REPORT OF GEOTECHNICAL INVESTIGATION
OTAY 2ND PIPELINE PHASE 4
CITY OF SAN DIEGO

Submitted to:

RICK ENGINEERING COMPANY
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Prepared By:

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AGE Project No. 223 GS-22

January 7, 2025

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Mr. Nick Dorner, P.E.
Rick Engineering Company
5620 Friars Road
San Diego, CA 92110

Subject: **REPORT OF GEOTECHNICAL INVESTIGATION**
OTAY 2ND PIPELINE PHASE 4
CITY OF SAN DIEGO
AGE Project No. 223 GS-22

Dear Mr. Dorner;

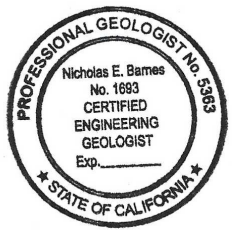
Allied Geotechnical Engineers, Inc. (AGE) is pleased to submit the accompanying report to present the findings, opinions, and recommendations of a geotechnical investigation that was performed to assist Rick Engineering Company with their design of the subject project. The report also incorporates AGE's responses to the City of San Diego Development Services Department (DSD) comments which we received on December 18, 2024.

We appreciate the opportunity to be of service on this project. If you have any questions regarding the contents of this report or need further assistance, please feel free to contact our office.

Sincerely,

ALLIED GEOTECHNICAL ENGINEERS, INC.

Nicholas E. Barnes, P.G., C.E.G.
Senior Geologist



Sani Sutanto, P.E.
Principal Engineer

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Distr. (1 electronic) Addressee

REPORT OF GEOTECHNICAL INVESTIGATION
OTAY 2ND PIPELINE PHASE 4
CITY OF SAN DIEGO

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1.0 INTRODUCTION

Allied Geotechnical Engineers, Inc. (AGE) is pleased to submit this report to present the findings, opinions, and recommendations of a geotechnical investigation conducted to assist Rick Engineering Company (Rick Engineering) with their design of the Otay 2nd Pipeline Phase 4Project for the City of San Diego (City). The report also incorporates AGE's responses to the City of San Diego Development Services Department (DSD) comments which we received on December 18, 2024.

This report has been prepared for the exclusive use of Rick Engineering and its design team and the City in their design of the subject project as described herein. The information presented in this report is not sufficient for any other uses or the purposes of other parties.

2.0 SITE AND PROJECT DESCRIPTION

The Otay 2nd Pipeline Phase 4 project alignment extends through the community of Bonita and the City of Chula Vista. The pipeline was originally built in 1930, and is one of the City's oldest and most important treated water pipelines. The primary purpose of the pipeline is to deliver treated water from the Otay Treatment plant to the Paradise Hills/Paradise Mesa communities and surrounding areas. Additionally, cross pipelines tie the Otay 2nd Pipeline to the San Diego County Water Authority (SDCWA) treated water system (City of San Diego, undated).

The Project intends to replace the original 36-inch and 40-inch steel pipelines with new 48-inch Cement Mortar Lined and Tape Coated (CMLC & TC) pipe. The original alignment is approximately 16,910 lineal feet (LF), (3.20 miles) in length, and extends within the City water easement as well as city-owned and private parcels. Much of the original alignment traverses open area.

The 30% submittal plans (City of San Diego, undated), indicate that the proposed new Otay 2nd Pipeline Phase 4 pipeline is approximately 22,791 feet (4.32 miles)in length. Portions of the new alignment will follow existing streets in new easements, thereby increasing the overall length of the pipeline but reducing the amount of pipeline extending across open areas for ease of maintenance.

The northern terminus of the Project will be a connection with the existing 48-inch diameter Otay 2nd Pipeline below the southwest side of the Willow Street bridge in Sweetwater County Park. The plans indicate a beginning Station (Sta) of 100 + 00, at an invert elevation (IE) of 44.9 feet above mean sea level (msl). The plans divide the pipeline alignment into a total of nine (9) segments, each segment beginning at Sta 100 +00. The alignment map is shown on Figure 1.

The northern segment, referred to as the Kaiser segment, will initially extend southeast from the connection with the existing Otay 2nd Pipeline, parallel to the Willow Street bridge. The pipeline alignment will then turn south and descend at a 1.0% slope in a trenchless crossing of the Sweetwater River, between approximate Sta 101 + 40 and Sta 104 + 30. The trenchless crossing will be a minimum of 10-feet below the Sweetwater River channel bottom, with an IE of 39.14 feet msl at the low point at the south end of the crossing. A 23-foot diameter receiving pit will be located at the north end of the crossing, with a 21-foot x 33-foot jacking pit located at the south end of the crossing. Along the trenchless crossing the pipe will be installed inside a 60-inch steel casing measuring 285.9 feet in length.

After the Sweetwater River crossing the pipe will turn southeast and rise to an IE of 55.29 feet msl at Sta 105 + 30, then turn south-southeast and cross below the Kaiser Permanente parking lot in a proposed new water pipeline easement. The Kaiser segment will end in Bonita Road at Sta 109 +97.17, at an IE of 47.79 feet msl.

The next segment is referred to as the Bonita segment. The segment will extend southwesterly along Bonita Road to end Sta 106 + 66.55 at the intersection with Glen Abbey Road, at an IE of approximately 52 feet msl.

At Glen Abbey Road the next segment, referred to as the Glen Abbey segment, will ascend following Glen Abbey Road and open space in the Glen Abbey Cemetery property. The alignment will cross out of the cemetery property, continuing in a south to southeasterly direction within the existing 100-foot wide City of San Diego pipeline easement, briefly following The Hill Road, a private roadway, and then open space in the County of San Diego Multi-Habitat Planning Area (MHPA). Near Sta 131 + 20 the pipeline will cross into the City of Chula Vista, and enter the City of Chula Vista MHPA. The segment ends within the City pipeline easement at Terra Nova Drive, Sta 148 + 10.93 at an IE of approximately 361 feet msl.

The next segment is referred to in the plans as the Terra Nova segment. The segment extends southwesterly and then south in a new easement following Terra Nova Drive, descending to East H Street. The segment ends at the intersection with East H Street, Sta 126 + 08.35 at an IE of 151.26 feet msl.

The East H Street segment will extend eastward in a new easement, following the north side of East H Street. At Sta 118 + 30 the pipeline will turn southeast and descend below an existing double, 96-inch CIPP storm drain pipe and the existing 40-inch steel water pipeline. The alignment will then turn east, cross the 100-foot wide City of San Diego water easement and then continue eastward following the south side of East H Street. The alignment will ascend following the trend of the roadway to the end of the segment at Paseo Del Rey, Sta 145 +60.87 at an IE of 287.90 feet msl.

The Paseo Del Rey segment will extend in a general south and southeastern direction in a new easement following Paseo Del Rey. The segment ends at the intersection with East J Street, Sta 114 + 93.27 at an IE of 357.82 feet msl.

The East J Street segment will extend east to southeasterly in a new easement along the south side of East J Street. The end of the segment is at the intersection with Paseo Ladera, Sta 134 +16.60 at an IE of 403.97 feet msl.

The next segment, the Paseo Ladera segment, will extend in a general southerly direction in a new easement, following the southbound lane of Paseo Ladera. The segment ends in Paseo Ladera where it meets the existing 100-foot wide City of San Diego water easement, end Sta 114 + 93.27 at an IE of 307.14 feet msl.

The final segment, the Open Space segment, will follow the existing City water easement in an east to southeasterly direction through open space in the City of Chula Vista MHPA. The segment will include a trenchless crossing of the Telegraph Drainage Channel and Telegraph Canyon Road, between approximate Sta 112 + 10 and Sta 115 + 88. the A 20-foot x 40-foot jacking shaft will be located at the northwest end of the crossing, with a 20-foot x 20-foot receiving pit located at the southeast end of the crossing.

Along the trenchless crossing the pipe will be installed inside a 60-inch steel casing measuring 378.21feet in length, and set at a 1.0% slope ascending to the southeast. The IE of the pipe is 279.28 feet msl at the low point at the northwest end of the crossing. The plans indicate a 10-foot minimum clearance between the bottom of the Telegraph Drainage Channel and the steel casing. After the crossing the pipe will turn east and ascend, connecting with the existing 48-inch Otay 2nd Pipeline at approximate Sta 116 + 55, at an IE of 309.5 feet msl.

The pipeline alignment will extend through open space, existing public right-of-ways, as well as the private Kaiser Permanente parking lot, Glen Abbey Cemetery property, and The Hill Road. Developments in the project study area includes a variety of newer neighborhoods, apartment complexes, business parks, shopping centers, schools, and community parks.

With the exception of the two trenchless sections, the remainder of the alignment will be installed using conventional cut and cover construction methods. Proposed depths of embedment for the pipeline will vary from approximately 6 feet below the ground surface (bgs) to 40 feet bgs. Due to numerous existing utilities along the alignment, the pipeline will employ a number of angle points to descend below or rise above existing pipelines. The Project will also include abandonment of the original pipeline, and removal and backfilling of structures abandoned by the Bonita Pipeline.

The study area is generally hilly and gentle to moderate sloping. The northwest end of the alignment is in the Sweetwater River valley, with the southeast end in Telegraph Canyon. The alignment also crosses Rice Canyon along the East H Street segment. Site elevations vary from 57 feet msl to 420 feet msl (30% Plans, undated; Google Earth, 2022).

3.0 OBJECTIVE AND SCOPE OF INVESTIGATION

The objectives of this investigation were to characterize the subsurface conditions along the project alignment and to develop geotechnical recommendations for use in the design of the proposed project. The scope of our investigation included several tasks which are described in more detail in the following sections.

3.1 Information Review

This task involved a review of readily available information pertaining to the project alignment, including the project plans, as-built utility maps, topographic maps, published geologic literature and maps, and AGE's in-house references.

3.2 Geotechnical Field Exploration

The field exploration program for this project was performed between February 18, 2023 and January 31, 2024. A total of fifteen (15) soil borings were performed at the approximate locations shown on Figure 1. The more detailed locations and generalized cross sections based on the subsurface conditions encountered in the borings are shown on Figures 2 through 13. The borings were extended to depths ranging between 13 feet bgs and 81.5 feet bgs, using either a Diedrich D120 or CME-75 truck-mounted drill rig equipped with hollow-stem augers and/or 4-inch mud rotary drill rod. An All-Terrain drill rig equipped with hollow-stem augers was utilized for borings performed in open areas.

A Right-of Entry permit was obtained from the County of San Diego for a boring performed in Sweetwater Regional Park. We also obtained Right-of Entry permits for borings performed on the Kaiser Permanente and Glen Abbey properties; a construction permit with the City of Chula Vista Public Works Department for borings performed in the City of Chula Vista rights-of-way; and a License Agreement with the City of Chula Vista for borings performed in the Chula Vista MHPA. A brief description of the location and depth, and the subsurface conditions encountered in each boring is presented in Table 1 below. A more detailed description of the drilling and sampling operations, and logs of the soil borings are presented in Appendix A.

Prior to commencement of the field exploration activities, several site reconnaissance visits were performed to observe existing conditions and to select suitable locations for the soil borings. Subsequently, Underground Service Alert (USA) was contacted to coordinate clearance of the proposed borings with respect to existing buried utilities. The utility clearance effort revealed the presence of the following buried utilities in the study area: potable water and sanitary sewer pipelines; storm drains; natural gas and electrical transmission lines; and cable, telephone, and fiber optic lines.

Table 1

Summary of Borings

Boring No.	Location	Depth (Feet)	Existing Pavement Section	Subsurface Conditions	Estimated Groundwater Depth/ Elevation (Feet bgs/feet msl)
B-1	Sweetwater River valley, approximately 60 feet southwest of proposed receiving shaft.	56.5	N/A	Af (fill) to 2 feet, young alluvial deposits (Qya) to 49 feet and Sweetwater Formation (Tsw) to the maximum depth of exploration.	3'/56'
B-2A	North side of Kaiser Permanente parking lot, approximately 20 feet west of proposed pipeline alignment.	11'-18.5' (AGE made 3 attempts and encountered refusal on concrete debris field/rip rap)	3.5" A.C., up to 14" miscellaneous base.	Af to the maximum depth of exploration.	3.5'/56'
B-2B Note: Relocated B-2A	Kaiser Permanente parking lot, approximately 50 feet northeast of proposed jacking shaft.	71.5	4" A.C., 14" miscellaneous base.	Af to 2 feet, Qya to 54 feet and Tsw to the maximum depth of exploration.	4'/56'
B-3	Glen Abbey Drive, approximately 820 feet southeast of Bonita Road.	16.5	6" P.C.C., no base.	Af to 4 feet, old alluvial deposits (Qoa) to 14 feet and Otay Formation (To) to the maximum depth of exploration.	N/A

Table 1

Summary of Borings

Boring No.	Location	Depth (Feet)	Existing Pavement Section	Subsurface Conditions	Estimated Groundwater Depth/ Elevation (Feet bgs/feet msl)
B-4	Open space approximately 240 feet southeast of access gate from The Hill Road.	16.5	N/A	Af to 2 feet, and San Diego Formation (Tsd) to the maximum depth of exploration.	N/A
B-5	East side of City water easement, approximately 60 feet north of Terra Nova Drive.	16.5	N/A	Af to 4 feet, very old paralic deposits (Qvop) to 8 feet and Tsd to the maximum depth of exploration.	N/A
B-6	West side of Terra Nova Drive, approximately 60 feet south of Kiley Street.	16.5	5" A.C., 4" miscellaneous base.	Af to 4 feet, and Tsd to the maximum depth of exploration.	N/A
B-7	North side of East H Street, approximately 30 feet west of existing Otay 2nd Pipeline.	31.5	8" A.C., 10" miscellaneous base.	Af to 28 feet, and Qya to the maximum depth of exploration.	14'/180'
B-8	West side of Paseo Ladera, approximately 90 feet south of Blackwood Road.	16.5	5" A.C., 7" miscellaneous base.	Af to 2 feet, and Tsd to the maximum depth of exploration.	N/A
B-9	South side of East H Street, approximately 170 feet west of Paseo Del Rey.	16.5	13" A.C.,9" cement treated base.	Af to 15 feet, and Tsd to the maximum depth of exploration.	N/A
B-10	South lane of East J Street, approximately 100 feet east of Paseo Del Rey.	13	4" A.C., 8" miscellaneous base.	Af to 2 feet, and Tsd to the maximum depth of exploration.	N/A

Table 1

Summary of Borings

Boring No.	Location	Depth (Feet)	Existing Pavement Section	Subsurface Conditions	Estimated Groundwater Depth/ Elevation (Feet bgs/feet msl)
B-11	Open space on south side of existing City water easement, approximately 315 feet southeast of Paseo Ladera.	16.5	N/A	Young colluvial (slopewash) deposits (Qyc) to 2 feet, and Otay Formation to the maximum depth of exploration.	N/A
B-12	Open space, approximately 50 feet west of proposed jacking shaft for Telegraph Drainage/Telegraph Canyon Road trenchless crossing.	65.5	N/A	Af to 2 feet, and Otay Formation to the maximum depth of exploration.	60'/273'
B-13	South side of access road, approximately 100 feet east of proposed receiving shaft for Telegraph Drainage/Telegraph Canyon Road trenchless crossing.	81.5	N/A	Af to 4 feet, and Otay Formation the maximum depth of exploration.	N/A
B-14	Landscape area on north side of Telegraph Canyon Road, approximately 30 feet west of proposed Telegraph Drainage/Telegraph Canyon Road trenchless crossing.	61.5	N/A	Af to 3 feet, Qya to 28 feet and Otay Formation to the maximum depth of exploration.	N/A
B-15	South lane of East J Street, approximately 165 feet west of River Ash Drive.	16.5	5.5" A.C., 5" miscellaneous base.	Qaf to 4 feet, and Tsd to the maximum depth of exploration.	N/A

3.3 Laboratory Testing

Selected soil samples obtained from the soil borings were tested in the laboratory to verify field classifications and evaluate certain engineering characteristics. The geotechnical laboratory tests were performed in general conformance with the American Society for Testing and Materials (ASTM) or other generally accepted testing procedures.

The laboratory tests included: in-place density and moisture content, maximum density and optimum moisture content, sieve (wash) analysis, and shear strength. In addition, representative samples of the onsite soil materials were collected and delivered to Clarkson Laboratories and Supply, Inc. for chemical (analytical) testing to determine soil pH and resistivity, soluble sulfate and chloride concentrations, and bicarbonate content. A brief description of the tests that were performed and the final test results are presented in Appendix B.

4.0 GEOLOGIC CONDITIONS

4.1 Geologic Setting and Site Physiography

The project study area is located within the Peninsular Ranges geomorphic province, a north-south oriented mountain range which extends from the southern edge of the Los Angeles Basin into Baja California, Mexico. Basement rocks of the Peninsular Ranges province include Cretaceous crystalline rocks of the Southern California Batholith and Jurassic metasedimentary and metavolcanic rocks of the Santiago Peak Volcanics.

The project alignment is situated within the San Diego Embayment, a deep sedimentary-filled basin which is underlain at depth by the basement rock complex. The sedimentary formations consist of nearly flat-lying to gently southwest dipping, marine and non-marine sediments which range from Cretaceous to Holocene in age. Mapped geologic units along the project alignment include Eocene to Holocene age sedimentary deposits. Man-made fills were also encountered at various locations along the project alignment.

4.2 Tectonic Setting

Tectonically, the San Diego region is situated in a broad zone of northwest-trending, predominantly right-slip faults that span the width of the Peninsular Ranges and extend offshore into the California Continental Borderland Province west of California and northern Baja California. At the latitude of San Diego, this zone extends from the San Clemente fault zone, located approximately 60 miles to the west, and the San Andreas fault located about 95 miles to the east.

Major active regional faults of tectonic significance include the Coronado Bank, San Diego Trough, San Clemente, and Newport Inglewood/Rose Canyon fault zones which are located offshore; the faults in Baja California, including the San Miguel-Vallecitos and Agua Blanca fault zones; and the faults located further to the east in Imperial Valley which include the Elsinore, San Jacinto and San Andreas fault zones.

4.3 Geologic Units

Based on their origin and compositional characteristics, the soil types encountered in the soil borings can be categorized into eight (8) geologic units which include (in order of increasing age) fill materials; young colluvial (slopewash) deposits; young alluvial deposits; old alluvial deposits; very old paralic deposits; San Diego Formation, Otay Formation; and Sweetwater Formation. A brief description of each unit is presented below. A generalized geologic map is shown on Figure 14.

4.3.1 Fill Materials (Af)

Fill materials were encountered at all of the boring locations except boring B-11, extending to depths ranging from 2 feet bgs to a maximum of 28 feet bgs. At borings B-2A and B-2B, located in the Kaiser Permanente parking lot on the south side of the Sweetwater River valley, fill materials extended to approximate respective depths of 12.5 feet bgs and 10 feet bgs. At boring B-2A we met refusal on large rock/riprap in two attempts at depths of 11 feet bgs and 12.5 feet bgs. A third attempt penetrated through the rock, but loss of drilling fluid into void spaces between the rocks necessitated termination of the boring.

Review of historic aerial photos indicates that the Kaiser site was developed in the 1970s, and included extending the north parking lot into the river valley. It is likely that grading for the parking area included removal and recompaction of on-site alluvium in the river valley, with rock/riprap placed to provide stabilization along the outer edge of the parking lot. A new boring B-2B was drilled in the parking lot approximately 80 feet to the southeast and 40 feet from the outer edge of the lot, and did not encounter rock or riprap.

Fill materials encountered at borings B-2A and B-2B consist of silty sands and clayey sands that appear to be derived from the river channel, with rock/riprap also encountered at the base of the fill at boring B-2A. Based on blow counts required to drive the soil sampler, field observation of drilling resistance and visual observation of the soil samples, the fill materials are generally in a loose to moderately well-compacted condition.

Fill materials were encountered to respective depths of 28 feet bgs and 15 feet bgs at borings B-7 and B-9. Boring B-7 was performed near the bottom of Rice Canyon along East H Street, and boring B-9 was performed near the outer edge of a fill slope supporting the south side of East H Street near Paseo Del Rey. Fill materials encountered at each of these locations was likely placed during construction of East H Street, generally consisting of silty to clayey sands and sandy clays with trace to scattered amounts of sub-rounded to sub-angular gravel. Based on blow counts required to drive the soil sampler, field observation of drilling resistance and visual observation of the soil samples, these fill materials appear to be well-compacted.

Fill materials encountered in the remaining soil borings were typically 4-feet or less in thickness, and likely placed during roadway grading. The fill materials largely consist of silty to clayey sands, and sandy clays with trace to scattered amounts of sub-rounded to sub-angular gravel. The fill materials generally appear to be moderately to well-compacted.

With the exception of rock/riprap encountered in boring B-2A, the fill materials at all of our borings appear to be locally derived from nearby geologic formations. The fills were typically in a damp to wet condition, with saturated conditions also encountered in fill at borings B-2A and B-2B. Documentation pertaining to placement of the fill materials is unavailable.

4.3.2 Young Colluvial Deposits (Qyc)

Although not shown on the geologic map by Kennedy and Tan (2008), young colluvial (slopewash) deposits of Holocene age were encountered to a depth of 2-feet bgs in boring B-11. These deposits are generally described as poorly consolidated and poorly sorted sand and silt slopewash materials. The deposits can generally be easily excavated with heavy duty construction equipment.

Young colluvial deposits encountered in our soil boring generally consist of silty sand derived from weathering of the native soil materials. Relatively shallow, surficial slopewash deposits were also observed on other natural slopes in the study area. The deposits vary from loose to medium dense/ medium stiff to stiff and damp to wet.

4.3.3 Young Alluvial Deposits (Qya)

Young alluvial flood-plain deposits of Holocene and late Pleistocene age (Kennedy & Tan, 2008) were encountered below fill materials in borings B-1, B-2B, B-7, and B-14. At borings B-1 and B-2B in the Sweetwater River valley, the deposits extended to respective depths of 49 feet bgs and 54 feet bgs. At boring B-7 in Rice Canyon, the deposits extended to the maximum depth of exploration of 31.5 feet bgs. At boring B-14 in Telegraph Canyon, the young alluvial deposits extended to a depth of 28 feet bgs.

Young alluvial deposits are generally described as poorly sorted, poorly consolidated, permeable flood-plain deposits of sandy, silty or clay-bearing alluvium. The deposits can generally be easily excavated with conventional heavy duty construction equipment, but localized gravel and cobble may present difficult excavation.

Young alluvial deposits encountered in our borings generally consist of gray to grayish brown, silty sands, poorly graded sand with silt, sandy silts, and sandy clays with scattered to trace amounts of sub-rounded fine gravel. The sandy facies were generally uncemented to weakly cemented. The deposits were in a loose to dense/soft to medium stiff and damp to wet condition.

