ft)	DEPTH (ft)	BULK SAMPLE	DRIVE SAMPLE	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	LAB TESTS
		X X X X X			FILL (Qf): SILTY SAND (SM), brown, dry, fine to medium grained, trace gravel, trace roots, trace asphalt debris.	COR
		X X X X X			OLD PARALIC DEPOSITS (Qop): SILTY SAND (SM), brown, moist, fine to medium grained, trace gravel, micaceous.	
35	5				BORING TERMINATED AT 5 FEET	
30	10					
25	15					
20	20					

Atlas Technical Consultants 6280 Riverdale Street San Diego, California 92120 Telephone: (619) 280-4321	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.	Figure I-1
--	--	--------------------------

LOG OF TEST BORING					ATLAS PROJECT NAME Private San Dieguito Drive Improvements			ATLAS PROJECT NUMBER 10939.000		B-4		
SITE Del Mar, California							START 10/13/23		END 10/13/23		SHEET NO. 4	
DRILLING COMPANY Baja Exploration					DRILL METHOD Hand Auger			LOGGED BY KBH		REVIEWED BY		
DRILLING EQUIPMENT Hand Auger					BORING DIA. (in.) 6		TOTAL DEPTH (ft) 5		GROUND ELEV. (ft) 118		DEPTH/ELEV. GROUND WATER (ft) ∇ AT TIME OF DRILLING --- ▼ AT END OF DRILLING --- ▼ AFTER DRILLING ---	
SAMPLING METHOD Manual					NOTES Elevation approximated using Google Earth.							

ELEVATION (ft)	DEPTH (ft)	BULK SAMPLE	DRIVE SAMPLE	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
					6 1/4 inches of Asphalt Concrete. <u>OLD PARALIC DEPOSITS (Qop):</u> SILTY SAND (SM), brown, moist, fine to medium grained, micaceous.
115					
	5				BORING TERMINATED AT 5 FEET
110					
10					
105					
15					
100					
20					

Atlas Technical Consultants 6280 Riverdale Street San Diego, California 92120 Telephone: (619) 280-4321	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.	Figure I-4
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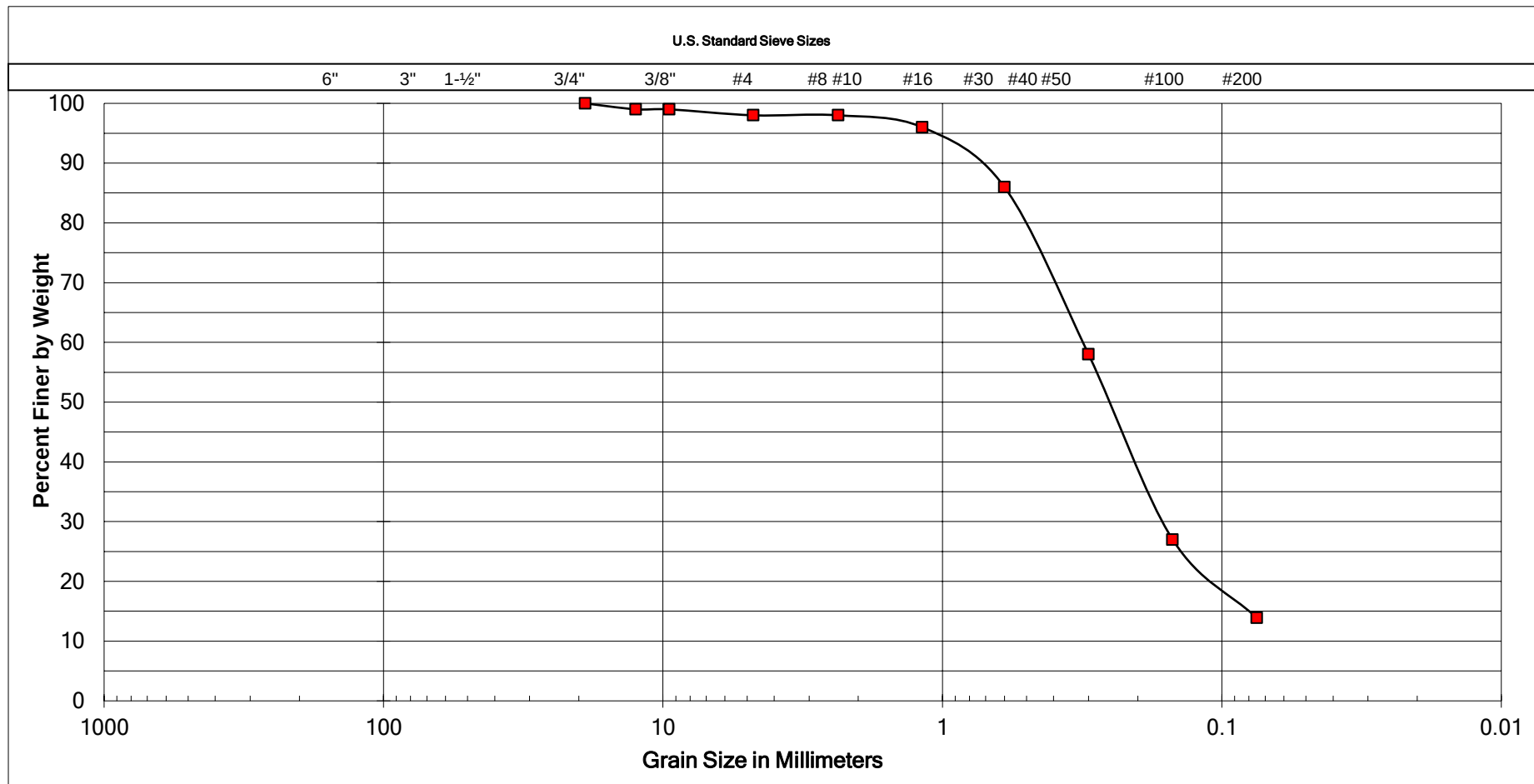