Geocon, Inc. (2006) encountered alluvial deposits at eight of their nine soil borings for the Willow Street bridge, located northeast of the proposed Sweetwater River crossing. Alluvial deposits encountered by Geocon were described as predominantly loose to medium dense silty sands and clayey sands with gravel. Scattered thin layers of soft to firm clay and sandy clay were also encountered in the deposits. Geocon reported that the thickness of the alluvial deposits within the main river channel ranged from 42 feet to 62 feet (to approximate bottom elevations varying between 2 feet msl and 15 feet msl). Loose and saturated portions of the alluvium were considered to be highly susceptible to liquefaction in the event of strong seismic activity.

4.3.4 Old Alluvial Deposits (Qoa)

Old alluvial deposits of late to middle Pleistocene age (Kennedy and Tan, 2008) were encountered below fill materials in boring B-3, extending to a contact with the underlying Otay Formation at a depth of 14 feet bgs. These deposits are mapped on the south and north sides of the Sweetwater River valley near the Project alignment, and described as fluvial sediments deposited on canyon

walls, and consisting of moderately well consolidated, poorly sorted and permeable gravel, sand, silt and clay alluvium that is commonly slightly dissected. These deposits were formerly referred to as terrace deposits (Kennedy and Tan, 1977). Old alluvial deposits can generally be easily excavated with conventional heavy duty construction equipment. However, difficult excavation conditions may be encountered in areas where these deposits contain large boulders.

Old alluvial deposits encountered in our boring generally consist of brown to yellow brown clayey sand and silty-clayey sand in a medium dense to very dense and damp condition.

Geocon, Inc. (2006) encountered older alluvial deposits at their three southeast-most soil borings for the Willow Street bridge. Geocon encountered the older alluvium below the young alluvial deposits, and described the deposits as dense to very dense silty sand with varying amounts of gravel. The older alluvium was considered suitable for the support of deep foundations. The Geocon borings were extended to depths ranging from 60 feet to 74 feet bgs (approximate elevations of 2 feet msl to -6 feet msl) and did not penetrate through the deposits.

3.3.5 Very Old Paralic Deposits, undivided (Qvop)

Very old paralic deposits were encountered below fill materials in boring B-5 only, which was located along the mesa top. The deposits are of middle to early Pleistocene age (Kennedy and Tan, 2008), and form a cap on top of the mesa. The deposits were formerly referred to as the Lindavista Formation (Kennedy and Tan, 1977) of early Pleistocene age. The formation consists of interfingered strandline, beach, estuarine and colluvial deposits composed of siltstone, sandstone and conglomerate with a distinct reddish-brown color due to ferruginous cement. The combination of strong cementation and locally abundant gravels and cobbles pose difficult excavation conditions even for heavy duty construction equipment.

Very old paralic deposits encountered in our boring extended to an approximate depth of 8 feet bgs, and generally consist of a yellow brown to reddish yellow, dense to very dense silty sand with traces of gravel. Similar deposits were visually observed along the mesa top northwest and southeast of boring B-5. The deposits locally contain abundant gravel.

4.3.6 San Diego Formation (Tsd)

The early Pleistocene to late Pliocene age San Diego Formation was encountered below fill and/or very old paralic deposits in borings B-4 through B-6, B-8 through B-10, and boring B-15. The formation extended to the maximum depth of exploration at all of these boring locations.

The San Diego Formation underlies very old paralic deposits on top of the mesa in the study area, and predominantly consists of a yellow brown and gray, fine to medium grained, poorly indurated, fossiliferous marine sandstone and a reddish brown, transitional marine and non-marine pebble and cobble-conglomerate (Kennedy and Tan, 2008). Thin beds of bentonite, marl, and brown mudstone may also be encountered in the unit. Based on fossil assemblages, the San Diego Formation has been assigned an early Pleistocene and late Pliocene age. The San Diego Formation can generally be easily excavated with conventional heavy duty construction equipment, but strongly cemented zones may pose difficult excavation conditions.

San Diego Formation encountered in our soil borings generally consists of a pale yellow, olive gray to reddish yellow, fine silty sandstone which is locally strongly to very strongly cemented. The formation was commonly micaceous and displayed iron staining. Trace fine gravel was encountered in the unit, with drill refusal met on a gravelly/cobbly zone in the formation at boring B-10, at a depth of 13 feet bgs.

4.3.7 Otay Formation (To)

The Otay Formation was encountered below fill, young colluvial deposits, and/or older alluvium in boring B-3, and borings B-11 through B-14. Where encountered the formation extended to the maximum depths of exploration.

The Otay Formation unconformably underlies the San Diego Formation in the study area. The formation is a fluvial deposit consisting of a basal conglomerate, middle gritstone, and upper sandstone-mudstone member, with bentonite claystone beds up to 4 feet thick present throughout the unit (Walsh and Demere, 1991). Based on vertebrate fossil assemblages, the Otay Formation has been assigned an Oligocene age (Kennedy and Tan, 2008). The Otay Formation can generally be excavated with conventional heavy duty construction equipment, although difficult excavation can be expected in the basal conglomerate member.

Otay Formation encountered in our soil borings consists predominantly of interlayered very stiff to hard sandy clay, clay, clayey sandstone, and silty sandstone with local gravelly zones. The clayey facies locally exhibit a "waxlike" texture, and are highly expansive. Sandstone facies are dense to very dense, and moderately to strongly cemented.

4.3.8 Sweetwater Formation (Tsw)

The late Eocene age Sweetwater Formation was encountered below young alluvial deposits at respective depths of 49 feet bgs and 54 feet bgs in borings B-1 and B-2B, extending to the maximum depths of exploration. The Sweetwater Formation is a fluvial and floodplain deposit consisting of

stacked, fining upward sequences of coarse-grained sandstone and gritstone grading upward into light brown siltstone and pink to pale red to reddish brown mudstone (Walsh & Demere, 1991). The late Eocene age is based on fossil assemblages from the lower part of the formation. Kuper (1976) assigns a Miocene age to the Sweetwater Formation.

Sweetwater Formation encountered in our test borings consists of a pinkish brown to greenish gray, medium to highly plastic mudstone. The mudstone is consistent with the upper unit described by Walsh & Demere (1991). The mudstone was wet, with a very stiff consistency.

Geocon (2006) encountered Mission Valley Formation (Kennedy & Tan, 2008) at respective depths of 49 feet bgs and 50 feet bgs in two of their borings performed near the north side of the proposed Sweetwater River crossing (elevations of 13 feet msl and 12 feet msl). Based on the soil descriptions, the Mission Valley Formation in the Geocon borings appears to be synonymous with the Sweetwater Formation (Walsh & Demere, 1991) encountered in our borings. Based on the proposed elevations of the Otay 2nd Pipeline Phase 4, it is unlikely that the Sweetwater Formation will be encountered during the pipeline construction.

4.3 Groundwater

The depths of the regional groundwater table will vary widely along the project alignment. In the Sweetwater River valley, shallow groundwater was encountered in borings B-1, B-2A and B-2B at respective depths of 3 feet bgs, 3.8 feet bgs, and 4.2 feet bgs. In boring B-7 in Rice Canyon, groundwater was encountered at a depth of 13.8 feet bgs.

In boring B-12, located near the northwest end of the trenchless crossing of Telegraph Drainage Channel and Telegraph Canyon Road, groundwater was encountered at a depth of 60 feet bgs, in a sandy, high permeable layer within the Otay Formation. The depth to groundwater could not be determined at borings B-13 and B-14,respectively sited near the southeast and central portions of this trenchless crossing, due to the use of drilling fluids for mud-rotary drilling methods.

No groundwater was encountered in the remainder of soil borings for the project, which were generally sited on hillside or mesa top locations. The depth to groundwater on the mesa is unknown but may be assumed to be in excess of 100 feet bgs. However, localized shallow perched water conditions are known to occur on the mesas, particularly during the wet (rainy) season.

The Geotracker website (www.Geotracker.com) provided water monitoring data from fifteen (15) onsite and offsite wells at a Union 76 gasoline service station located at 3995 Bonita Road, near the Kaiser segment of the project alignment adjacent to Willow Street. During the last sampling event in the second quarter of 2011, URS Corporation (2011) measured the groundwater at depths ranging between 6.8 feet and 10.9 feet below the top of well casing (average elevation of approximately 55 feet msl). The reported direction of groundwater flow was to the west at a gradient of 0.003 ft/ft.

5.0 DISCUSSIONS, OPINIONS AND RECOMMENDATIONS

5.1 Potential Geologic Hazards

Geologic hazards are those hazards that could impact a site due to local and regional geologic and seismic conditions. Our evaluation of the various geologic hazards and their potential impact on the project alignment are discussed in the following sections.

5.1.1 Faulting

The project alignment crosses several strands of the potentially active La Nacion fault zone (LNFZ). The LNFZ is comprised of several en echelon faults within a generally north-south trending broad system of faults across the southern San Diego metropolitan area. The faults are generally dip-slip in nature with a down-to-the-west sense of separation (Kennedy and Tan, 1977). The project alignment is not located within an Alquist-Priolo Earthquake Study Zone.

Geologic studies that have been performed on the LNFZ to date have not discovered any evidence for fault activity within Holocene time (11,000 years BP) (Dowlen, et.al, 1975; Hart, 1974). Based on the California Division of Mines and Geology fault classification criteria, the LNFZ may be considered "potentially active", meaning that it has documented evidence of movement within Pleistocene time (the last 1.5 to 2 million years) but no movement in Holocene time.

For the purpose of this project we consider the Rose Canyon fault zone (RCFZ) to represent the most significant seismic hazard. The RCFZ is a complex set of anastomosing and en-echelon, predominantly strike slip faults that extend from off the coast near Carlsbad to offshore south of downtown San Diego (Treiman, 1993). Previous geologic investigations on the RCFZ in the Rose

Creek area (Rockwell et. al., 1991) and in downtown San Diego (Patterson et. al., 1986) found evidence of multiple Holocene earthquakes. Based on these studies, several fault strands within the RCFZ have been classified as active faults, and are included in Alquist-Priolo Special Studies Zones. In San Diego Bay, this fault zone is believed to splay into multiple, subparallel strands; the most pronounced of which are the Silver Strand, Spanish Bight and Coronado Bank faults.

A study by Kleinfelder (2017) at the San Diego International Airport identified two zones of active faulting. One of these faults was named the East Bay fault and the second fault was determined to be a northward extension of the Spanish Bight fault. A study by Ninyo & Moore (2018) at Seaport Village found evidence of recent movement along a fault that was determined to be a northward extension of the active Coronado fault.

The project alignment is subject to moderate to severe ground shaking in response to a major earthquake occurring on the RCFZ or on one of the major regional active faults. The closest active regional faults to the project alignment with recurring magnitude 4.0 and greater earthquakes are the Coronado Bank, the Vallecitos-San Miguel, and the Elsinore fault zones. Other more distant, active regional faults that are considered potential sources of seismic activity include the offshore located San Diego Trough and San Clemente fault zones and some of the faults in Imperial Valley which include the San Jacinto and San Andreas fault zones.

The location of the project alignment in relation to the local and regional active faults is shown on the Local and Regional Fault Maps (Figures 14 and 15).

5.1.2 Fault Ground Rupture & Ground Lurching

The project alignment does not cross active faults (Kennedy & Tan, 2008). Therefore, the potential for fault ground rupture and ground lurching is considered to be low.

5.1.3 Soil Liquefaction

Seismically-induced soil liquefaction is a phenomenon in which loose to medium dense, saturated granular materials undergo matrix rearrangement, develop high pore water pressure, and lose shear strength due to cyclic ground vibrations induced by earthquakes.

We encountered young alluvial deposits to depths of up to 54 feet bgs at the Sweetwater River crossing. These deposits are considered to have a low liquefaction potential, but loose zones were encountered within the unit which may locally display a high liquefaction potential. Geocon (2006) determined that loose and saturated portions of the alluvium are highly susceptible to liquefaction in the event of a major earthquake.

Young alluvial deposits encountered at our soil borings in Rice Canyon and Telegraph Canyon were found to be in a medium dense condition, and are considered to have a very low liquefaction potential. Additionally, the young alluvial deposits in these canyons are of limited vertical and areal extent.

The remainder of the project alignment is underlain with dense/stiff formational soils that are considered to have a negligible liquefaction potential. With the exception of the canyon bottoms, the majority of the project alignment traverses hillsides and mesa tops that are well above the elevation of the regional groundwater table.

5.1.4 Landslides

A landslide is mapped south of Telegraph Canyon Road, west of the southeast end of the project alignment (Kennedy and Tan, 2008). The toe of this mapped landslide is near the south side of the roadway. Significant grading was performed during development of the roadway and a residential subdivision along the top of the slope, and it is presumed that the earthwork included mitigation of the ancient landslide feature. Site reconnaissance and review of historic aerial photos and aerial photography available on Google Earth (2022) revealed no evidence of the mapped landslide feature.

A study by Vanderhurst et al (2011) describes the presence of a mega-landslide in the southwest portion of San Diego County. This feature, named the Otay Mesa Lateral Spread, encompasses portions of the study area. The paper describes the unit as an approximately 4-km wide tabular body exposed discontinuously between Sweetwater Valley on the north and Spring Canyon near the U.S.-Mexico border on the south. The landslide debris is described as steeply-tilted, coherent blocks, separated by steeply-dipping shear zones. The basal rupture occurred along a low-angle, continuous bentonite bed in the Otay Formation that is up to 2-meters in thickness. The feature was discovered during the course of large-scale grading operations for residential subdivisions in Otay Mesa beginning in the late 1980s and early 1990s.

Vandenhurst et al (2011) reported that the top of the Otay Mesa Lateral Spread was removed by erosion prior to deposition of the San Diego Formation, indicating a minimum late Pliocene-early Pleistocene age for the lateral spread feature. There is no reported active movement along this feature. We encountered no significant bentonite in our soil borings performed in the Otay Formation, nor did inspection of soil samples reveal indications of shearing or landsliding. Landsliding and the lateral spread feature are not considered credible risks to the project.

5.1.5 Lateral Spread Displacement

The project alignment is underlain by competent geologic units which are not considered susceptible to seismic-induced lateral spreading. The Sweetwater River valley is underlain by poorly consolidated soil materials, but the valley floor is relatively flat; and therefore, it is our opinion that the risk of lateral spread displacement during a seismic event is considered remote.

The above-described Otay Mesa Lateral Spread is an ancient feature with a minimum late Pliocene-early Pleistocene age. The feature is not considered a credible risk to the project.

5.1.6 Differential Seismic-Induced Settlement

Differential seismic settlement occurs when seismic shaking causes one type of soil to settle more than another type. It may also occur within a soil deposit with largely homogeneous properties if the seismic shaking is uneven due to variable geometry or thickness of the soil deposit. There is a low potential of seismic-induced settlement in mechanically placed fill materials along the project alignment.

5.1.7 Secondary Hazards

A review of the State of California Tsunami Inundation Map for Emergency Planning La Jolla Quadrangle (Graehl and Wilson, 2022) indicates that the project alignment is not located within the tsunami inundation area.

The FEMA Flood Insurance Rate Map designates the Sweetwater River valley in the study area as Zone A and Zone AE. Zone AE is defined as a floodplain area (channel of a stream) and any adjacent floodplain areas with a 1 percent annual chance of being inundated by flooding up to the Base Flood Elevation. A portion of the river valley at the proposed trenchless crossing is designated as a Zone AE Regulatory Floodway. The map indicates a Base Flood Elevation of 66 feet msl below the Willow Street bridge, and 63.3 feet msl southwest of the proposed trenchless crossing.

Significant flooding would also occur in the Sweetwater River valley in the event of a seismic-related failure of the upstream Sweetwater dam.

The FEMA Flood Insurance Rate Map designates Rice Canyon at the proposed East H Street undercrossing of the double 96-inch CIPP storm drain as having a 0.2% Annual Chance Flood Hazard Area. The potential for flooding along the remainder of the project alignment is considered low.

5.2 Soil Corrosivity

In accordance with the City of San Diego Water Facility Design Guidelines, Book 2, Chapter 7, soil is generally considered aggressive to concrete if its chloride concentration is greater than 300 parts per million (ppm) or sulfate concentration is greater than 1,000 ppm, or if the pH is 5.5 or less.

Analytical testing was performed on representative sample of the onsite soil materials to determine pH, resistivity, soluble sulfate, chlorides and bicarbonates content. The tests were performed in accordance with California Test Method Nos. 643, 417 and 422. A summary of the test results is presented in Table 2 below.

Table 2

Summary of Corrosivity Test Results

	pH	Resistivity (ohm-cm)	Sulfate Conc. (ppm)	Chloride Conc. (ppm)	Bicarbonates Conc. (ppm)
B-1 #4 @20'-21.5'	7.4	2,400	33	53	36
B-2A #2 @4'-5'	8.5	2,700	51	75	32
B-3 #3 @9'-10'	8.2	520	78	270	58
B-4 @2 @6'-7.5'	8.5	4,300	<30	32	22
B-5 #4 @11'-12'	7.0	580	84	270	20
B-6 #1 @5'-6.5'	8.0	550	170	53	62
B-7 #5 @17'-19'	7.6	460	78	320	54

Table 2

Summary of Corrosivity Test Results

	pH	Resistivity (ohm-cm)	Sulfate Conc. (ppm)	Chloride Conc. (ppm)	Bicarbonates Conc. (ppm)
B-8 #2 @1'-5'	5.4	950	75	64	4
B-9 #2 @5'-10'	9.4	2,200	45	21	310
B-10 #2 @1'-5'	5.1	660	200	120	4
B-11 #4 @13'-14'	8.1	240	570	1,250	52
B-12 #5 @16'-18'	8.3	320	140	770	38
B-14 #1 @4'-5'	8.2	670	140	130	80
B-15 #2 @6'-7'	8.7	2,400	36	11	200

The test results indicate that the majority of the soils along the project alignment are not considered aggressive to concrete. Therefore, Type I and Type 2 Portland Cement Concrete may be used for proposed facilities. It should be noted here that the most effective way to prevent sulfate attack is to keep the sulfate ions from entering the concrete in the first place. This can be done by using mix designs that give a low permeability (mainly by keeping the water/cement ratio low) and, if practical, by placing moisture barriers between the concrete and the soil.

AGE does not practice in the field of corrosion engineering. In the event that corrosion sensitive facilities are planned, we recommend that a corrosion engineer be retained to perform the necessary corrosion protection evaluation and design.

5.3 Expansive Soil

Based on visual observations, soil classifications and laboratory testing, clayey facies of the Otay Formation and Sweetwater Formation are highly expansive. The remainder of on-site soil materials are considered to be non-expansive or display a low expansion potential.

5.4 Trench Excavation

5.4.1 Excavation Characteristics

The materials within the anticipated depths of the trenched pipeline excavations will likely be comprised of materials which can be readily excavated with conventional heavy-duty construction equipment. Difficult excavation is anticipated for cemented portions of the very old paralic deposits and San Diego Formation, and in very dense/hard Otay Formation.

5.4.2 Fill Materials

Fill material for trenched excavation backfill should be free of biodegradable material, hazardous substance contamination, other deleterious debris, and or rocks or hard lumps greater than 6 inches. If the fill material contains rocks or hard lumps, at least 70 percent (by weight) of its particles shall pass a U.S. Standard $^{3}/_{4}$-inch sieve. Fill material should consists of predominantly granular soil (less than 40 percent passing the U.S. Standard #200 sieve) with Expansion Index of less than 50.

The majority of onsite soil materials are considered suitable for use as compacted backfill materials. Young alluvial deposits, particularly in the Sweetwater River valley, are anticipated to be in a wet condition, and will require drying and mixing if they are to be re-used as compacted fill. Highly expansive clayey facies of the Otay Formation and Sweetwater Formation are not considered suitable for use as compacted fill. Due to lack of space to dry the wet materials and mix the clay-rich materials with sandy materials, AGE recommend that wet and clay-rich materials be exported from the project site and import materials that meet the criteria presented herein be used as backfill and structural fill materials. AGE further recommend that additional corrosivity testing be performed during construction to confirm the general findings of the geotechnical investigation.

5.4.3 Placement and Compaction of Backfill

Prior to placement, all backfill materials should be moisture- conditioned, spread and placed in lifts (layers) not-to-exceed 6 inches in loose (uncompacted) thickness, and uniformly compacted to at least 90 percent relative compaction. During backfilling, the soil moisture content should be maintained at or within 2 percent above the optimum moisture content of the backfill materials. It

is recommended that the upper 36 inches directly beneath proposed paved areas be compacted to at least 95 percent relative compaction. The maximum dry density and optimum moisture content of the backfill materials should be determined in the laboratory in accordance with the ASTM D1557 testing procedures.

Small hand-operated compacting equipment should be used for compaction of the backfill materials to an elevation of at least 3 feet above the top (crown) of the pipes. Flooding or jetting should not be used to densify the backfill.

5.5 Buried Structures

It is recommended that any proposed buried structures be founded on firm native soils or approved compacted materials. In the unlikely event that loose or disturbed soils are encountered at the bottom of the excavation for the proposed structures, it is recommended that they be over-excavated and replaced with Class 2 base materials compacted to 95% of maximum density or other approved materials. The actual limits/extent of over-excavation of loose or soft materials at the manhole excavations should be evaluated by City's Resident Engineer during construction.

5.5.1 Placement and Compaction of Wall Backfill

Fill materials used around buried structures should meet the criteria for fill materials presented in Section 5.4.2. Placement and compaction of backfill materials around the buried structures should be performed in accordance with the recommendations presented in Section 5.4.3 of this report.

5.5.2 Foundations

An allowable soil bearing capacity of 4,000 psf and 3,000 psf may be use for design of foundations which are founded on undisturbed formation and properly compacted filled ground, respectively. For design of mat foundations, a modulus subgrade reaction (k) value of 275 pounds per cubic inch (pci) and 125 pci may be used for mats placed directly on undisturbed formation and properly compacted filled ground, respectively. We recommend that buried structures supported in young alluvial deposits, young colluvial deposits or old alluvial deposits be supported on 48 inches of 3-inch crushed rock materials wrapped in geotextile fabric such as Mirafi 500X or equivalent. An allowable soil bearing capacity of 3,000 psf and modulus of subgrade reaction (k) of 125 pci may be used in the design of buried structures supported as described herein.

Under static condition, total settlement of the foundations designed as recommended herein is estimated to be less than 0.5 inch. No permanent deformation and/or post-construction settlement is anticipated, provided that backfill around the structures is properly compacted in accordance with the project specifications.