APPENDIX II LABORATORY TESTING

Laboratory tests were performed to provide geotechnical parameters for engineering analyses. The following tests were performed:

- **CLASSIFICATION:** Field classifications were verified in the laboratory by visual examination. The final soil classifications are in accordance with the Unified Soil Classification System.
- **IN SITU MOISTURE AND DENSITY:** In situ moisture content and dry unit weight testing was performed on select samples collected from the borings. The test results are presented on the boring logs in Appendix I.
- **PARTICLE-SIZE DISTRIBUTION:** Particle-size distribution testing was determined on a selected soil sample in accordance with ASTM D6913.
- **EXPANSION INDEX:** The expansion index was evaluated on a selected soil sample in accordance with ASTM D4289.
- **R-VALUE:** R-Value testing was performed on a selected soil sample in accordance with California Test 301.
- **CORROSIVITY:** Corrosivity test was performed on a selected soil sample. The pH and minimum resistivity were determined in accordance with California Test 643 and ASTM G51. The soluble chloride content was determined in accordance with California Test 422. The soluble sulfate content was determined in accordance with California Test 417.
- **DIRECT SHEAR:** A direct shear test was performed on a selected sample in accordance with ASTM D3080. The shear stress was applied at a constant rate of strain of 0.003 inch per minute. Test results are presented in this appendix.

Soil samples not tested are now stored in our laboratory for future reference and analysis, if needed. Unless notified to the contrary, all samples will be disposed of 30 days from the date of this report.