An allowable passive earth resistance of 400 psf and 300 psf per foot of foundation embedment below grade may be used for the sides of foundations placed against undisturbed formation and properly compacted filled ground, respectively. The maximum recommended allowable passive pressure is 4,000 psf and 3,000 psf, respectively. A coefficient of friction of 0.40 may be used for foundations cast directly on competent native soils, properly compacted filled ground and 3-inch crushed rock. When the passive resistance is used in conjunction with the coefficient of friction, we recommend that the allowable passive earth resistance of 200 psf and 150 psf per foot of foundation embedment be used in the analysis for undisturbed formation and properly compacted filled ground, respectively. The maximum recommended allowable passive resistance is still 4,000 psf and 3,000 psf, respectively.

A summary of the general foundation recommendations are presented in Table 3 below.

Table 3

Summary of General Foundation Recommendations

Recommended Design Parameters	Undisturbed Formation (very old paralic deposits, San Diego Formation, Otay Formation, and Sweetwater Formation)	Properly Compacted Filled Ground & 48" of 3-Inch Crushed Rock for Bearing Only
Allowable Bearing (psf)	4,000	3,000
Modulus of Subgrade Reaction (pci)	275	125
Passive Resistance	400 pcf equivalent fluid weight not to exceed 4,000 psf	300 pcf equivalent fluid weight not to exceed 3,000 psf
Coefficient of Friction	0.40	0.40
Passive Resistance in Combination with Coefficient of Friction	200 pcf equivalent fluid weight not to exceed 4,000 psf	150 pcf equivalent fluid weight not to exceed 3,000 psf

5.5.3 Wall Lateral Loads

For design of properly backfilled buried structures, an active soil pressure equivalent to that generated by a fluid weighing 35 and 61 pounds per cubic foot, for level and 2:1 (horizontal : vertical) sloped backfill, respectively, may be used for design of the walls assuming that they are free

to rotate at the top at least 0.001H (where H is the height of the wall). An at-rest soil pressure equivalent to that generated by a fluid weighing 60 pounds per cubic foot may be used for design of walls restrained at the top. Traffic surcharge occurring within a horizontal distance equal to the wall height should be added as lateral pressure equal to a uniformly distributed load of 75 psf along the entire face of the walls. A summary of the lateral earth pressures is presented in Table 4 on the next page. Surcharge and foundation loads occurring within a horizontal distance equal to the wall height should be added to the lateral pressures.

Table 4

Summary of Lateral Earth Pressures

Condition	Equivalent Fluid Weight (pcf) Properly Compacted Fill
Active Pressure - Level Backfill	35
Active Pressure - 2 : 1 (H : V)	61
At-Rest Pressure	60

5.6 Trenchless Crossings

Sweetwater River Crossing

At the proposed elevations of a trenchless crossing of the Sweetwater River, our soil borings encountered young alluvial deposits generally consisting of interlayered silty sands and poorly graded sand with silt, with lesser amounts of sandy silt and sandy clay. The soils materials were in a loose to medium dense/medium stiff to stiff condition. The sandy alluvial materials are highly permeable and generally uncemented. Groundwater was encountered at approximate depths of 3-feet to 4-feet bgs in our borings.

Given the high permeability and shallow groundwater, significant dewatering is anticipated for the receiving/jacking pit construction and tunneling operations. Dewatering operation for the Sweetwater River Crossing trenchless construction will likely require combination of water tight shoring extended a minimum of 15 feet below the bottom of the test pit excavation, placement of mud slab at the bottom of the pits, and dewatering wells. The design, installation, and operation of any construction dewatering measures necessary for the project shall be the sole responsibility of the contractor.

Telegraph Drainage Channel and Telegraph Canyon Road Crossing

At the proposed elevations of a trenchless crossing of Telegraph Drainage Channel and Telegraph Canyon Road, our soil borings predominantly encountered Otay Formation. These formational soils consist of interlayered stiff/hard claystone and dense to very dense silty sandstones. A mixed face condition of young alluvial deposits and underlying Otay Formation may be encountered where the tunnel crosses below the Telegraph Drainage Channel. Young alluvial deposits encountered at the proposed tunnel elevation in our soil boring performed near the drainage channel generally consist of dense/stiff clayey sands and sandy clays. Significant groundwater is not anticipated at this crossing.

5.7 Summary & Conclusions

Based on the results of our investigation, it is our opinion that there are no known significant geologic hazards within the proposed pipeline alignment which cannot be avoided or mitigated provided that the project is designed and constructed in accordance with the City of San Diego codes and regulations. Work performed in other jurisdictions should be performed in accordance with the local codes and regulations.

The proposed pipeline alignment extends along existing public right-of-ways, in open area and on private properties. The proposed improvements do not add surcharge on existing improvements or structures within the project study area, nor is the pipeline construction anticipated to destabilize or result in settlement of adjacent properties and/or the right-of-way. Furthermore, the proposed improvements are not anticipated to increase geologic hazards within the project study area and/or affect the global stability of existing slopes.

6.0 CONSTRUCTION-RELATED CONSIDERATIONS

6.1 Construction Dewatering

Shallow groundwater and highly permeable soil conditions are anticipated for the Sweetwater River crossing. The contractor should therefore anticipate the need for sump pumps or other dewatering methods for this trenchless crossing and for pipeline construction in the adjacent Kaiser Permanente parking lot. There is also a concern that dewatering operations may encounter petroleum-hydrocarbon contaminated groundwater from an adjacent operating Chevron gasoline service station (AGE, 2022). A prior County of San Diego Department of Environmental Health (DEH) case involving petroleum hydrocarbon contamination of soil and groundwater from the service station was closed in 2011. At this time there are no known (reported) active leaks occurring from the service station.

Groundwater may also be encountered at Rice Canyon and the trenchless crossing of Telegraph Drainage Channel and Telegraph Canyon Road. For the remainder of the project alignment, the depth of the local groundwater table is expected to be well below the anticipated depth of the proposed excavations for this project. The contractor should, however, anticipate the possible need for sump pumps in the event that localized perched water conditions are encountered during construction. The design, installation, and operation of any construction dewatering measures necessary for the project shall be the sole responsibility of the contractor.

6.2 Temporary Shoring

Since the anticipated excavation depths will be more than 5 feet below the ground surface, prevailing Federal and Cal OSHA safety regulations require that the excavations be either sloped (if sufficient construction space or easement is available), shored, braced, or protected with approved sliding trench shield. Limited construction space, the presence of other buried utilities, and the need to avoid excessive community and environmental disruption dictate that a shored excavation will be needed. Design and construction of temporary shoring should be the sole responsibility of the contractor.

Settlement

Settlement of existing street improvements and/or utilties adjacent to the shoring may occur in proportion to both the distance between shoring system and adjacent structures or utilities and the amount of horizontal deflection of the shoring system. Vertical settlement will be maximum directly adjacent to the shoring system, and decreases as the distance from the shoring increases. At a distance equal to the height of the shoring, settlement is expected to be negligible. Maximum vertical settlement is estimated to be on the order of 75 percent of the horizontal deflection of the shoring system. It is recommended that shoring be designed to limit the maximum horizontal deflection to 1-inch or less where structures or utilities are to be supported.

It is recommended that pre- and post-construction surveys be conducted to document existing site conditions. Documentation should include photographic and video surveys of the existing facilities and site improvements, as well as field surveys. We further recommend that a weekly survey of existing facilities and site improvements be performed during the construction phase.

Lateral Earth Pressures

Temporary shoring should be designed to resist the pressure exerted by the retained soils and any additional lateral forces due to loads placed near the top of the excavation. For design of braced shorings supporting fill materials (af), young alluvial deposits (Qya), young colluvial deposits (Qyc), or older alluvium (Qoa), the recommended lateral earth pressure should be 32H psf, where H is equal to the height of the retained earth in feet. For braced shoring supporting very old paralic deposits (Qvop), San Diego Formation (Tsd), Otay Formation (To) or Sweetwater Formation (Tsw), the recommended lateral earth pressures may be reduced to 20H psf.

Any surcharge loads would impose uniform lateral pressure of 0.3q, where "q" equals the uniform surcharge pressure. The surcharge pressure should be applied starting at a depth equal to the distance of the surcharge load from the top of the excavation. In the event that the bottom of the excavation is located below the groundwater level, hydrostatic pressure should be added to the lateral loads.

The recommended lateral earth pressures have been prepared based on the assumptions that the shored earth is level at the surface and that the shoring system is temporary in nature.

Lateral Bearing Capacity

Resistance to lateral loads will be provided by passive soil resistance. The allowable passive soil resistance presented in Section 5.5.2 may be used for design of temporary shoring.

6.3 Environmental Considerations

AGE (2022) performed a previously submitted Phase I Environmental Site Assessment (Phase I ESA) to evaluate the possible presence of soil and/or groundwater contamination beneath the project alignment. With the exception of petroleum hydrocarbon contamination from a gasoline service station located northeast of the Kaiser Permanente parking lot, the potential of encountering contaminated soil and groundwater along the remainder of the project alignment is considered low.

During our subsurface investigation soil samples were field screened for the presence of volatile organics using a RAE Systems MiniRAE 3000 organic vapor meter (OVM). The field screening did not reveal elevated levels of volatile organics in the samples.

Prior to the start of the demolition and earthwork activities it is recommended that the contractor prepare a Community Health and Safety Plan (CHSP) for review and approval by the City and County of San Diego. The issues to be addressed in the CHSP should at a minimum include the monitoring, testing and handling of petroleum-impacted soil and groundwater, if encountered. The contractor should be prepared to handle and dispose of such materials in accordance with current industry practices and applicable Local, State and Federal regulations. The CHSP should also address the proper Personal Protective Equipment (PPE) for construction workers doing the pipeline installation.

A Soil Management Plan (SMP) is recommended as a means of preventing delays in the event that petroleum-hydrocarbon contaminated soil is encountered during the project. The SMP can be included as part of the CHSP.

7.0 GENERAL CONDITIONS

7.1 Post-Investigation Services

Post-investigation geotechnical services are an important continuation of this investigation, and we recommend that the City's Construction Inspection Division performs the necessary geotechnical observation and testing services during construction. In the event that the City is unable to perform said services, it is recommended that our firm be retained to provide the services.

Sufficient and timely observation and testing should be performed during excavation, pipeline installation, backfilling and other related earthwork operations. The purpose of the geotechnical observation and testing is to correlate findings of this investigation with the actual subsurface conditions encountered during construction and to provide supplemental recommendations, if necessary.

7.2 Uncertainties and Limitations

The information presented in this report is intended for the sole use of Rick Engineering and other members of the project design team and the City for project design purposes only and may not provide sufficient data to prepare an accurate bid. The contractor should be required to perform an independent evaluation of the subsurface conditions at the project sites prior to submitting his/her bid.

AGE has observed and investigated the subsurface conditions only at selected locations along the project alignment. The findings and recommendations presented in this report are based on the assumption that the subsurface conditions beneath all the alignments do not deviate substantially from those encountered in the exploratory soil borings. Consequently, modifications or changes to the recommendations presented herein may be necessary based on the actual subsurface conditions encountered during construction.

California, including San Diego County, is in an area of high seismic risk. It is generally considered economically unfeasible to build a totally earthquake-resistant project and it is, therefore, possible that a nearby large magnitude earthquake could cause damage at the project site.

Geotechnical engineering and geologic sciences are characterized by uncertainty. Professional judgments and opinions presented in this report are based partly on our evaluation and analysis of the technical data gathered during our present study, partly on our understanding of the scope of the proposed project, and partly on our general experience in geotechnical engineering.

In the performance of our professional services, we have complied with that level of care and skill ordinarily exercised by other members of the geotechnical engineering profession currently practicing under similar circumstances in southern California. Our services consist of professional consultation only, and no warranty of any kind whatsoever, expressed or implied, is made or intended in connection with the work performed. Furthermore, our firm does not guarantee the performance of the project in any respect.

AGE does not practice or consult in the field of safety engineering. The contractor will be responsible for the health and safety of his/her personnel and all subcontractors at the construction site. The contractor should notify the City if he or she considers any of the recommendations presented in this report to be unsafe.

8.0 REFERENCES

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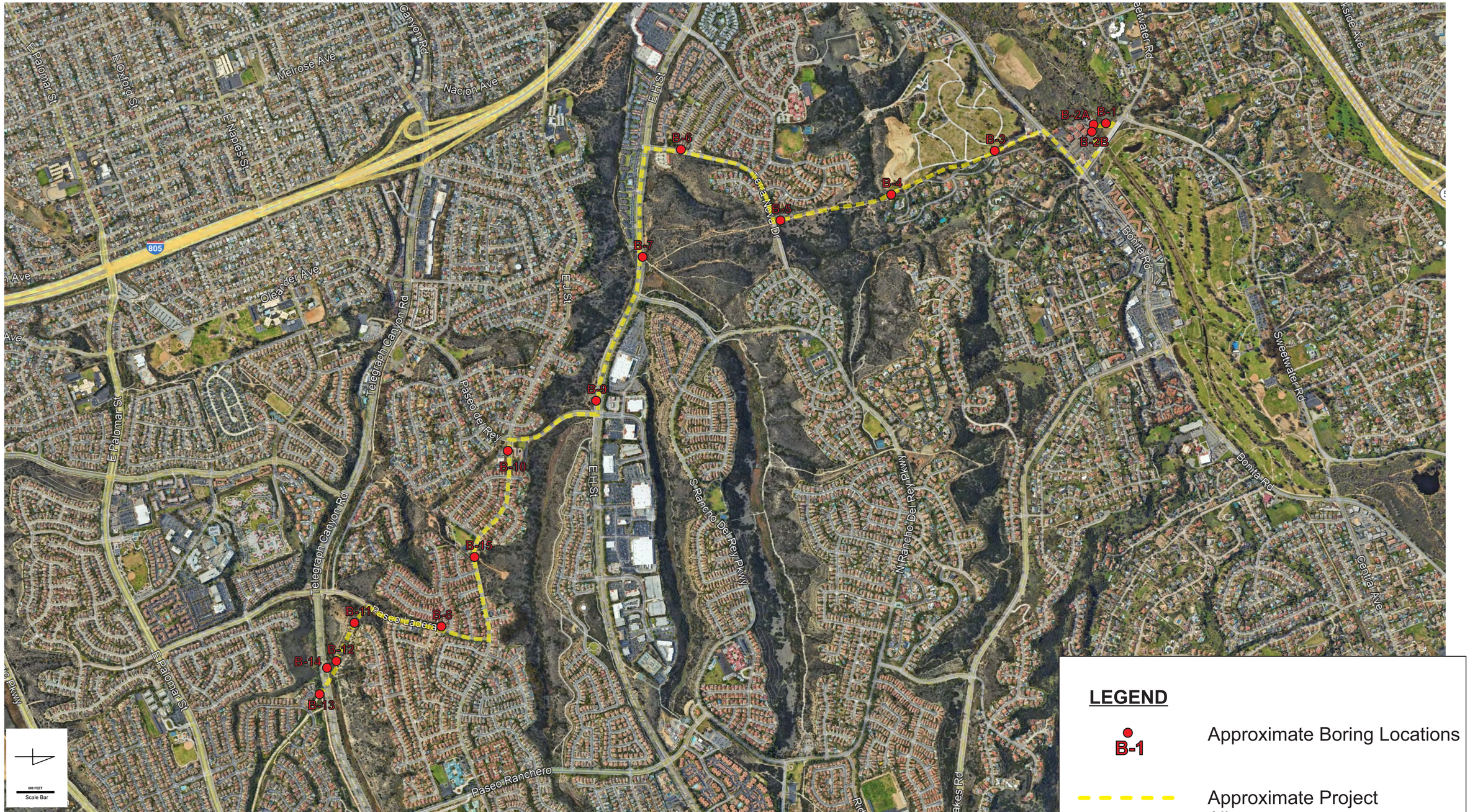
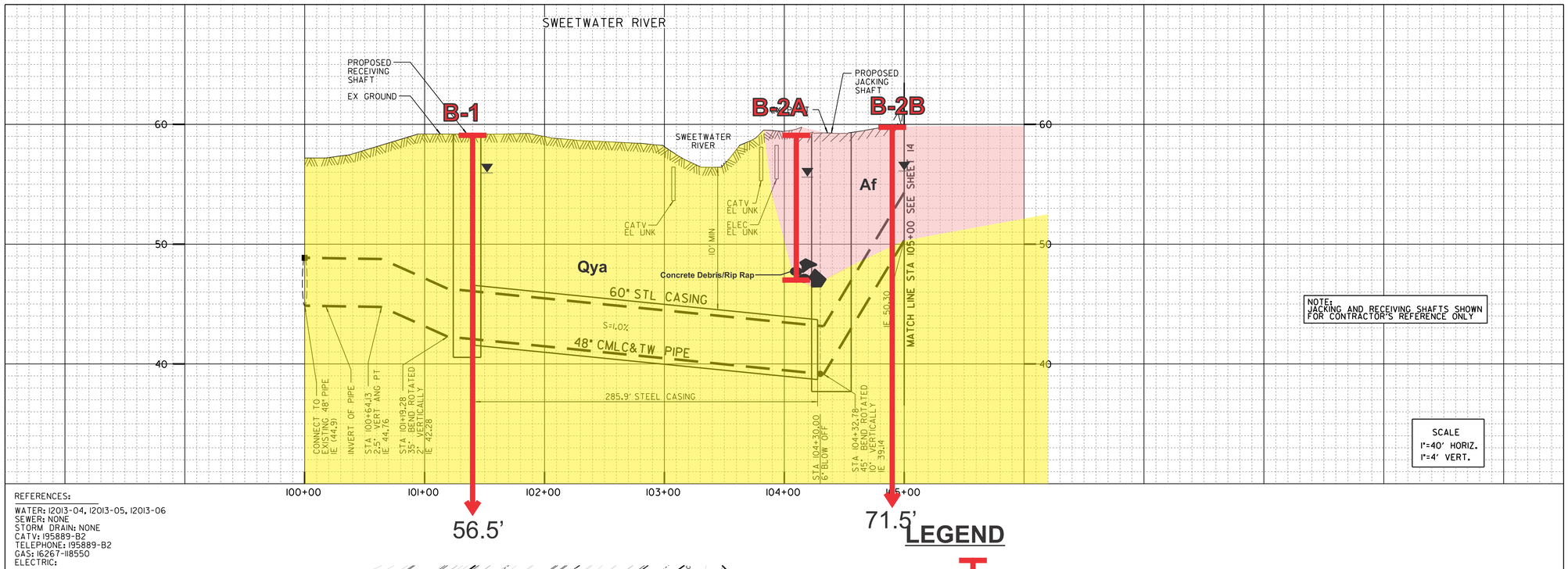
Aerial Photographs

U.S. Department of Agriculture black and white aerial photograph Nos. AXN-10M-117 thru 119 (all photos dated 1953).

FIGURES

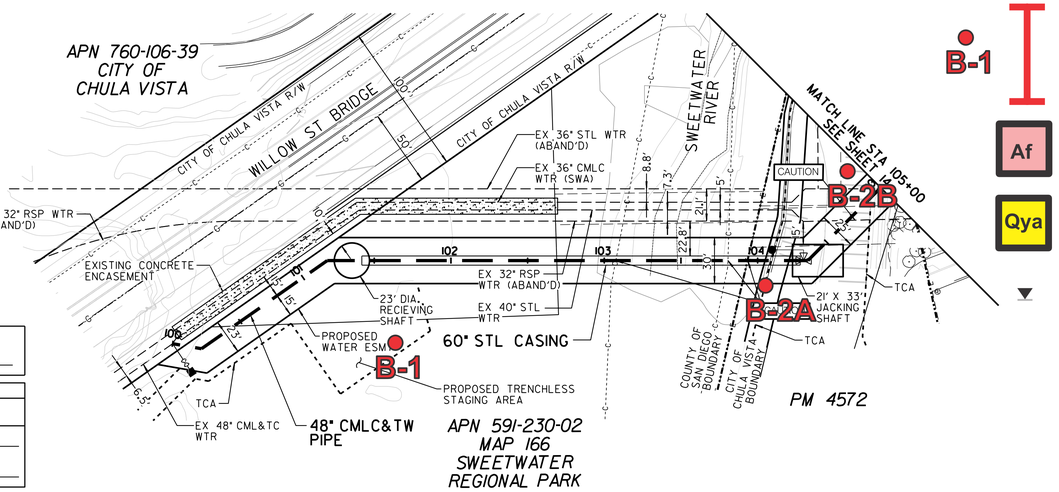


OTAY 2ND PIPELINE PHASE 4	ALIGNMENT MAP
PROJECT NO. 223 GS-22	ALLIED GEOTECHNICAL ENGINEERS, INC.
	FIGURE 1



REFERENCES:

WATER: 12013-04, 12013-05, 12013-06
SEWER: NONE
STORM DRAIN: NONE
CATV: 195889-B2
TELEPHONE: 195889-B2
GAS: 16267-118550
ELECTRIC:



LEGEND

B-1 — Approximate Boring Locations & Geologic Profile

Af — Artificial Fill

Qya — Young Alluvial Deposits

Approximate Ground Water Elevation During Drilling

APPROVED BY

COUNTY ENGINEER DATE:

SWEETWATER AUTHORITY

PLANS FOR THE INSTALLATION OF:
OTAY 2ND PIPELINE PHASE 4

ENGINEER DATE

APPROVED DATE

RICK ENGINEERING COMPANY
San Diego
5620 FRIARS ROAD
SAN DIEGO, CA 92110
619-291-0707
(FAX) 619-291-4165
rickengineering.com
Riverside - Orange - Sacramento - San Luis Obispo - Phoenix - Tucson - Denver

CITY OF CHULA VISTA DEVELOPMENT SERVICES DEPARTMENT
Drawing No. 23050 Project No. IP230012 Accela No. IP23-0012
Approved: By: Principal Civil Engineer
Submitted: By:
Planning: Landscape:
AS BUILT
CONTRACTOR:
INSPECTOR: DATE COMPLETED:

C-3

OTAY 2ND PIPELINE PHASE 4

SWEETWATER RIVER

WILLOW STREET BRIDGE TO KAISER PARKING LOT

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING & CAPITAL PROJECTS DEPARTMENT
SHEET 13 OF 52 SHEETS

WBS S-20001

APPROVED: FOR CITY ENGINEER PARITA AMMERLAHN PRINT DCE NAME DATE XXXX RCE#

SUBMITTED BY: SHAZA NEZHA PROJECT MANAGER

DESIGNED BY: NOORA FATHULLAH PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	RICK			

178-1755 CCS27 COORDINATE

1818-6315 CCS83 COORDINATE

0100476-13-D

REGISTERED PROFESSIONAL ENGINEER KEVIN R. O'BRIEN NO. 52295 STATE OF CALIFORNIA

XX-XX-XX

CONTRACTOR DATE
INSPECTOR NTP DATE NOC DATE

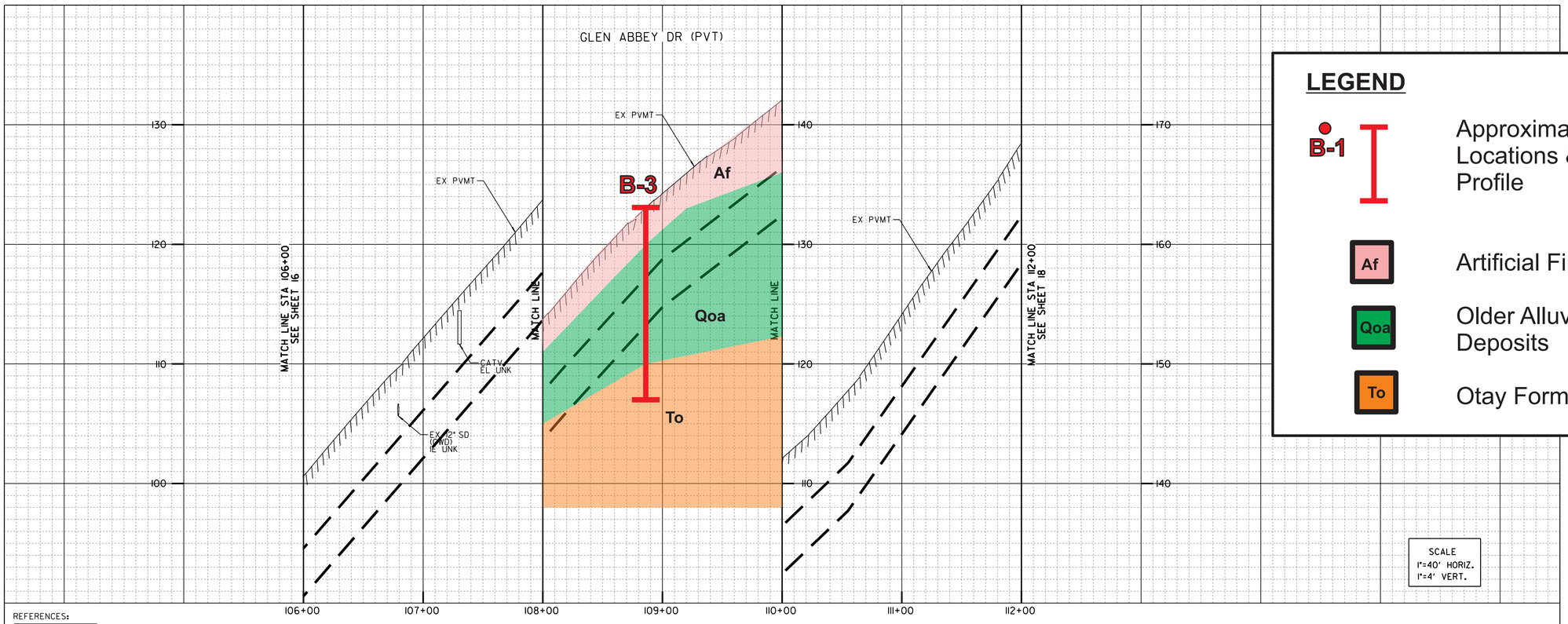
0 40 80 120
SCALE 1" = 40'

30% SUBMITTAL

SWEETWATER RIVER

OTAY 2ND PIPELINE PHASE 4 | **BORING LOCATION MAP - B-1, B-2A & B-2B**

PROJECT NO. 223 GS-22 | **ALLIED GEOTECHNICAL ENGINEERS, INC.** | **FIGURE 2**



LEGEND

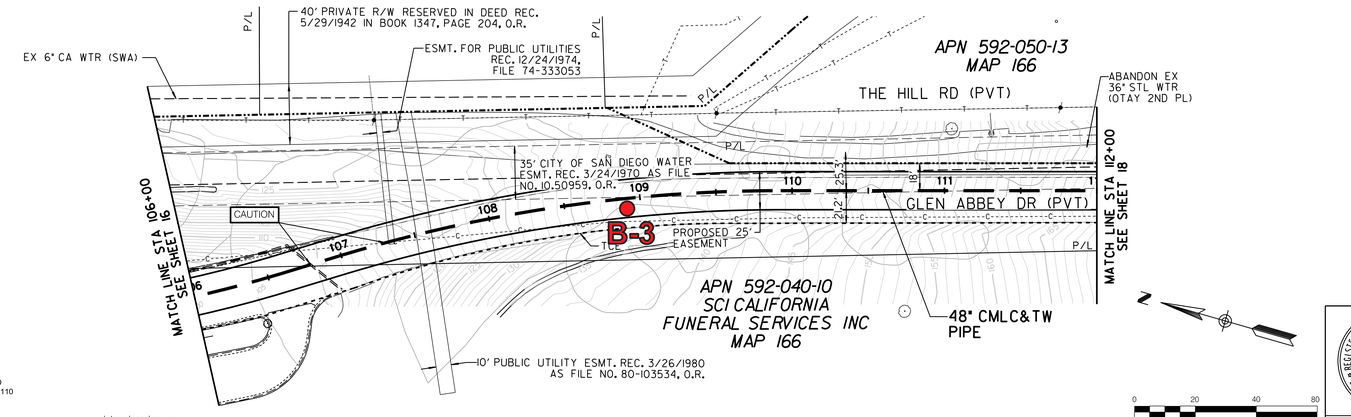
- B-1 — Approximate Boring Locations & Geologic Profile
- Af — Artificial Fill
- Qoa — Older Alluvial Deposits
- To — Otay Formation

SCALE
1"=40' HORIZ.
1"=4' VERT.

GLEN ABBEY DRIVE

REFERENCES:

WATER: 11904-16-D, 11904-17-D
SEWER: CGI334-1
STORM DRAIN: NONE
CATV: 195326-A5
TELEPHONE: 195326-A5
GAS: NONE
ELECTRIC: NONE



APPROVED BY
COUNTY ENGINEER _____ DATE: _____

C-7

OTAY 2ND PIPELINE PHASE 4

GLEN ABBEY DR
BONITA ROAD TO THE HILL ROAD

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING & CAPITAL PROJECTS DEPARTMENT
SHEET 17 OF 52 SHEETS

WBS S-20001

APPROVED:
FOR CITY ENGINEER _____ DATE
PARITA AMMERLAHN
PRINT DCE NAME
XXXXX
RCE#

SUBMITTED BY: SHAZA NEZHA, PROJECT MANAGER
DESIGNED BY: NOORA FATHULLAH, PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	RICK			

178-1755 CCS27 COORDINATE
1818-6315 CCS83 COORDINATE

CONTRACTOR _____ NTP DATE _____
INSPECTOR _____ NOC DATE _____
0100476-17-D

REGISTERED PROFESSIONAL ENGINEER
KEVIN R. GIBSON
NO. 52295
STATE OF CALIFORNIA
XX-XX-XX

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SAN DIEGO, CA 92110
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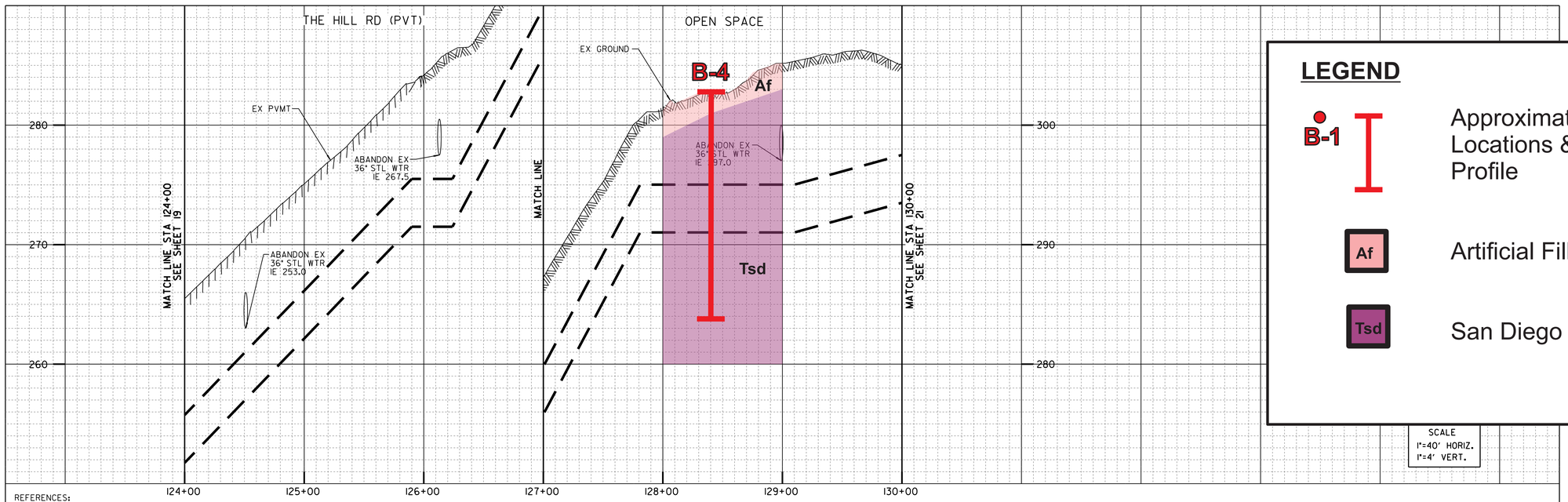
30% SUBMITTAL

OTAY 2ND PIPELINE PHASE 4 | **BORING LOCATION MAP - B-3**

PROJECT NO. 223 GS-22 | **ALLIED GEOTECHNICAL ENGINEERS, INC.** | **FIGURE 3**



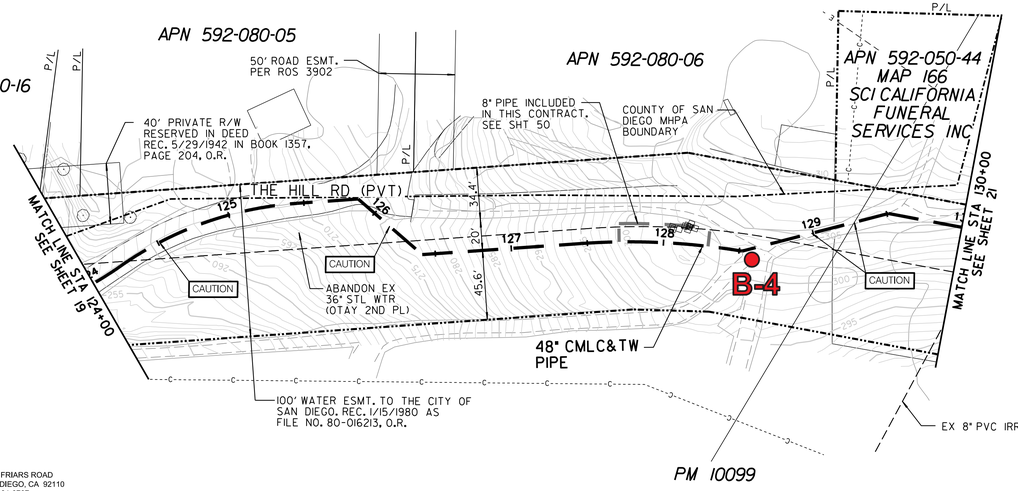
LEGEND

- B-1 — Approximate Boring Locations & Geologic Profile
- Af — Artificial Fill
- Tsd — San Diego Formation

SCALE
1"=40' HORIZ.
1"=4' VERT.

REFERENCES:

WATER: 11904-16-D
SEWER: NONE
STORM DRAIN: NONE
CATV: 195326-B5, 195326-B6
TELEPHONE: 195326-B5, 195326-B6
GAS: NONE
ELECTRIC:



0 40 80 120
SCALE 1" = 40'

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APPROVED BY
COUNTY ENGINEER _____ DATE: _____

C-10

OTAY 2ND PIPELINE PHASE 4

OPEN SPACE

THE HILL ROAD TO TERRA NOVA DRIVE

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING & CAPITAL PROJECTS DEPARTMENT
SHEET 20 OF 52 SHEETS

WBS S-20001

APPROVED: FOR CITY ENGINEER _____ DATE _____
PARITA AMMERLAHN XXXXX
PRINT DOE NAME RCE#

SUBMITTED BY: SHAZA NEZHA, PROJECT MANAGER
APPROVED BY: NOORA FATHULLAH, PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	RICK			

174-1755 COS27 COORDINATE
1814-6315 CCS83 COORDINATE

CONTRACTOR _____ NTP DATE _____
INSPECTOR _____ NOC DATE _____

0100476-20-D

30% SUBMITTAL

OPEN SPACE

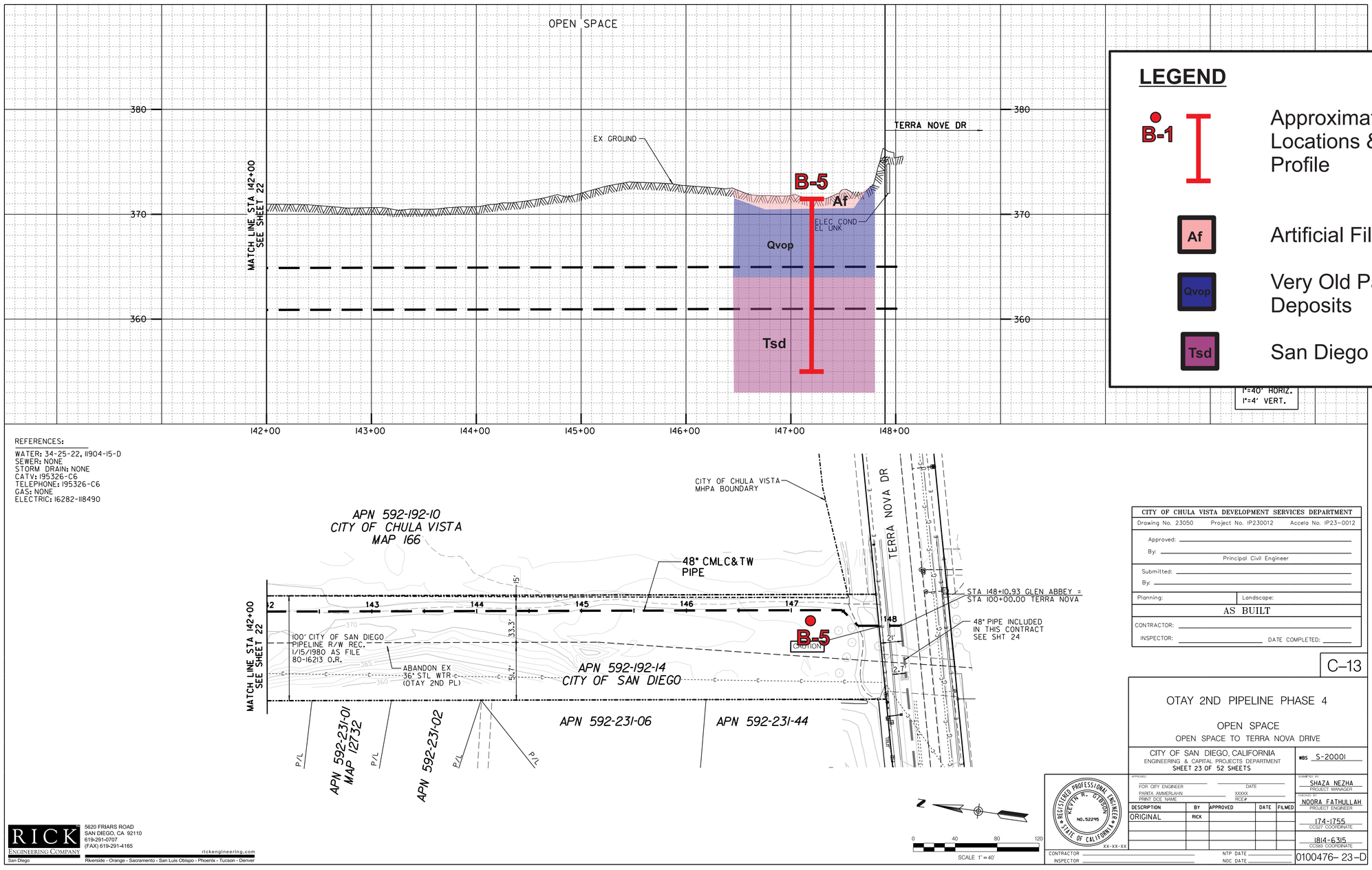
OTAY 2ND PIPELINE PHASE 4

BORING LOCATION MAP - B-4

PROJECT NO.
223 GS-22

ALLIED GEOTECHNICAL ENGINEERS, INC.

FIGURE 4



LEGEND

- B-1 — Approximate Boring Locations & Geologic Profile
- Af — Artificial Fill
- Qvop — Very Old Paralic Deposits
- Tsd — San Diego Formation

REFERENCES:

WATER: 34-25-22, 11904-15-D
SEWER: NONE
STORM DRAIN: NONE
CATV: 195326-C6
TELEPHONE: 195326-C6
GAS: NONE
ELECTRIC: 16282-118490

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CITY OF CHULA VISTA DEVELOPMENT SERVICES DEPARTMENT

Drawing No. 23050 Project No. IP230012 Accela No. IP23-0012

Approved: _____
Principal Civil Engineer

Submitted: _____
By: _____

Planning: | Landscape:

AS BUILT

CONTRACTOR: _____

INSPECTOR: _____ DATE COMPLETED: _____

C-13

OPEN SPACE

OTAY 2ND PIPELINE PHASE 4

OPEN SPACE

OPEN SPACE TO TERRA NOVA DRIVE

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING & CAPITAL PROJECTS DEPARTMENT
SHEET 23 OF 52 SHEETS

WBS S-20001

REGISTERED PROFESSIONAL ENGINEER — KRISTIN R. GIBSON — NO. 52295 — STATE OF CALIFORNIA

APPROVED: FOR CITY ENGINEER _____ DATE _____
PARITA AMMERLAHN _____ XXXXX
PRINT DCE NAME RCE#

SUBMITTED BY: SHAZA NEZHA, PROJECT MANAGER
DESIGNED BY: NOORA FATHULLAH, PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	RICK			

174-1755 CCS27 COORDINATE
1814-6315 CCS83 COORDINATE

CONTRACTOR _____ NTP DATE _____
INSPECTOR _____ NOC DATE _____

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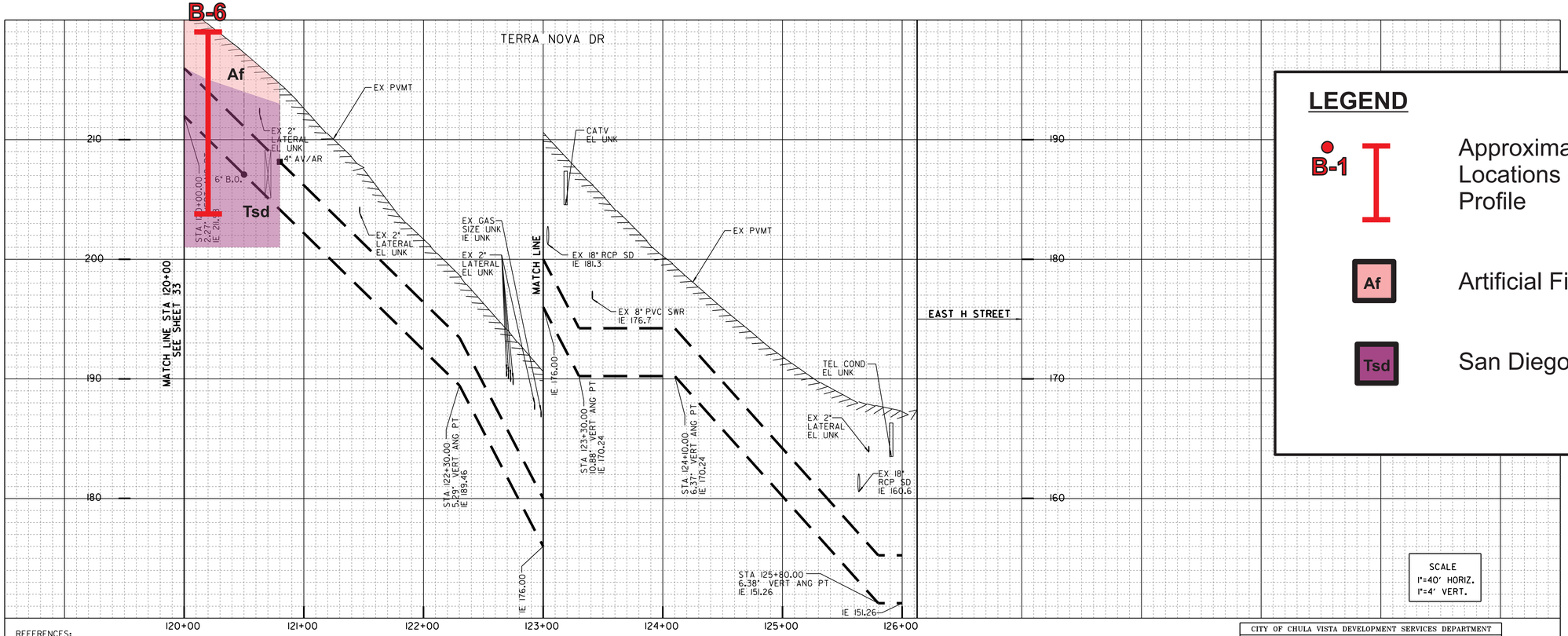
OTAY 2ND PIPELINE PHASE 4

BORING LOCATION MAP - B-5

PROJECT NO.
223 GS-22

ALLIED GEOTECHNICAL ENGINEERS, INC.