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

SAMPLE LOCATION
B-2 at 6 to 6½ Feet
SAMPLE NUMBER
85891

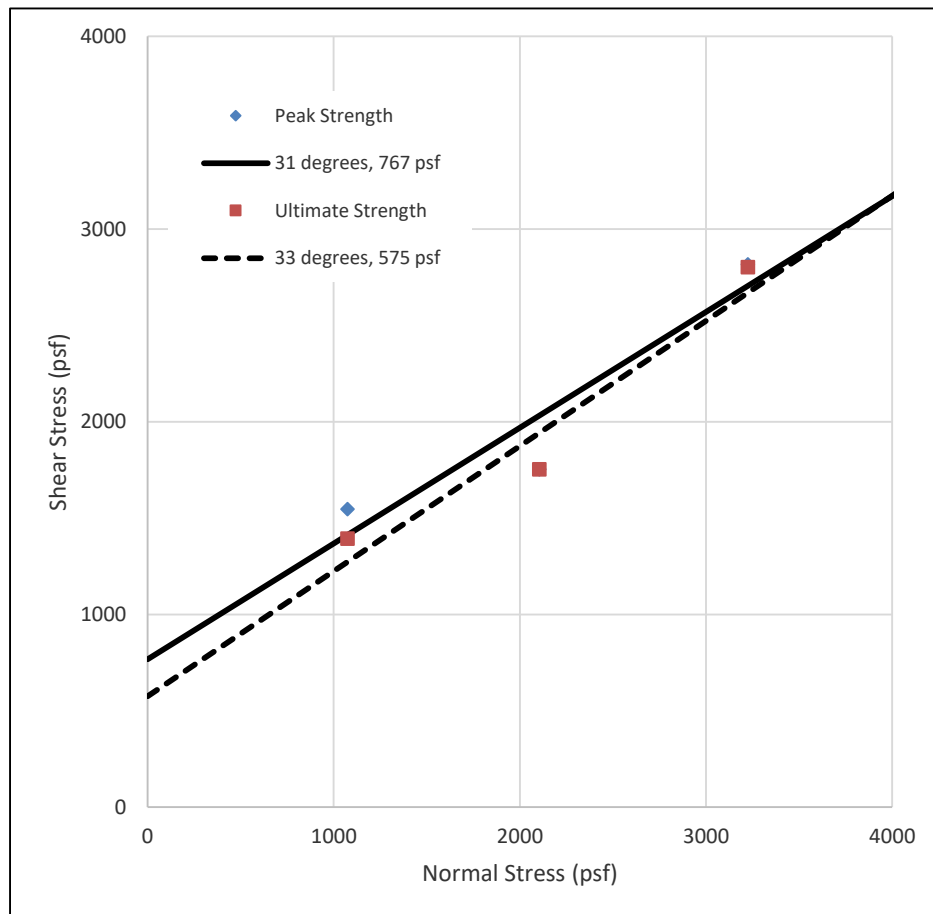
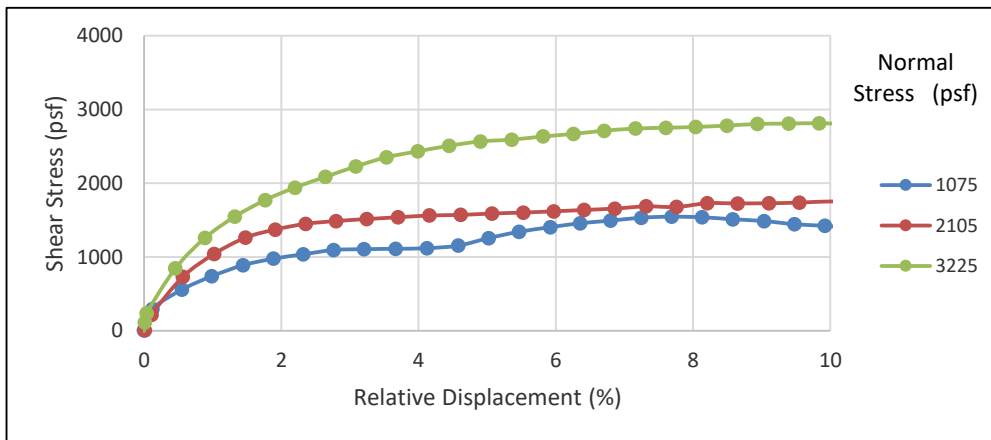
UNIFIED SOIL CLASSIFICATION:	SM
DESCRIPTION	SILTY SAND

ATTERBERG LIMITS	
LIQUID LIMIT	NP
PLASTIC LIMIT	NP
PLASTICITY INDEX	NP



Private San Dieguito Drive Improvements
Del Mar, California

By:	KBH	Date:	November, 2023
Job Number:	10939.000	Figure:	II-1



SAMPLE ID: B-2 at 6 to 6½ Feet

Light Brown SILTY SAND (SM)

NOTES: Insitu

Strain Rate: 0.003 in/min

Sample was consolidated and drained

	Peak	Ultimate
Φ	31 °	33 °
c	767 psf	575 psf
	Initial	Final
γ_d	108.0 pcf	-
w_c	9.8 %	17.1 %
Saturation	48 %	84 %



Private San Dieguito Drive Improvements
Del Mar, California

By:	KBH	Date:	November, 2023
Job Number:	10939.000	Figure:	II-2

R-VALUE

CALIFORNIA TEST 301

SAMPLE	DESCRIPTION	R-VALUE
B-3 at ½ to 5 Feet	SILTY SAND (SM)	67

RESISTIVITY, pH, SOLUBLE CHLORIDE and SOLUBLE SULFATE

CALIFORNIA TESTS 417, 422, 643 / ASTM G51

SAMPLE	RESISTIVITY (Ω -cm)	pH	CHLORIDE (%)	SULFATE (%)
B-1 at ½ to 2½ Feet	4540	7.16	0.004	0.000

Water-Soluble Sulfate Exposure²

Water-Soluble Sulfate (SO_4) in soil (percent by weight)	Exposure Severity	Exposure Class	Cement Type (ASTM C150)	Max. W/C	Min. f'_c (psi)
$SO_4 < 0.10$	N/A	S0	No type restriction	N/A	2,500
$0.10 \leq SO_4 < 0.20$	Moderate	S1	II	0.50	4,000
$0.20 \leq SO_4 \leq 2.00$	Severe	S2	V	0.45	4,500
$SO_4 > 2.00$	Very Severe	S3	V plus pozzolan or slag cement	0.45	4,500

2. Modified from ACI 318-14 Table 19.3.1.1 and Table 19.3.2.1

EXPANSION INDEX

(ASTM D4829)

SAMPLE	EXPANSION INDEX	EXPANSION POTENTIAL
B-2 at ½ to 5 Feet	1	Very Low

Expansion Index	Expansion Potential
1-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High


 Private San Dieguito Drive Improvements
 Del Mar, California

By:	KBH	Date:	November, 2023
Job Number:	10939.000	Figure:	II-3