FIGURE 5

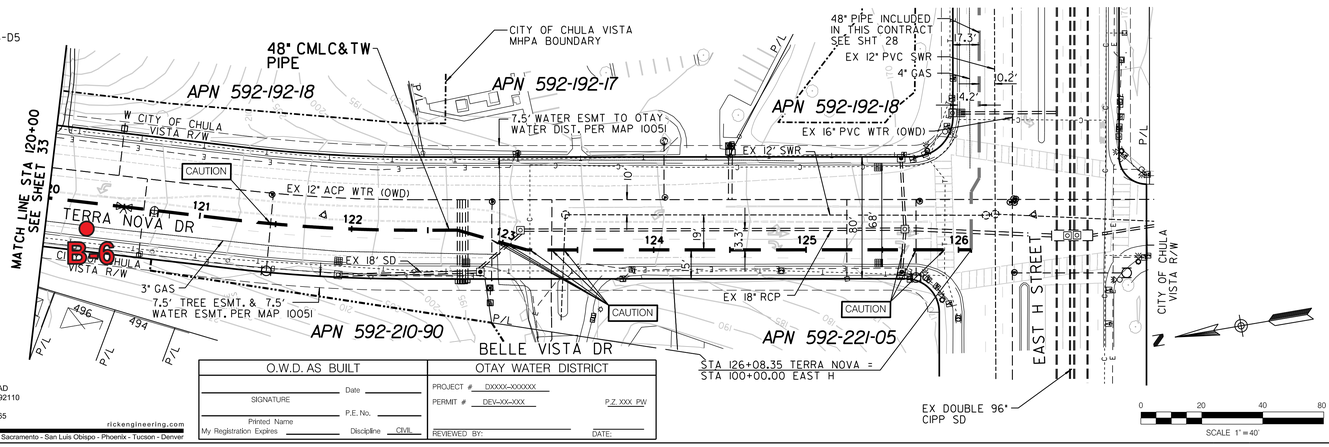


LEGEND

- B-1 — Approximate Boring Locations & Geologic Profile
- Af — Artificial Fill
- Tsd — San Diego Formation

REFERENCES:

WATER: 30-17-22, 34-20-22, 34-23-22
SEWER: 34-20-22
STORM DRAIN: 34-78-22
CATV: 195326-D4, 195326-D5
TELEPHONE: 195326-D4, 195326-D5
GAS: 16312-118460
ELECTRIC: 16312-118460



O.W.D. AS BUILT	OTAY WATER DISTRICT
Date	PROJECT # DXXXX-XXXXXX
SIGNATURE	PERMIT # DEV-XX-XXX P.Z. XXX PW
Printed Name	P.E. No.
My Registration Expires	Discipline CIVIL
	REVIEWED BY: DATE:

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Approved: _____
By: _____ Principal Civil Engineer

Submitted: _____
By: _____

Planning: | Landscape:

AS BUILT

CONTRACTOR: _____
INSPECTOR: _____ DATE COMPLETED: _____

C-17

OTAY 2ND PIPELINE PHASE 4

TERRA NOVA DRIVE
KILEY ROAD TO EAST H STREET

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING & CAPITAL PROJECTS DEPARTMENT
SHEET 27 OF 52 SHEETS

WBS S-20001

APPROVED:
FOR CITY ENGINEER _____ DATE
PARITA AMMERLAHN XXXXX
PRINT DCE NAME RCE#

SUBMITTED BY: SHAZA NEZHA, PROJECT MANAGER
CHECKED BY: NOORA FATHULLAH, PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	RICK			

170-1755 COGO COORDINATE
1810-6315 COGO COORDINATE

REGISTERED PROFESSIONAL ENGINEER — KEITH R. GIBSON — NO. 52795 — STATE OF CALIFORNIA — XX-XX-XX

CONTRACTOR _____ NTP DATE _____
INSPECTOR _____ NOC DATE _____

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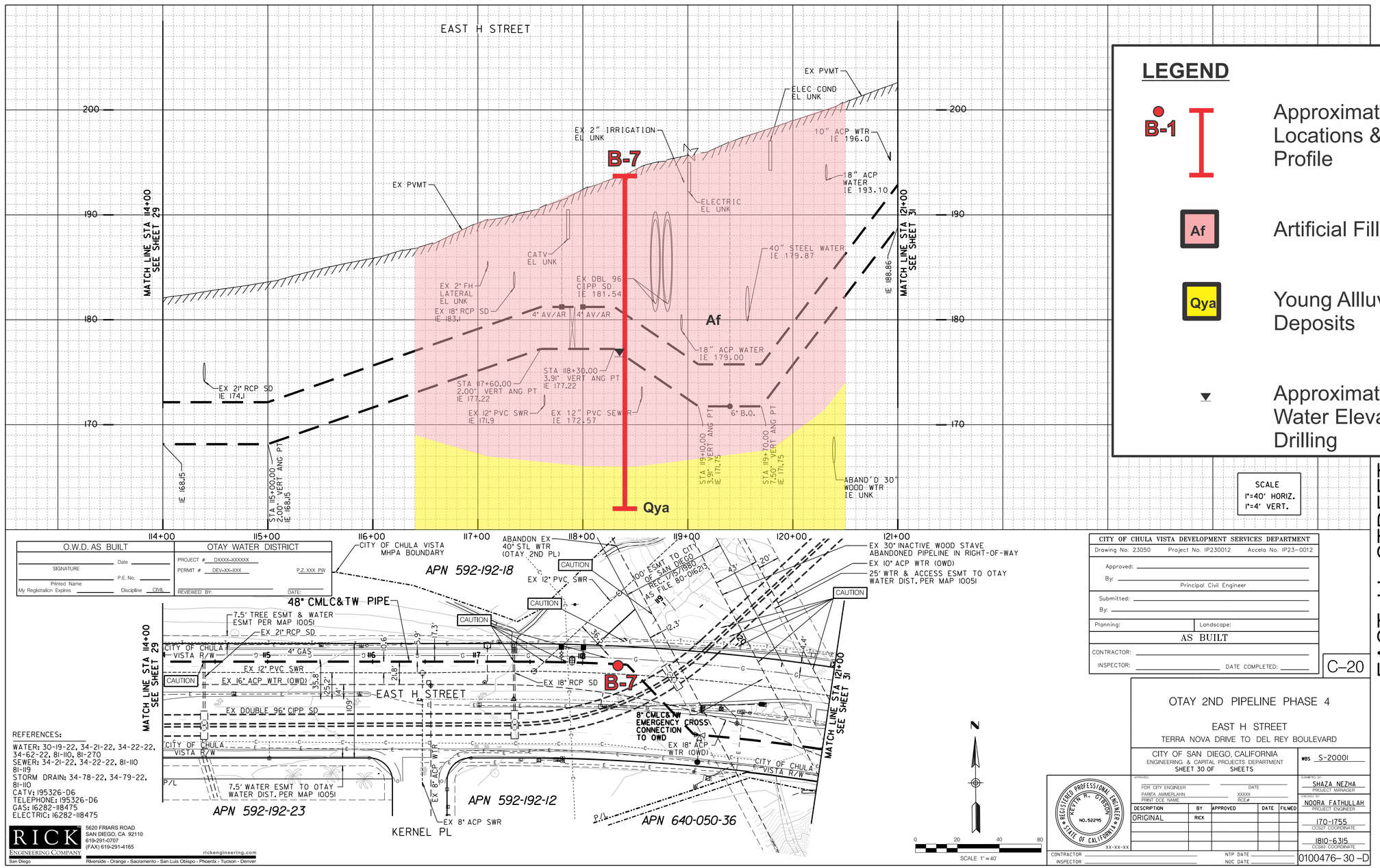
OTAY 2ND PIPELINE PHASE 4 | **BORING LOCATION MAP - B-6**

PROJECT NO. 223 GS-22

ALLIED GEOTECHNICAL ENGINEERS, INC.

FIGURE 6



LEGEND

- B-1 — Approximate Boring Locations & Geologic Profile
- Af — Artificial Fill
- Qya — Young Allluvial Deposits
- ▼ — Approximate Ground Water Elevation During Drilling

O.W.D. AS BUILT

SIGNATURE _____ Date _____

Printed Name _____ P.E. No. _____

My Registration Expires _____ Discipline CIVIL

OTAY WATER DISTRICT

PROJECT # DXXXX-XXXXXX

PERMIT # DEV-XX-XXX P.Z. XXX PW

REVIEWED BY: _____ DATE: _____

CITY OF CHULA VISTA DEVELOPMENT SERVICES DEPARTMENT

Drawing No. 23050 Project No. IP230012 Accela No. IP23-0012

Approved: _____

By: _____ Principal Civil Engineer

Submitted: _____

By: _____

Planning: _____ Landscape: _____

AS BUILT

CONTRACTOR: _____

INSPECTOR: _____ DATE COMPLETED: _____

C-20

REFERENCES:

WATER: 30-19-22, 34-21-22, 34-22-22, 34-62-22, 81-110, 81-270
SEWER: 34-21-22, 34-22-22, 81-110 81-119
STORM DRAIN: 34-78-22, 34-79-22, 81-110
CATV: 195326-D6
TELEPHONE: 195326-D6
GAS: 16282-118475
ELECTRIC: 16282-118475

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OTAY 2ND PIPELINE PHASE 4

EAST H STREET

TERRA NOVA DRIVE TO DEL REY BOULEVARD

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING & CAPITAL PROJECTS DEPARTMENT
SHEET 30 OF SHEETS

WBS S-20001

REGISTERED PROFESSIONAL ENGINEER — KEVIN R. GIBSON — NO. 52295 — STATE OF CALIFORNIA — XX-XX-XX

APPROVED: FOR CITY ENGINEER _____ DATE _____
PARITA AMMERJAHN
PRINT DCE NAME XXXXX RCE#

SUBMITTED BY: SHAZA NEZHA PROJECT MANAGER

PREPARED BY: NOORA FATHULLAH PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	RICK			

170-1755 CCS27 COORDINATE

1810-6315 CCS83 COORDINATE

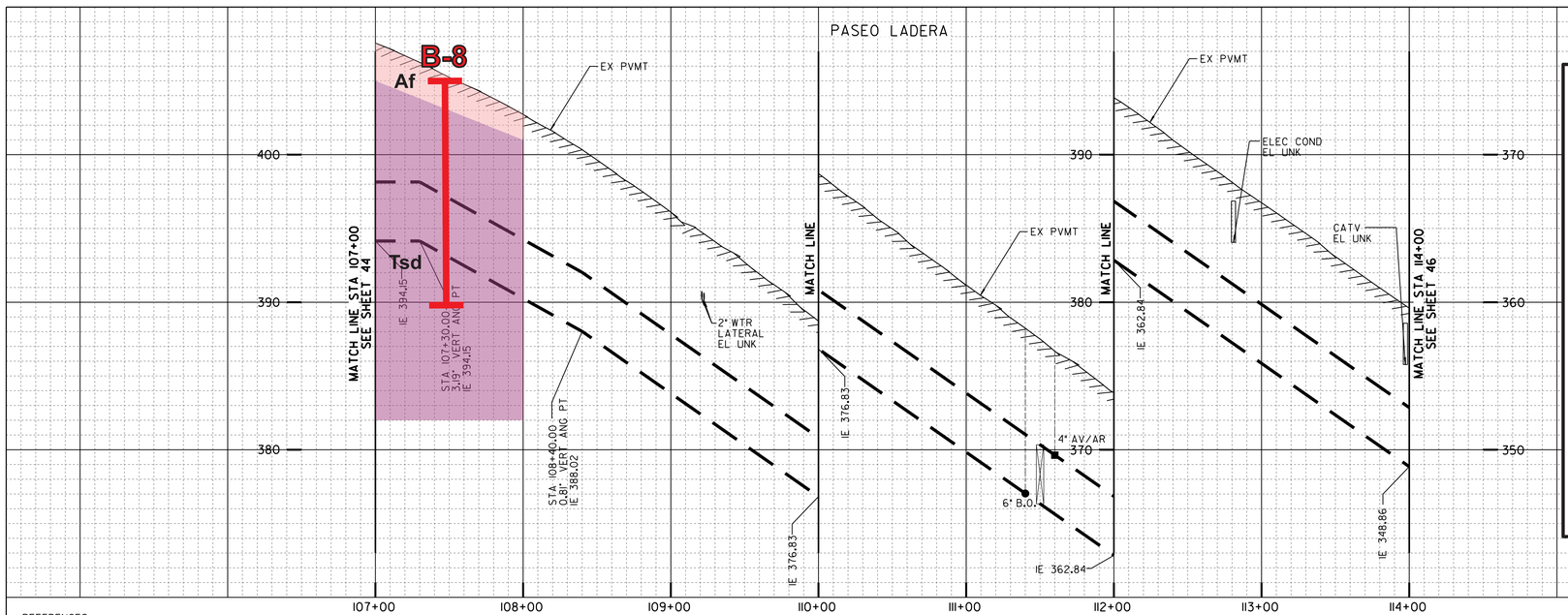
0100476-30-D

CONTRACTOR _____ NTP DATE _____
INSPECTOR _____ NOC DATE _____

30% SUBMITTAL

OTAY 2ND PIPELINE PHASE 4 | **BORING LOCATION MAP - B-7**

PROJECT NO. 223 GS-22 | **ALLIED GEOTECHNICAL ENGINEERS, INC.** | **FIGURE 7**



LEGEND

B-1 — Approximate Boring Locations & Geologic Profile

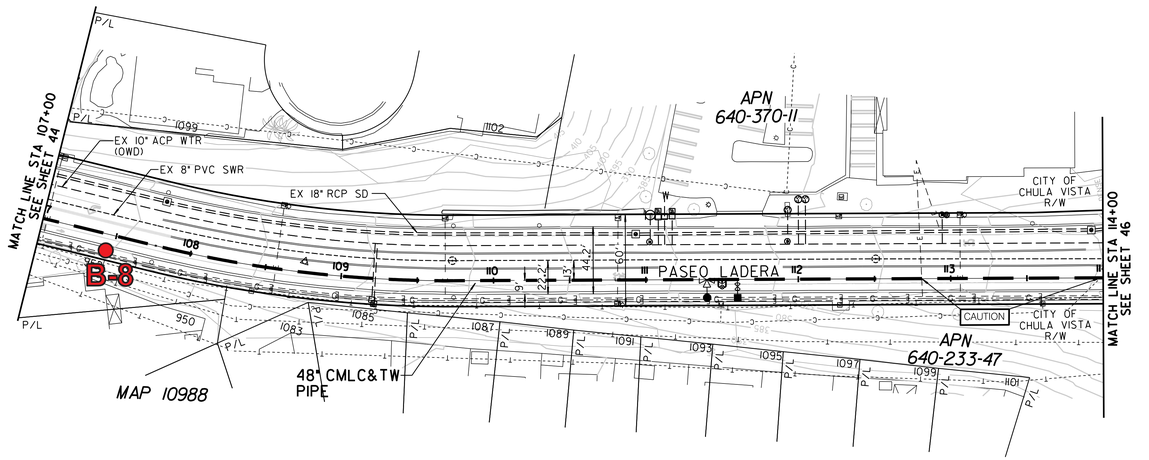
Af — Artificial Fill

Tsd — San Diego Formation

1"=40' HORIZ.
1"=4' VERT.

REFERENCES:

WATER: 84-21, 45-08-22
SEWER: 84-21, 45-08-22
STORM DRAIN: 26-07-22
CATV: 195326-F10
TELEPHONE: 195326-F10
GAS: 16342-118440
ELECTRIC: 16342-118440



SCALE 1" = 40'

O.W.D. AS BUILT	OTAY WATER DISTRICT
SIGNATURE Date	PROJECT # DXXXX-XXXXXX
Printed Name P.E. No.	PERMIT # DEV-XX-XXX P.Z. XXX P.W.
My Registration Expires Discipline CIVIL	REVIEWED BY: DATE:

CITY OF CHULA VISTA DEVELOPMENT SERVICES DEPARTMENT

Drawing No. 23050 Project No. IP230012 Accela No. IP23-0012

Approved:
By: Principal Civil Engineer

Submitted:
By:

Planning: Landscape:

AS BUILT

CONTRACTOR:
INSPECTOR: DATE COMPLETED:

C-35

PASEO LADERA

OTAY 2ND PIPELINE PHASE 4

PASEO LADERA

BLACKWOOD ROAD TO PASEO ENTRADA

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING & CAPITAL PROJECTS DEPARTMENT
SHEET 45 OF 52 SHEETS

WBS S-20001

APPROVED:
FOR CITY ENGINEER DATE
PARITA AMMERLAHN XXXXX
PRINT DCE NAME RCE#

SUBMITTED BY: SHAZA NEZHA, PROJECT MANAGER
CHECKED BY: NOORA FATHULLAH, PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	F&MED
ORIGINAL	RICK			

166-1761 CCS27 COORDINATE
1806-6321 CCS83 COORDINATE
0100476-45-D

REGISTERED PROFESSIONAL ENGINEER — KEITH R. OSBORN — NO. 52295 — STATE OF CALIFORNIA — xx-xx-xx

CONTRACTOR NTP DATE
INSPECTOR NOC DATE

30% SUBMITTAL

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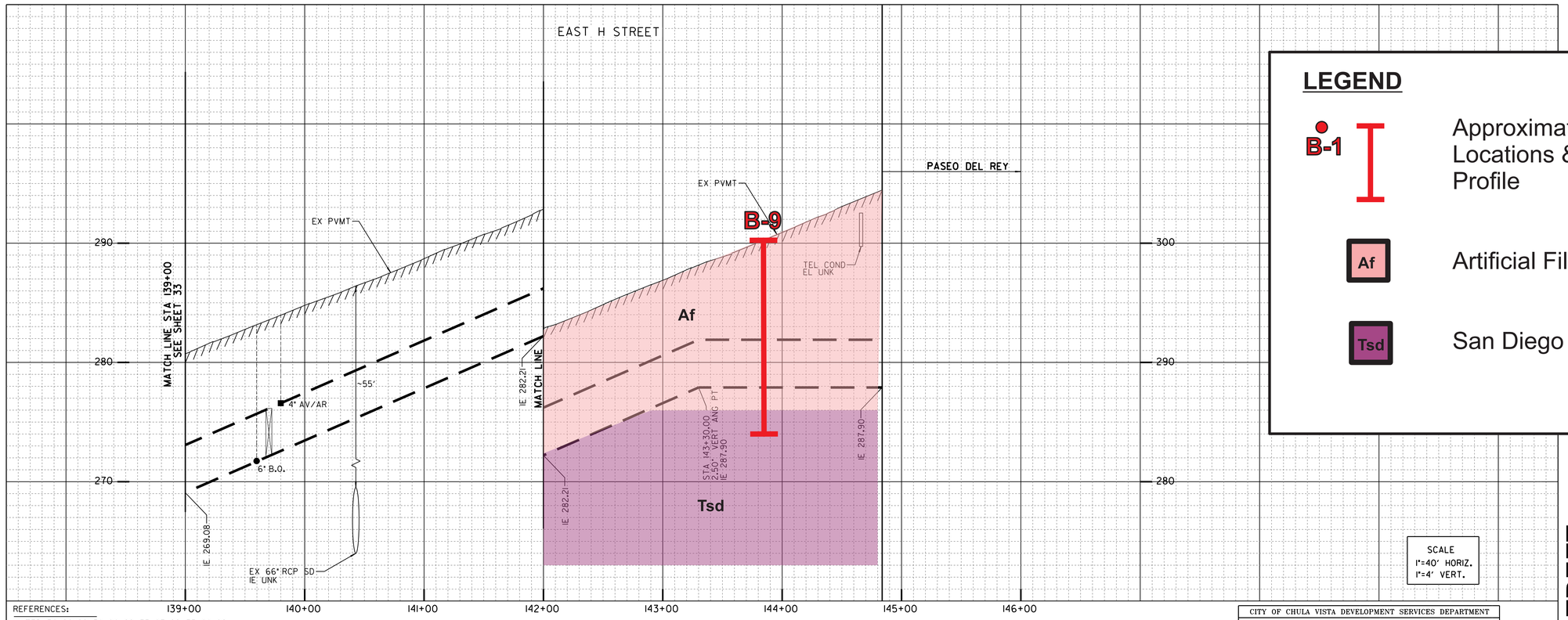
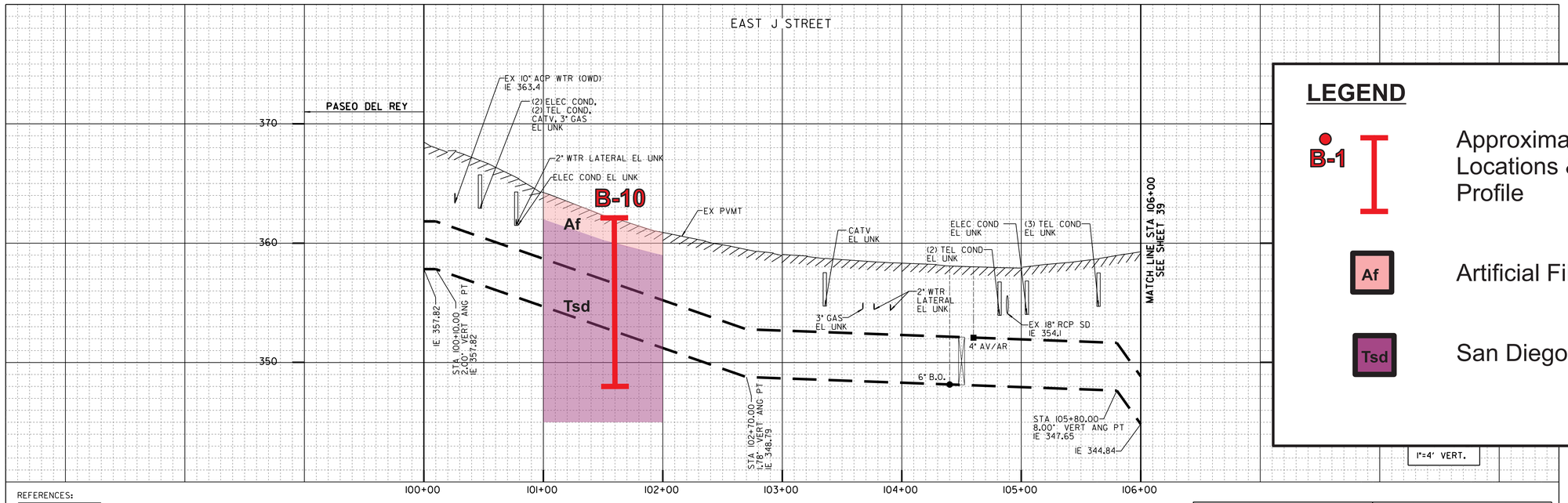
OTAY 2ND PIPELINE PHASE 4 | **BORING LOCATION MAP - B-8**

PROJECT NO. 223 GS-22 | **ALLIED GEOTECHNICAL ENGINEERS, INC.** | **FIGURE 8**



OTAY 2ND PIPELINE PHASE 4	BORING LOCATION MAP - B-9
PROJECT NO. 223 GS-22	ALLIED GEOTECHNICAL ENGINEERS, INC.
	FIGURE 9



LEGEND

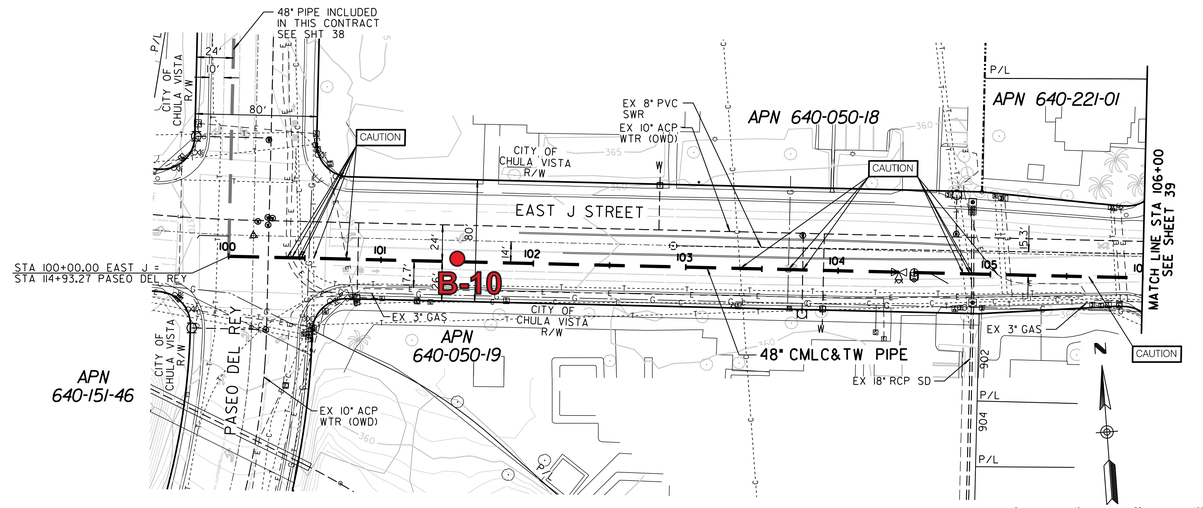
B-1 — Approximate Boring Locations & Geologic Profile

Af — Artificial Fill

Tsd — San Diego Formation

REFERENCES:

WATER: 37-04-22, 38-07-22, 77-351-D, 83-12, 11904-13, 11904-14
SEWER: 37-04-22, 83-12
STORM DRAIN: 83-14
CATV: 195326-E8
TELEPHONE: 195326-E8
GAS: 16312-118450, 16320-118450
ELECTRIC: 16312-118450, 16320-118450



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rickengineering.com
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O.W.D. AS BUILT	OTAY WATER DISTRICT
SIGNATURE / Date	PROJECT # DXXXX-XXXXXX
P.E. No.	PERMIT # DEV-XX-XXX P.Z. XXX PW
Printed Name / My Registration Expires / Discipline CIVIL	REVIEWED BY: / DATE:

CITY OF CHULA VISTA DEVELOPMENT SERVICES DEPARTMENT

Drawing No. 23050 Project No. IP230012 Accela No. IP23-0012

Approved: _____ By: _____ Principal Civil Engineer

Submitted: _____ By: _____

Planning: | Landscape:

AS BUILT

CONTRACTOR: _____

INSPECTOR: _____ DATE COMPLETED: _____

C-28

EAST J STREET

OTAY 2ND PIPELINE PHASE 4

EAST J STREET

PASEO DEL REY TO REDBUD ROAD

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING & CAPITAL PROJECTS DEPARTMENT
SHEET 38 OF 52 SHEETS

WBS S-20001

APPROVED: FOR CITY ENGINEER _____ DATE
PARITA AMMERLAHN
PRINT DCE NAME

DESIGNED SHAZA NEZHA PROJECT MANAGER

DRAWN NOORA FATHULLAH PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	RICK			

170-1755 CCS27 COORDINATE

1810-6315 CCS83 COORDINATE

0100476-38-D

REGISTERED PROFESSIONAL ENGINEER KEVIN R. GIBSON NO. 52295 STATE OF CALIFORNIA
XX-XX-XX

CONTRACTOR _____ NTP DATE _____
INSPECTOR _____ NOC DATE _____

30% SUBMITTAL

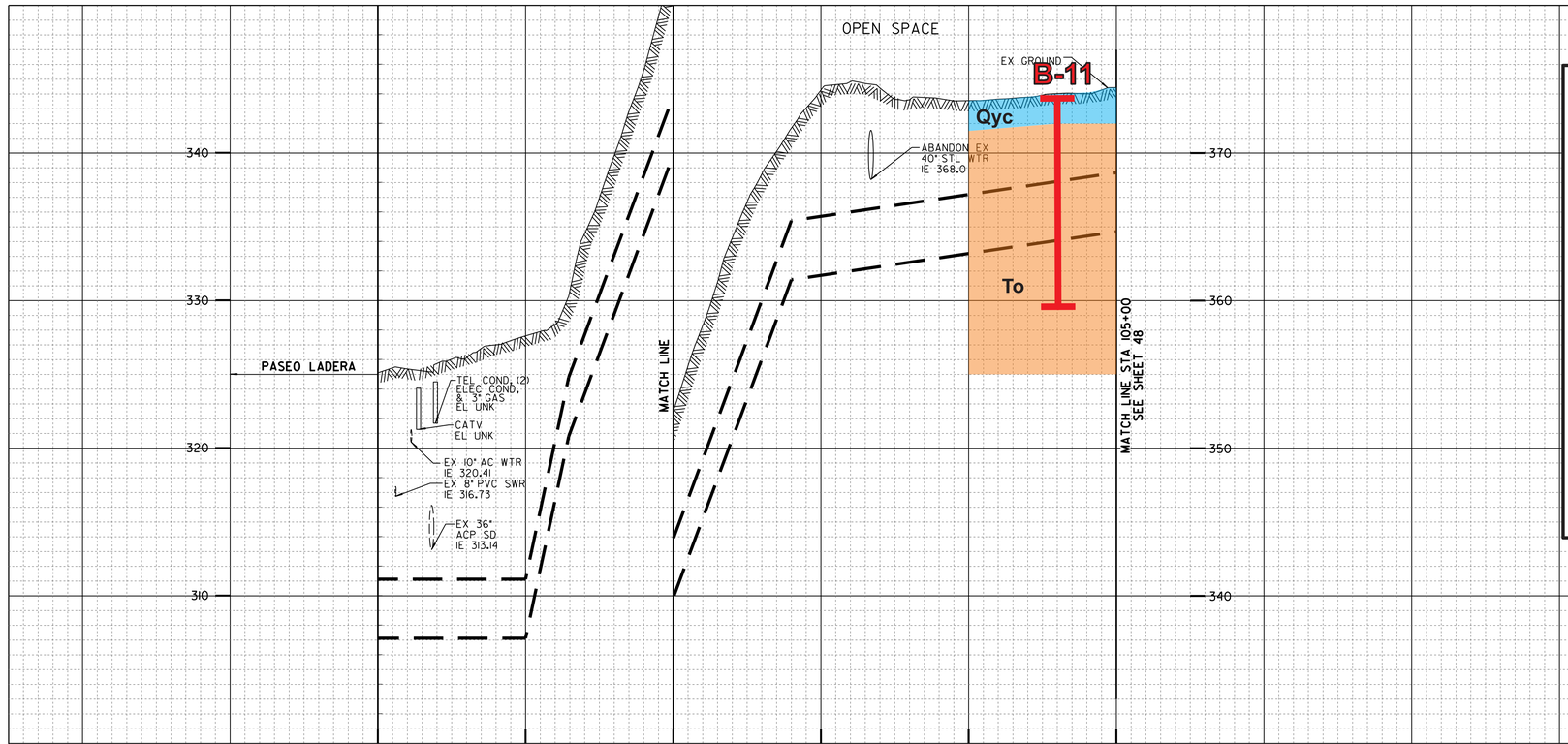
OTAY 2ND PIPELINE PHASE 4

BORING LOCATION MAP - B-10

PROJECT NO.
223 GS-22

ALLIED GEOTECHNICAL ENGINEERS, INC.

FIGURE 10



LEGEND

B-1 — Approximate Boring Locations & Geologic Profile

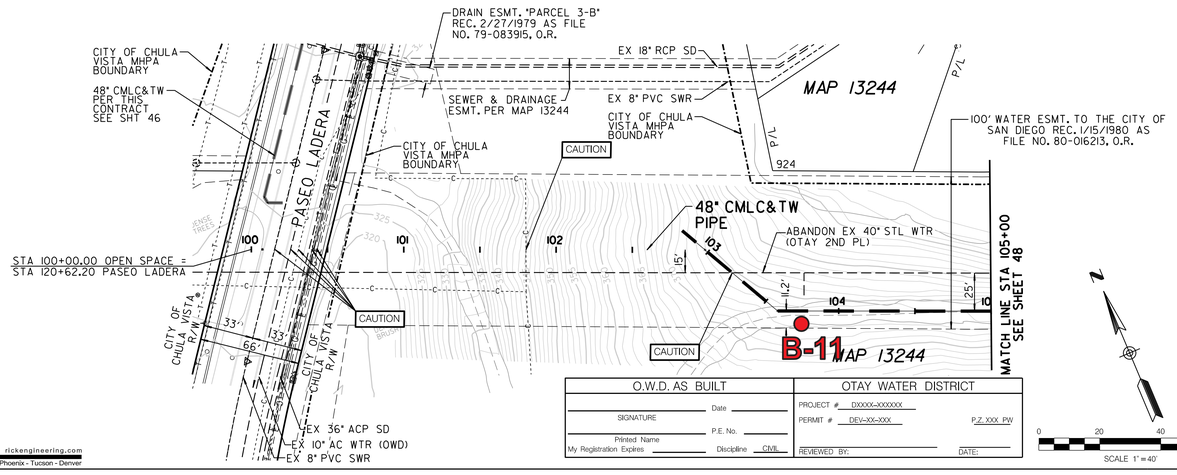
Qyc — Slopewash Deposits

To — Otay Formation

SCALE
1"=40' HORIZ.
1"=4' VERT.

REFERENCES:

WATER: 26-05-22, 1190412-D
SEWER: 78-3430, 84-18, 94-395
STORM DRAIN: 78-3430, 94-395
CATV: 195326-F10
TELEPHONE: 195326-F10
GAS: 16342-118430
ELECTRIC: 16342-118430



O.W.D. AS BUILT	OTAY WATER DISTRICT
SIGNATURE Date	PROJECT # DXXXX-XXXXXX
P.E. No.	PERMIT # DEV-XX-XXX P.Z. XXX PW
Printed Name My Registration Expires	Discipline CIVIL
	REVIEWED BY: DATE:

CITY OF CHULA VISTA DEVELOPMENT SERVICES DEPARTMENT

Drawing No. 23050 Project No. IP230012 Accela No. IP23-0012

Approved: _____
By: _____ Principal Civil Engineer

Submitted: _____
By: _____

Planning: Landscape:

AS BUILT

CONTRACTOR: _____
INSPECTOR: _____ DATE COMPLETED: _____

C-37

OPEN SPACE

OTAY 2ND PIPELINE PHASE 4

OPEN SPACE

PASEO LADERA TO TELEGRAPH CANYON ROAD

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING & CAPITAL PROJECTS DEPARTMENT
SHEET 47 OF 52 SHEETS

WBS S-20001

APPROVED: FOR CITY ENGINEER _____ DATE
PARITA AMMERLAHN XXXXX
PRINT DOE NAME RCE#

SUBMITTED BY: SHAZA NEZHA PROJECT MANAGER
CHECKED BY: NOORA FATHULLAH PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	RICK			

166-1761 COS27 COORDINATE
1806-6321 COS83 COORDINATE

REGISTERED PROFESSIONAL ENGINEER — KEITH R. GIBSON — NO. 52295 — STATE OF CALIFORNIA — XX-XX-XX

CONTRACTOR _____ NTP DATE _____
INSPECTOR _____ NOC DATE _____

0100476-47-D

30% SUBMITTAL

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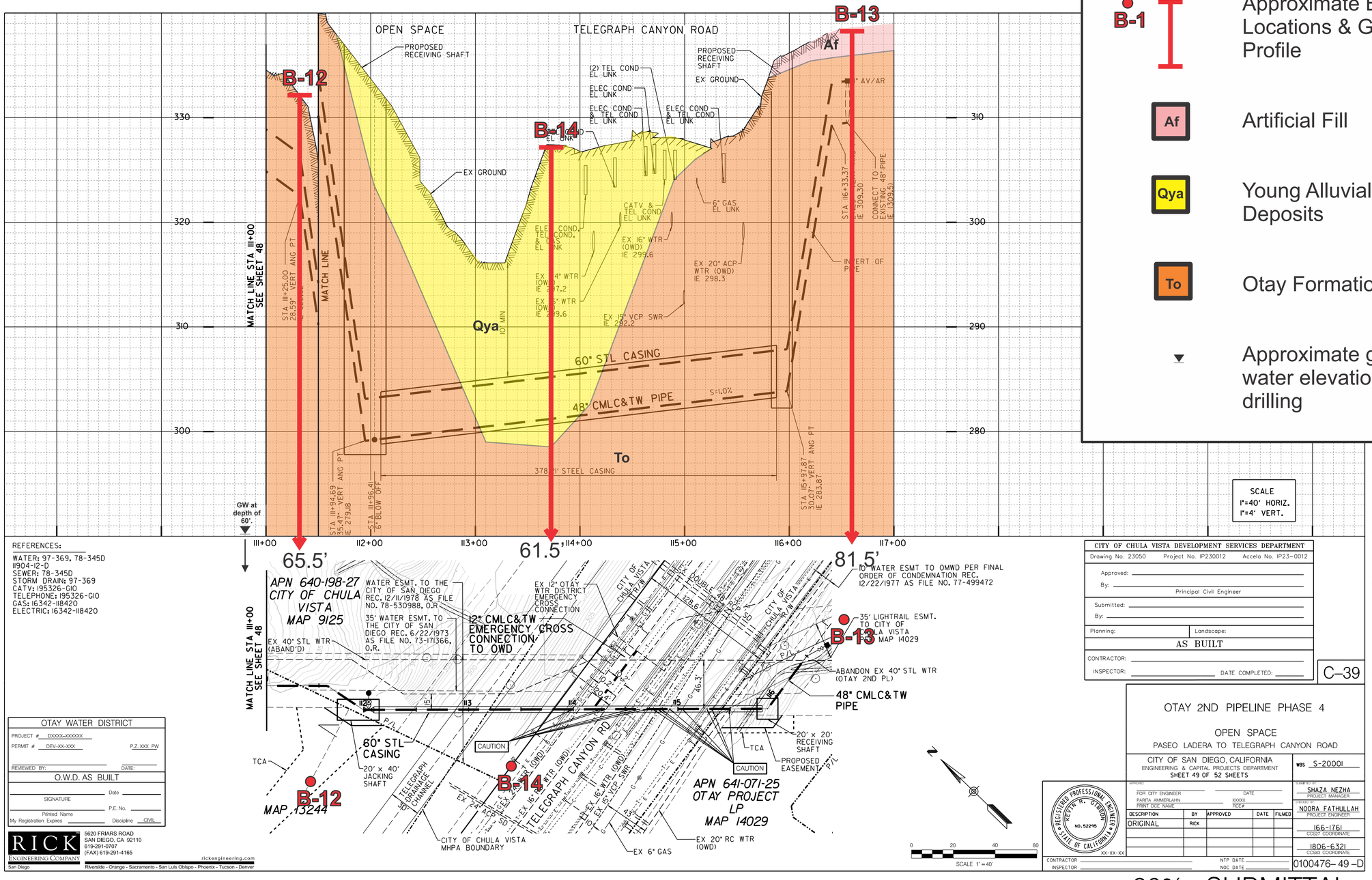
OTAY 2ND PIPELINE PHASE 4

BORING LOCATION MAP - B-11

PROJECT NO.
223 GS-22

ALLIED GEOTECHNICAL ENGINEERS, INC.

FIGURE 11



LEGEND

- B-1 — Approximate Boring Locations & Geologic Profile
- Af — Artificial Fill
- Qya — Young Alluvial Deposits
- To — Otay Formation
- ▼ — Approximate ground water elevation during drilling

OTAY WATER DISTRICT
PROJECT # DXXXX-XXXXXX
PERMIT # DEV-XX-XXX P.Z. XXX PW
REVIEWED BY: DATE:
O.W.D. AS BUILT
SIGNATURE Date
Printed Name P.E. No.
My Registration Expires Discipline CIVIL

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CITY OF CHULA VISTA DEVELOPMENT SERVICES DEPARTMENT
Drawing No. 23050 Project No. IP230012 Accela No. IP23-0012
Approved: By: Principal Civil Engineer
Submitted: By:
Planning: Landscape:
AS BUILT
CONTRACTOR:
INSPECTOR: DATE COMPLETED:

C-39

OTAY 2ND PIPELINE PHASE 4
OPEN SPACE
PASEO LADERA TO TELEGRAPH CANYON ROAD
CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING & CAPITAL PROJECTS DEPARTMENT
SHEET 49 OF 52 SHEETS
WBS S-20001

APPROVED FOR CITY ENGINEER PARITA AMMERLAHN PRINT DCE NAME DATE XXXXX RCE#
SUBMITTED BY SHAZA NEZHA PROJECT MANAGER
CHECKED BY NOORA FATHULLAH PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	RICK			

166-1761 CCS27 COORDINATE
1806-6321 CCS83 COORDINATE
0100476-49-D

REGISTERED PROFESSIONAL ENGINEER KEITH R. GIBSON NO. 52295 STATE OF CALIFORNIA
XX-XX-XX
CONTRACTOR NTP DATE
INSPECTOR NOC DATE

30% SUBMITTAL

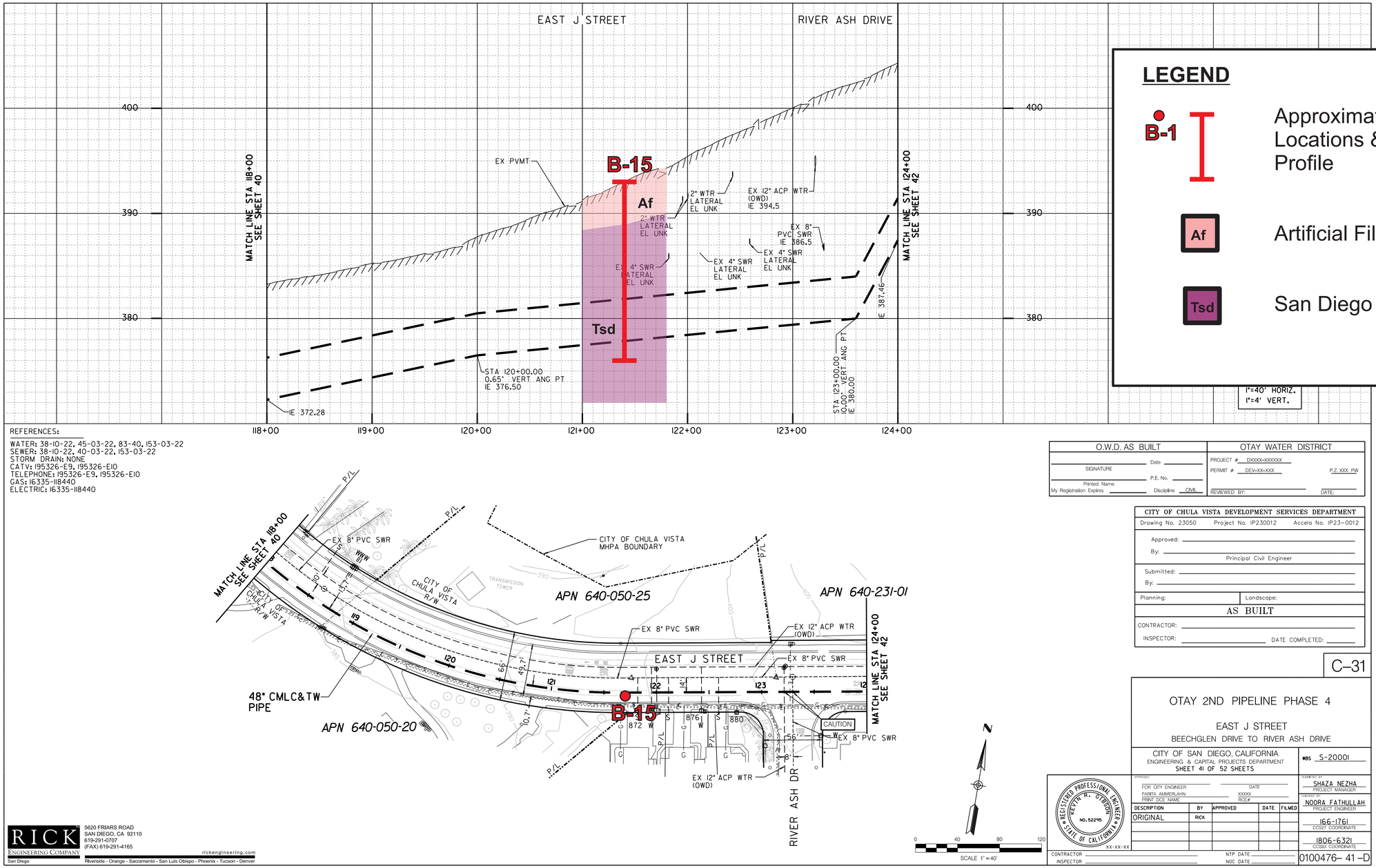
OTAY 2ND PIPELINE PHASE 4

BORING LOCATION MAP - B-12, B-13 & B-14

PROJECT NO. 223 GS-22

ALLIED GEOTECHNICAL ENGINEERS, INC.

FIGURE 12



LEGEND

- B-1 — Approximate Boring Locations & Geologic Profile
- Af — Artificial Fill
- Tsd — San Diego Formation

O.W.D. AS BUILT	OTAY WATER DISTRICT
SIGNATURE — Date	PROJECT # DXXXX-XXXXXX
Printed Name — P.E. No.	PERMIT # DEV-XX-XXX — P.Z. XXX PW
My Registration Expires — Discipline CIVIL	REVIEWED BY: — DATE:

CITY OF CHULA VISTA DEVELOPMENT SERVICES DEPARTMENT

Drawing No. 23050 Project No. IP230012 Accela No. IP23-0012

Approved: _____
By: _____
Principal Civil Engineer

Submitted: _____
By: _____

Planning: | Landscape:

AS BUILT

CONTRACTOR: _____

INSPECTOR: _____ DATE COMPLETED: _____

C-31

EAST J STREET

OTAY 2ND PIPELINE PHASE 4

EAST J STREET
BEECHGLEN DRIVE TO RIVER ASH DRIVE

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING & CAPITAL PROJECTS DEPARTMENT
SHEET 41 OF 52 SHEETS

WBS S-20001

APPROVED: FOR CITY ENGINEER — DATE
PARITA AMMERLAHN — XXXX
PRINT DCE NAME — RCE#

SUBMITTED BY: SHAZA NEZHA, PROJECT MANAGER
DESIGNED BY: NOORA FATHULLAH, PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	RICK			

166-1761 CCS27 COORDINATE
1806-6321 CCS83 COORDINATE
0100476-41-D

CONTRACTOR _____ NTP DATE _____
INSPECTOR _____ NOC DATE _____

REGISTERED PROFESSIONAL ENGINEER — KEVIN R. OTIS — NO. 52295 — STATE OF CALIFORNIA — XX-XX-XX

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OTAY 2ND PIPELINE PHASE 4

BORING LOCATION MAP - B-15

PROJECT NO. 223 GS-22

ALLIED GEOTECHNICAL ENGINEERS, INC.

FIGURE 13

LEGEND

Af	Fill Materials
Qyc	Young Colluvial Deposits
Qya	Young Alluvial Deposits
Qoa	Old Alluvial Deposits
Qvop	Very Old Paralic Deposits
Tsd	San Diego Formation
To	Otay Formation
Tsw	Sweetwater Formation
	Approximate Project Alignment

Faults

Fault - Solid where well defined; dashed where approximately located; short dash where inferred; dotted where concealed; queried where uncertain. Where fault offsets sea floor, age symbol is shown on bar on downthrown side. Where age was determined, age symbol is shown astride fault and relative offset, if known, is shown by "D" and "U" on downthrown and upthrown sides. Ages of faults are indicated as follows:

- cuts strata of Holocene age
- cuts strata of late Quaternary age
- cuts strata of Quaternary age
- cuts Miocene or older strata

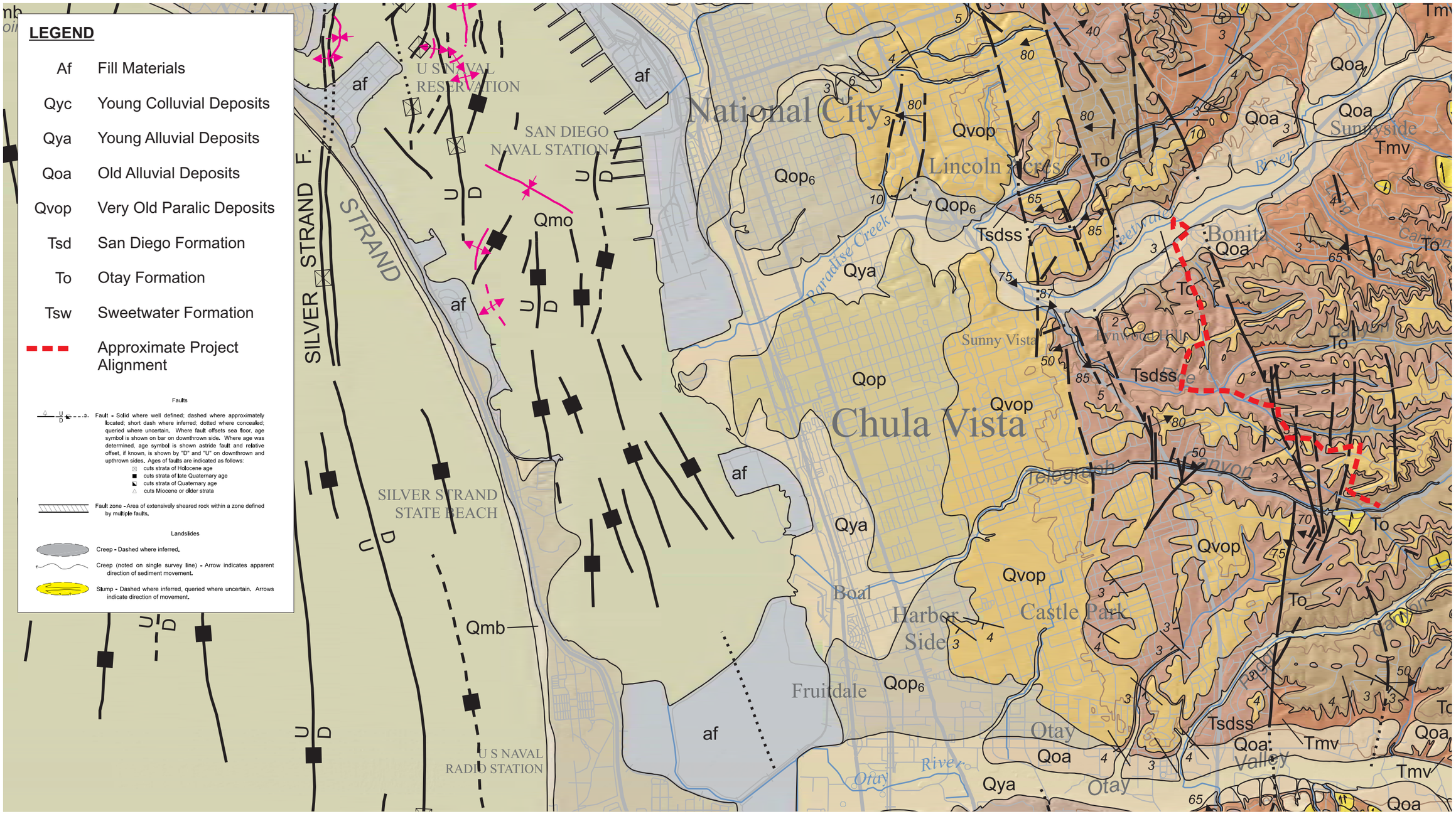
Fault zone - Area of extensively sheared rock within a zone defined by multiple faults.

Landslides

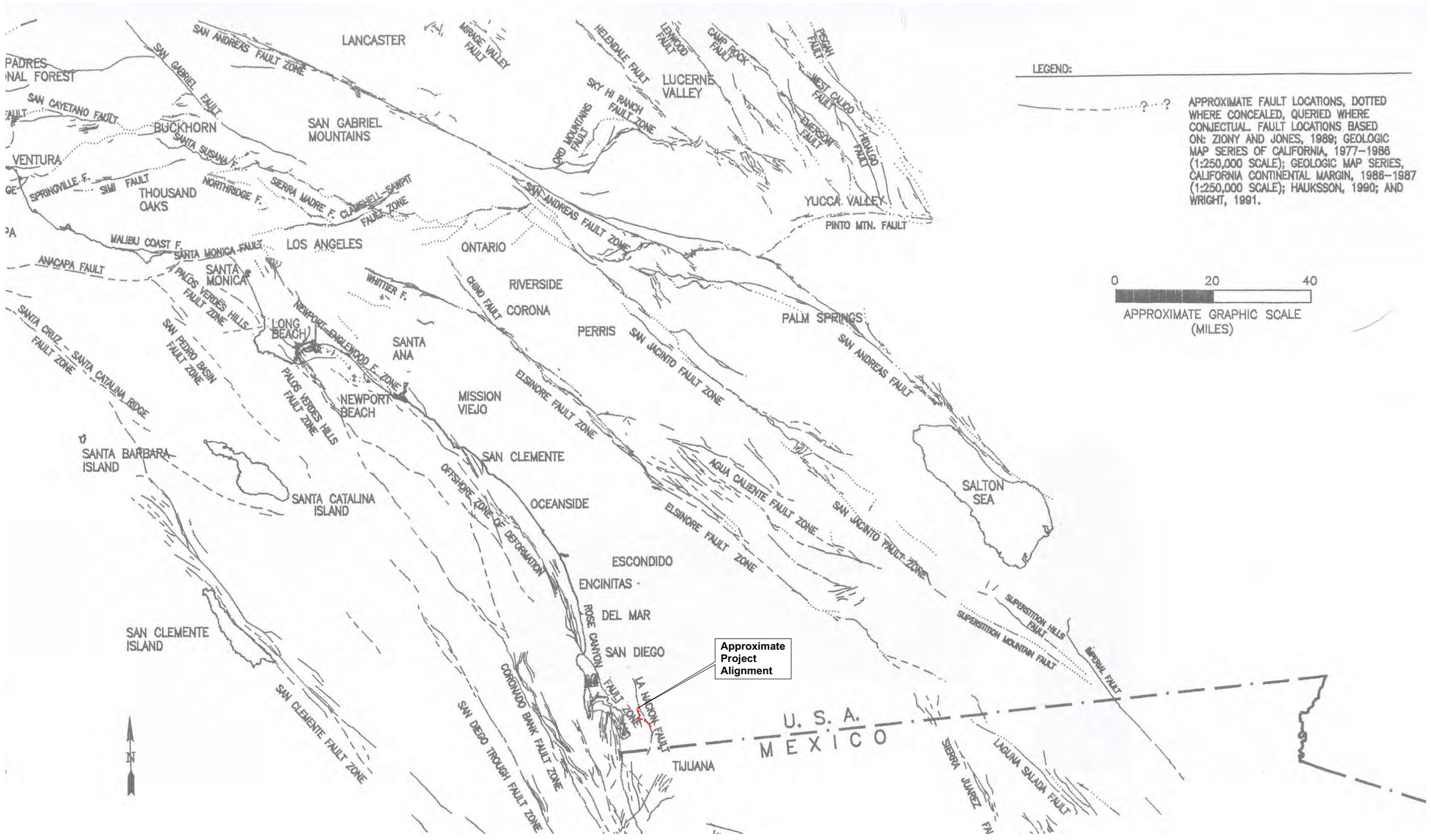
Creep - Dashed where inferred.

Creep (noted on single survey line) - Arrow indicates apparent direction of sediment movement.

Slump - Dashed where inferred, queried where uncertain. Arrows indicate direction of movement.



OTAY 2ND PIPELINE PHASE 4		GENERALIZED GEOLOGIC AND LOCAL FAULT MAP
PROJECT NO. 223 GS-22	ALLIED GEOTECHNICAL ENGINEERS, INC.	FIGURE 14



OTAY 2ND PIPELINE PHASE 4	REGIONAL FAULT MAP
PROJECT NO. 223 GS-22	ALLIED GEOTECHNICAL ENGINEERS, INC. — FIGURE 15

APPENDIX A

FIELD EXPLORATION PROGRAM

APPENDIX A

FIELD EXPLORATION PROGRAM

The field exploration program for this project was performed between February 18, 2023 and January 31, 2024. A total of fifteen (15) soil borings were performed at the approximate locations shown on Figure 1. The more detailed locations and generalized cross sections based on the subsurface conditions encountered in the borings are shown on Figures 2 through 13. The borings were performed using either a Diedrich D120 or CME-75 truck-mounted drill rig equipped with hollow-stem augers and/or 4-inch mud rotary drill rod. An All-Terrain drill rig equipped with hollow-stem augers was utilized for borings performed in open areas. The borings were extended to depths of 13 feet to 81.5 feet below the existing ground surface (bgs).

Prior to commencement of the field exploration activities, several site reconnaissance visits were performed to observe existing conditions and to select suitable locations for the soil borings. Subsequently, Underground Service Alert (USA) was contacted to coordinate clearance of the proposed boring locations with respect to existing buried utilities. The utility clearance effort reveals the presence of the following buried utilities: potable water and sanitary sewer pipelines; storm drains; natural gas and electrical transmission lines; and cable, telephone, and fiber optic lines.

A Right-of Entry permit was obtained from the County of San Diego for a boring performed in Sweetwater Regional Park. We also obtained Right-of Entry permits for borings performed on the Kaiser Permanente and Glen Abbey properties; a construction permit with the City of Chula Vista Public Works Department for borings performed in the City of Chula Vista rights-of-way; and a License Agreement with the City of Chula Vista for borings performed in the Chula Vista Multi-Habitat Planning Area.

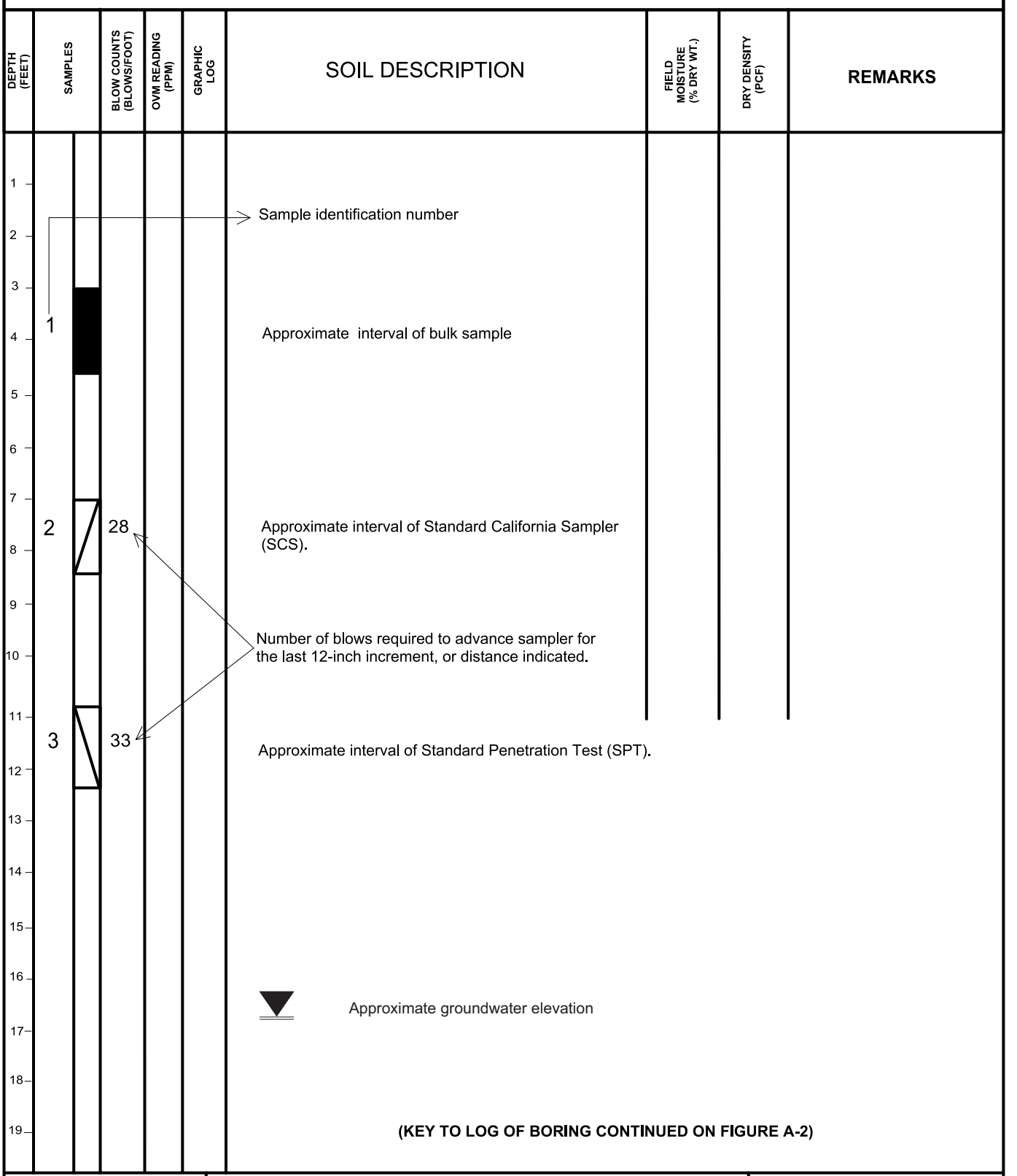
The soils encountered in the soil borings were visually classified and logged by an experienced engineering geologist from AGE. A Key to Logs is presented on Figures A-1 and A-2, and logs of the boring and test pit are presented on Figures A-3 through A-18. The logs depict the various soil types encountered and indicate the depths at which samples were obtained for laboratory testing and analysis.

During drilling, Standard Penetration Tests (SPT) were performed at selected depth intervals. The SPT tests involve the use of a specially manufactured "split spoon" sampler which is driven into the soils at the bottom of the borehole by dropping a 140-pound weight from a height of 30 inches. The number of blows required to penetrate each 6-inch increment was counted and recorded on the field logs, and have been used to evaluate the relative density and consistency of the materials. The blow counts were subsequently corrected for sample type, hammer model, groundwater and surcharge. The corrected blow counts are shown on the boring logs. To prevent damage to the sampling equipment, the drives were terminated at 100 blow. The amount of penetration can be estimate from the length of the sample shown on the logs.

Relatively undisturbed samples were obtained by driving a 3-inch (OD) diameter standard California sampler with a special cutting tip and inside lining of thin brass rings into the soils at the bottom of the borehole. The sampler is driven a distance of 18 inches into the soils at the bottom of the borehole by dropping a 140-pound weight from a height of 30 inches. A 6-inch long section of the soil samples that were retained in the brass rings were extracted from the sampling tube and transported to our laboratory in close-fitting, waterproof containers. The samples were field screened for the presence of volatile organics using a RAE Systems MiniRAE 3000 organic vapor meter (OVM). The OVM readings are indicated on the boring logs. In addition, loose bulk samples were also collected.

Following completion of the drilling and sampling activities, the borings were backfilled with Portland cement grout to approximately 12 inches below the ground surface. Borings performed within paved areas were then repaired using rapid set concrete to match the adjacent pavement surface. Borings performed in dirt areas were capped with native soils.

KEY TO LOG



(KEY TO LOG OF BORING CONTINUED ON FIGURE A-2)

PROJECT NO. 223 GS-22	ALLIED GEOTECHNICAL ENGINEERS, INC.	FIGURE A-1

KEY TO LOG

DEPTH (FEET)	SAMPLES	BLOW COUNTS (BLOWS/FOOT)	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE (% DRY WT.)	DRY DENSITY (PCF)	REMARKS

Symbol Description

Strata symbols

- **Silty sand**
- **Poorly graded sand with silt**
- **Silty gravel and sand**
- **Silt**
- **Low-high plasticity clays**
- **High plasticity clay**
- **Poorly graded clayey silty sand**
- **Low plasticity clay**
- **Poorly graded silty fine sand**
- **Poorly graded gravel and sand**
- **Well graded sand with silt**
- **Clayey sand**

Notes:

1. Boring location was measured from existing features and elevations were extrapolated from the Preliminary Project Plans (Rick Engineering, undated).

2. The logs are subject to the limitations, conclusions, and recommendations presented in the report.

PROJECT NO. 223 GS-22	ALLIED GEOTECHNICAL ENGINEERS, INC.	FIGURE A-2

BORING NO. B-1

DATE OF DRILLING: 01/31/2024 | TOTAL BORING DEPTH: 56.5 FEET

GENERAL LOCATION: TRAIL ON NORTH SIDE OF SWEETWATER RIVER, APPROXIMATELY 100 FEET SOUTHWEST OF WILLOW

APPROXIMATE SURFACE ELEV.: +60 FEET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING, INC.

DRILLING METHOD: 8-INCH HOLLOW STEM AUGER | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
1					**FILL**			
2					Light gray to brownish gray, damp to wet, fine-to medium-grained, Silty Sand (SM).			
3					▼ **YOUNG ALLUVIAL DEPOSITS**			
4								
5								
6	1	6	0.3		Gray to olive gray, wet, medium dense, fine to medium-grained, Poorly Graded sand With Silt (SP SM).	23.2		
7								
8								
9								
10								
11	2	18	0.2			19.7	110.9	
12								
13								
14								
15								
16	3	16	0.1		Traces of scattered fine gravel, 15' to 20'.	18.4		Adding water into hollow stem to prevent sandy alluvium from flowing into auger.
17								
18								
19								
20								
21	4	44	0.1		Olive gray to gray color, soil is dense with trace of sub-rounded gravel up to 1" in maximum dimension.	15.7	115.6	
22								
23	5							
24								
25								
26	6	29	0.1		Medium dense to dense, no gravel observed in sampler.	19.4		
27								
28								
29								
30								
31	7	63	0.1		Soil is dense to very dense.	16.1	115.9	
32								
33								
34								
35								
36	8	20	0.1		Soil is medium dense.	17.2		
37								

PROJECT NO. 223 GS-22

ALLIED GEOTECHNICAL ENGINEERS, INC.

FIGURE A-3-1

BORING NO. B-1

DATE OF DRILLING: 01/31/2024 | TOTAL BORING DEPTH: 56.5 FEET

GENERAL LOCATION: TRAIL ON NORTH SIDE OF SWEETWATER RIVER, APPROXIMATELY 100 FEET SOUTHWEST OF WILLOW

APPROXIMATE SURFACE ELEV.: +60 FEET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING, INC.

DRILLING METHOD: 8-INCH HOLLOW STEM AUGER | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
38–40					Dark gray, wet, medium stiff, fine-grained, micaceous Sandy Silt (ML).			
41	9	41	0.0		Gray, wet, dense, Silty Sand (SM).	21.0	106.4	
45–48	10	35	0.0		Gray to olive gray, wet, dense, fine- to medium-grained, Poorly Graded Sand With Silt (SP SM). -	15.8		
49			?		? ? ?			?
50					**SWEETWATER FORMATION**			
51	11	48	0.0		Pale olive gray to pinkish brown, wet, very stiff to hard, Sandy Clay (CL/CH).	25.4	100.4	
55–56	12	45	0.0		Very stiff, high plasticilty Clay (CH)	38.0		

NOTES

Boring terminated at a depth of 56.5 feet.
Groundwater was encountered at a depth of approximately 3 feet.

PROJECT NO. 223 GS-22	ALLIED GEOTECHNICAL ENGINEERS, INC.	FIGURE A-3-2

BORING NO. B-2A

DATE OF DRILLING: 02/18/2023 | TOTAL BORING DEPTH: 18.5 FEET

GENERAL LOCATION: KAISER PERMANANTE PARKING LOT

APPROXIMATE SURFACE ELEV.: +60 FEET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING, INC.

DRILLING METHOD: 8-INCH HSA/4-INCH MUD ROTARY | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
1					**PAVEMENT SECTIONS**			
2	1				3.5" of A.C. and no base			
3					**FILL**			
4					Yellow brown, damp, Silty Sand (SM) with gravel Intermixed brown, damp, Silty Sand (SM) and Clayey Sand (SC)			
5	2							
6	3	8	0.2		Grayish brown to medium gray, wet, loose, fine to medium grained micaceous Poorly Graded Sand (SP) with Silty Sand (SM)	26.3	93.6	
7								
8								
9								
10								
11	4	13	4.3		Medium gray to dark gray, trace of sub-angular metavolcanic rock fragments up to 0.75" between depth of 12' to 14'.	20.3		
12								
13								
14								
15								
16								
17								
18	5	0	0.2			31.1	96.2	
19					**NOTES**			
20					Boring terminated at depth of 17'. Drill rod dropped 24 inches at depth of 15 feet, indicating possible void within a debris field. Lost all drilling fluid in voids, unable to continue drilling.			
21					On March 3, 2023, we made two additional attempts to drill near B-2. Encountered refusal on concrete and/or large riprap at depths of 11 feet and 12 feet.			
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								

PROJECT NO. 223 GS-22 | ALLIED GEOTECHNICAL ENGINEERS, INC. | FIGURE A-4

BORING NO. B-2B

DATE OF DRILLING: 03/18/2023 | TOTAL BORING DEPTH: 71.5 FEET

GENERAL LOCATION: KAISER PERMANANTE PARKING LOT

APPROXIMATE SURFACE ELEV.: +60 FEET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING

DRILLING METHOD: 8-INCH HSA/4-INCH MUD ROTARY | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
0					**PAVEMENT SECTION**			
1					4" A.C., 14" miscellaneous base.			
2					**FILL**			
3					▼ Yellow brown to grayish brown, damp to wet, Silty Sand (SM) and intermixed Clayey Sand (SC).			
4								
5					Gray, wet, fine to medium-grained, micaceous, Silty Sand (SM).			
6	1	7	0.1			28.1		
7								
8								
9								
10			?		? ?			?
11	2	8	0.0		**YOUNG ALLUVIAL DEPOSITS** Gray, wet, medium dense, medium-grained, micaceous, Poorly Graded Sand with Silt (SP-SM). Soil is uncemented.	16.5	113.1	
12								
13								
14								
15								Switch from 8-inch auger to 4-inch mud rotary drilling.
16	3	7				23.1		
17								
18								
19								
20					Dark grayish brown, wet, stiff, micaceous, Sandy lean Clay (CL).			
21	4	8	0.0			28.0	98.6	
22								
23								
24								
25					Very dark grayish brown, wet, loose/medium stiff, fine-grained, micaceous, Silty Sand/Sandy Silt (SM/ML).			
26	5	8	0.0			25.2		
27								
28								
29								
30					Gray, wet, dense, fine-grained, micaceous, Silty Sand (SM).			
31	6	31	0.0			22.8	103.8	
32								
33								
34								
35					Soil is medium dense, fine to medium-grained.			
36	7	18	0.2			30.4		
37								

PROJECT NO. 223 GS-22

ALLIED GEOTECHNICAL ENGINEERS, INC.

FIGURE A-5-1

BORING NO. B-2B

DATE OF DRILLING: 03/18/2023 | TOTAL BORING DEPTH: 71.5 FEET

GENERAL LOCATION: KAISER PERMANANTE PARKING LOT

APPROXIMATE SURFACE ELEV.: +60 FEET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING

DRILLING METHOD: 8-INCH HSA/4-INCH MUD ROTARY | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
40	8	22	0.1		Dark gray, wet, medium dense, fine to medium-grained, micaceous, Poorly Graded Sand with Silt (SP-SM).	22.8	103.4	
44					Gravelly zone 44'-46'.			
45	9	24	0.3		Fine to coarse sand, with traces of fine, sub-angular and sub-rounded gravel.	19.5		
48					Gravelly zone 48'-54'.			
50	10	55	0.1		Light gray, wet, dense, Well-Graded Sand with Silt (SW-SM). Contains scattered to appreciable sub-angula and sub-rounded gravel up to 3/4 inches in size, and one 2-inch angular gravel clast.	17.6	110.1	
54			?		? ?			?
55					**SWEETWATER FORMATION**			
56	11	31	0.5		Pinkish brown to greenish gray, wet, very stiff, medium to high plasticity Sandy Clay (CL/CH).	22.8		
60	12	120	0.0		Soil becomes very hard.	19.2		
65	13	112	0.0			21.3		
71	14	87	0.0			19.6		

NOTES

Boring terminated at a depth of 71.5 feet.
Groundwater was measured at depth of 4.2 feet.

PROJECT NO. 223 GS-22 | ALLIED GEOTECHNICAL ENGINEERS, INC. | FIGURE A-5-2

BORING NO. B-3

DATE OF DRILLING: 02/18/2023 | TOTAL BORING DEPTH: 16.5 FEET

GENERAL LOCATION: GLEN ABBEY DRIVE

APPROXIMATE SURFACE ELEV.: +133 FEET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING

DRILLING METHOD: 8-INCH HOLLOW STEM AUGER | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
1					**PAVEMENT SECTION**			
2					6' P.C.C., no base.			
3					**FILL**			
4			?		Brown, damp, Silty Sand (SM) and intermixed Clayey Sand (SC), with trace of fine gravel.			?
5					**OLDER ALLUVIAL DEPOSITS**			
6	1	64	0.1		Dark brown to daryk yellow brown, damp, very dense, fine to coarse-grained, Clayey Sand (SC), with minor caliche vein filling.	9.1	126.6	
7	2							
8								
9								
10	3							
11	4	29	0.3		Mottled pale brown to yellow brown with irregular 1/16" to 1/8" wide caliche vein fillings, damp, medium dense, Silty-Clayey Sand (SC-SM).	15.1		
12								
13								
14			?		? ?			?
15					**OTAY FORMATION**			
16	5	55	0.1		Yellow brown to strong brown, damp, hard, Sandy Clay (CL), grading to pale brown, damp, very dense, fine-grained, micaceous, Silty Sand (SM).	22.2	102.6	
17					**NOTES:**			
18								
19					Boring terminated at depth of 16.5 feet.			
20					No seepage or groundwater was encountered at the time of drilling.			
21								
22								
23								
24								
25								
26								
27								
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PROJECT NO. 223 GS-22

ALLIED GEOTECHNICAL ENGINEERS, INC.

FIGURE A-6

BORING NO. B-4

DATE OF DRILLING: 06/02/2023 | TOTAL BORING DEPTH: 16.5 FEET

GENERAL LOCATION: APPROXIMATELY 230 FEET SOUTHEAST OF GATE ON THE HILL ROAD AND 30 FEET WEST OF CITY

APPROXIMATE SURFACE ELEV.: +295 FEET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING

DRILLING METHOD: 8-INCH HOLLOW STEM AUGER | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
1					**FILL**			
2					Pale yellow brown, dry to damp, fine-grained, Silty Sand (SM).			
3					**SAN DIEGO FORMATION**			
5	1	100+	0.0		Light gray to light greenish gray with reddish orange oxide stains, dry to damp, very dense, fine-grained, weak to moderately cemented, Silty Sandstone (SM).	9.7	92.5	
7	2							
8	3							
10	4	40	0.0		Pale yellow, damp, dense/very stiff, Silty Sand/Sandy Silt (SM/ML).	7.4		
15	5	100+	0.0		Soil is very dense/hard, locally strongly cemented.	8.7	104.0	

NOTES

Boring terminated at a depth of 16.6 feet.
No groundwater or seepage was encountered during the drilling operations.

PROJECT NO. 223 GS-22

ALLIED GEOTECHNICAL ENGINEERS, INC.

FIGURE A-7

BORING NO. B-5

DATE OF DRILLING: 04/24/2023 | TOTAL BORING DEPTH: 16.5 FEET

GENERAL LOCATION: DIRT ACCESS ROAD APPROXIMATELY 60 FEET NORTH OF TERRA NOVA DRIVE

APPROXIMATE SURFACE ELEV.: +375 FEET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING

DRILLING METHOD: 8-INCH HOLLOW STEM AUGER | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
1					12” of gravel road base.			
2					**FILL**			
3					Brown, damp, Silty Sand (SM), with some sub-angular gravel up to 1" in maximum dimension.			
4			?		? ?			?
5					**VERY OLD PARALIC DEPOSITS**			
6	1 2	50	0.1		Yellow brown to pale reddish yellow, damp, very dense, fine- to medium-grained, Silty Sand (SM) with trace of sub-rounded and sub-angular gravel up to 1" in size.	7.3		
7								
8			?		? ?			?
9					**SAN DIEGO FORMATION**			
10	3	100+	0.0		Pale yellow, damp, very dense, fine- to medium-grained, locally coarse-grained, Silty Sandstone (SM). Weakly cemented and friable.	5.9	102.1	
11	4							
12	4							
13								
14								
15								
16	5	69	0.0		Decrease in fines. Soil contains some sub-rounded gravel up to 1" in size.	6.9		
17					**NOTES**			
18					Boring terminated at a depth of 16.5 feet.			
19					No groundwater or seepage was encountered during the drilling operations.			
20								
21								
22								
23								
24								
25								
26								
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PROJECT NO. 223 GS-22 | ALLIED GEOTECHNICAL ENGINEERS, INC. | FIGURE A-8

BORING NO. B-6

DATE OF DRILLING: 11/30/2023 | TOTAL BORING DEPTH: 16.5 FEET

GENERAL LOCATION: WEST SIDE OF TERRA NOVA DRIVE, APPROXIMATELY 65 FEET SOUTH OF KILEY STREET

APPROXIMATE SURFACE ELEV.: +222 FEET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING

DRILLING METHOD: 8-INCH HOLLOW STEM AUGER | LOGGED BY: MLM

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
					PAVEMENT SECTION			
1					5" A.C., 4" miscellaneous base.			
2					**FILL**			
3								
4			?		Light brown and light gray, damp, fine-grained Silty Sand (SM), with trace of sub-rounded gravel. Thin banding from individual fill lifts observed in soil. The fill was derived from the San Diego Formation, and appears to be well-compacted.			?
5								
6	1	53				14.2	106.5	
7					**SAN DIEGO FORMATION**			
8								
9					Light brown to light gray with iron oxide staining, damp, dense to very dense, fine-grained, slightly micaceous, Silty Sandstone (SM).			
10								
11	2	21			Pale olive to olive color, sandstone is medium dense.	12.3		
12								
13								
14								
15								
16	3	46			light olive gray color, sandstone is dense.	9.7	99.1	
17					**NOTES**			
18								
19					Boring terminated at a depth of 16.5 feet.			
20					No groundwater or seepage was encountered during the drilling operations.			
21								
22								
23								
24								
25								
26								
27								
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PROJECT NO. 223 GS-22 | ALLIED GEOTECHNICAL ENGINEERS, INC. | FIGURE A-9

BORING NO. B-7

DATE OF DRILLING: 10/11/2023 | TOTAL BORING DEPTH: 31.5 FEET

GENERAL LOCATION: RIGHT WESTBOUND LANE OF EAST H STREET, APPROXIMATELY 640 FEET WEST OF DEL REY BLVD.

APPROXIMATE SURFACE ELEV.: +194 FEET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING

DRILLING METHOD: 8-INCH HOLLOW STEM AUGER | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
0–1					**PAVEMENT SECTION** 8" A.C., 10" miscellaneous base.			
2–6	1	27	0.3		**FILL** Pale greenish gray to pale olive with reddish yellow oxide staining, damp, fine-grained, Silty Sand/Sandy Silt (SM/ML). Fill appears to be derived from San Diego Formation.	19.2		
7–11	2 3	32	0.2		Pale olive yellow to olive, damp, fine-grained Silty Sand (SM), with intermixed chunks of bluish gray, reddish yellow and light gray, cemented, Silty sand (SM).	19.9	114.6	
12–16	4	14	0.4		Dark olive gray to very dark grayish brown, damp to wet, Silty-Clayey Sand (SC-SM). Contains trace small chunks of caliche.	15.8		
17–21	5 6	16	0.1		Brown and grayish brown, wet, fine- to medium-grained, Silty Sand (SM), with trace of sub-rounded gravel up to 3/4 inches in maximum dimension.	16.9	106.7	
22–26	7	17	0.7			19.9		
27–28			?		? ?			?
29–31	8	31	0.0		**YOUNG ALLUVIAL DEPOSITS** Dark grayish brown, wet, fine- to medium-grained, Silty-Clayey Sand (SC-SM). ? ?	17.3	113.6	?
32–35					**SAN DIEGO FORMATION** Yellow brown, wet, medium dense, fine- to coarse grained, Well-Graded Sand With Silt (SW-SM). At approximately 31-feet, soil grades to pale brown, damp, dense, fine-grained, micaceous, Silty Sand (SM) with narrow caliche-filled veins.			
36–37					**NOTES** Boring terminated at a depth of 31.5 feet. Groundwater measured at a depth of 13.8 feet.			

PROJECT NO. 223 GS-22 | ALLIED GEOTECHNICAL ENGINEERS, INC. | FIGURE A-10

BORING NO. B-8

DATE OF DRILLING: 10/23/2023 | TOTAL BORING DEPTH: 16.5 FEET

GENERAL LOCATION: WEST SIDE OF PASEO LADERA, APPROXIMATELY 90 FEET SOUTH OF BLACKWOOD ROAD

APPROXIMATE SURFACE ELEV.: +408 FEET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING

DRILLING METHOD: 8-INCH HOLLOW STEM AUGER | LOGGED BY: SS

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
1					**PAVEMENT SECTION**			
2			?		5" A.C., 7" miscellaneous base.			?
3	1				**FILL** Reddish brown to orange, micaceous, Silty Sand (SM).			
4					**SAN DIEGO FORMATION**			
5								
6	2	38			Reddish brown to orange, damp, dense, fine- to medium-grained, micaceous, Silty Sand (SM). Weakly cemented.	10.1	106.2	
7								
8								
9								
10								
11	3	41				11.4		
12					Concreted layer 12-feet to 13 feet.			
13								
14								
15								
16	4	35			Gray to light gray, damp, very stiff to hard, micaceous, Sandy Silt (ML).	17.1		
17					**NOTES**			
18					Boring terminated at a depth of 16.5 feet.			
19					No groundwater or seepage was encountered during the drilling operations.			
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								

PROJECT NO. 223 GS-22

ALLIED GEOTECHNICAL ENGINEERS, INC.

FIGURE A-11

BORING NO. B-10

DATE OF DRILLING: 10/23/2023 | TOTAL BORING DEPTH: 13 FEET

GENERAL LOCATION: SOUTH SIDE OF EAST J STREET, APPROXIMATELY 100 FEET EAST OF PASEO DEL REY

APPROXIMATE SURFACE ELEV.: +365 FEET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING

DRILLING METHOD: 8-INCH HOLLOW STEM AUGER | LOGGED BY: SS

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
1					**PAVEMENT SECTION**			
2			?		4" A.C., 8" miscellaneous base.			?
3	1				**FILL** Reddish brown, dry to damp, Silty Sand (SM).			
4					**SAN DIEGO FORMATION**			
5								
6	2	43			Light gray, dry to damp, dense, Silty-Clayey Sand (SC-SM). Pale olive to gray, damp, dense, fine-grained, micaceous, Silty Sand (SM). Soil is weakly cemented and friable.	8.9	90.7	
7								
8								
9								
10								
11	3	52			Yellowish brown to light gray, very dense with narrow caliche vein fillings and trace of gravel. Weak to moderately cemented.	14.5		
12								
13								

NOTES

Refusal on gravel/cobbles at a depth of 13 feet.
No groundwater or seepage was encountered during the drilling operations.

PROJECT NO. 223 GS-22	ALLIED GEOTECHNICAL ENGINEERS, INC.	FIGURE A-12

BORING NO. B-9

DATE OF DRILLING: 11/30/2023 | TOTAL BORING DEPTH: 16.5 FEET

GENERAL LOCATION: RIGHT TURN POCKET ON SOUTH SIDE OF EAST H STREET, APPROXIMATELY 185 FEET WEST OF PASEO

APPROXIMATE SURFACE ELEV.: +297 FEET MSL | DRILLING CONTRACTOR: TR-COUNTY DRILLING

DRILLING METHOD: 8-INCH HOLLOW STEM AUGER | LOGGED BY: MLM

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
1					**PAVEMENT SECTION** 13" A.C., 9" cement-treated base.			
2					**FILL**			
6	1	69			Light gray, damp, fine-grained Silty Sand (SM) with trace of gravel. Fill derived from San Diego Formation, and appears to be well-compacted.	13.1	103.9	
8	2							
11	3	33				10.1		
15			?		? ?			?
16	4	44			**SAN DIEGO FORMATION** Light gray to light brown with iron oxide staining, damp, dense, Fine-grained, Silty Sandstone (SM).	9.6		

NOTES

Boring terminated at a depth of 16.5 feet.
No groundwater or seepage was encountered during the drilling operations.

PROJECT NO. 223 GS-22	ALLIED GEOTECHNICAL ENGINEERS, INC.	FIGURE A-13

BORING NO. B-11

DATE OF DRILLING: 01/30/2024 | TOTAL BORING DEPTH: 16.5 FEET

GENERAL LOCATION: ALONG TRAIL APPROXIMATELY 15 FEET SOUTH OF OTAY 2ND PIPELINE, 310 FEET SOUTHEAST OF PASEO

APPROXIMATE SURFACE ELEV.: +375 FEET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING, INC.

DRILLING METHOD: 8-INCH HOLLOW STEM AUGER | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
1					**SLOPEWASH DEPOSITS**			
2					Brown to yellow brown, damp, Silty Sand (SM) with some organic matter and roots.			
3					**OTAY FORMATION**			
5	1	36	0.0		Pale olive, damp, hard, Clay (CL/CH) with abundant interlayered caliche and caliche pore fillings.	28.1	74.8	
8	2							
10	3	56	0.0		Light brownish gray to pale olive, damp, hard, Clay (CL/CH), with caliche vein and pore fillings.	16.0		
12	4							
15	5	100+	0.1		Mottled strong brown, red, and reddish yellow, damp, hard, high plasticity Clay (CH). Clay exhibits a waxy texture.	25.9	99.0	

NOTES

Boring terminated at a depth of 16.5 feet.
No groundwater or seepage was encountered during the drilling operations.

PROJECT NO. 223 GS-22 | ALLIED GEOTECHNICAL ENGINEERS, INC. | FIGURE A-14

BORING NO. B-12

DATE OF DRILLING: 01/30/2024 | TOTAL BORING DEPTH: 65.5 FEET

GENERAL LOCATION: ACCESS ROAD, APPROX. 50 FEET WEST OF EXISTING PIPELINE AND 175 FEET NORTH OF TELEGRAPH CYN.

APPROXIMATE SURFACE ELEV.: 325 FEET MSL | DRILLING CONTRACTOR: TRI-CONTY DRILLING

DRILLING METHOD: 8-INCH HOLLOW STEM AUGER | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
0–2					**FILL** Light brown, damp, Sandy Clay (CL).			
2–5					**OTAY FORMATION**			
5–6	1	100+	0.0		White to pale brown, dry to damp, fine- to medium-grained, Clayey Sand (SC) with caliche pore fillings.	4.2	100.9	
6–10	2							
10–11	3	57	0.0		Light brownish gray, damp, very dense, Clayey Sand (SC).	15.2		
11–13								
13–14					Brown, damp, very stiff , medium to high plasticity Clay (CL/CH).			
14–15								
15–16	4	100+	0.0		Light brownish gray, damp, very dense, Clayey Sand (SC).	12.2	90.8	
16–17	5							
17–20								
20–21	6	100+	0.0		Pale brown to grayish brown, damp, very dense, fine- to coarse-grained, Clayey Sand (SC).	9.0		Driller adding water to assist in bringing cuttings to surface.
21–25								
25–26	7	100+	0.0		Pale brown to brownish yellow, damp, very dense, fine- to coarse-grained, Silty Sand (SM).	11.4		
26–30								
30–31	8	100+	0.0		Yellow brown to reddish brown color, soil is weakly cemented and friable.	10.6		
31–35								
35–36	9	100+	0.0		Pale brown, damp, very dense, fine- to locally coarse-grained, Clayey Sand (SC), with caliche vein and pore infillings.	8.4		
36–37								

PROJECT NO. 223 GS-22

ALLIED GEOTECHNICAL ENGINEERS, INC.

FIGURE A-15

BORING NO. B-12

DATE OF DRILLING: 01/30/2024 | TOTAL BORING DEPTH: 65.5 FEET

GENERAL LOCATION: ACCESS ROAD, APPROX. 50 FEET WEST OF EXISTING PIPELINE AND 175 FEET NORTH OF TELEGRAPH CYN.

APPROXIMATE SURFACE ELEV.: 325 FEET MSL | DRILLING CONTRACTOR: TRI-CONTY DRILLING

DRILLING METHOD: 8-INCH HOLLOW STEM AUGER | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
40	10	100+	0.0			9.7		
45	11	100+	0.0		Similar to above, with trace of sub-rounded gravel up to 1/2" in maximum dimension.	11.5		
50	12	100+	0.0		Brown to olive brown, damp, hard, Sandy Claystone (CL/CH).	19.5		
55	13	100+	0.0		Brown to olive brown, damp, very dense, fine- to coarse-grained, Clayey Sand (SC).	14.2		
60	14	100+	0.0		▼ Brown, wet, very dense, fine- to coarse-grained, Well-Graded Sand With Silt (SW-SM).	12.7	119.5	Sample saturated, below groundwater table. 2-feet of sand flowed into hollow-stem auger after sampler was pulled.
65	15	100+	0.0		Brown to brownish yellow, wet, very dense, fine- to coarse-grained, Silty-Clayey Sand (SC-SM).	13.2		

NOTES

Boring terminated at a depth of 65.5 feet.
Groundwater depth was measured at depth of 60 feet.

PROJECT NO. 223 GS-22	ALLIED GEOTECHNICAL ENGINEERS, INC.	FIGURE A-15-2

BORING NO. B-13

DATE OF DRILLING: 06/26/2023 | TOTAL BORING DEPTH: 81.5 FEET

GENERAL LOCATION: ACCESS ROAD, APPROX. 1,650 FEET EAST OF PASEO LADERO AND 60 FEET SOUTH OF TELEGRAPH CYN.

APPROXIMATE SURFACE ELEV.: +323 FEET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING

DRILLING METHOD: 8-INCH HSA/4-INCH MUD ROTARY | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
0–4					**FILL** Pale yellow, damp, fine- to coarse-grained, Silty Sand (SM).			Begin drilling using 8-inch hollow stem auger
5–6	1	100+	0.0		**OTAY FORMATION** Light gray to pale brown, damp, very dense, fine- to coarse-grained, Silty Sand (SM).	11.6	106.0	
7–8	2							
10	3	100+						No sample recovery
13–14	4							
15	5	100+	0.0			7.9		Disturbed sample. Switch to 4-inch mud rotary.
20–21	6	100+			Pale brown to light yellow brown, damp, very dense, fine- to medium-grained, Silty Sand (SM). Trace of coarse sand.	15.4		
25–26	7	100+	0.0		Similar, sample also contains trace amounts of fine, sub-angular gravel.	8.3	125.5	
30–31	8	100+			Light yellow brown, damp, very dense, fine- to medium-grained, Silty-Clayey sand (SC-SM), trace of coarse sand.	14.6		
35	9	100+	0.1		Brown to light brown, damp, hard, Claystone (CL/CH). very high cohesion.	15.0	119.1	

PROJECT NO. 223 GS-22

ALLIED GEOTECHNICAL ENGINEERS, INC.

FIGURE A-16-1

BORING NO. B-13

DATE OF DRILLING: 06/26/2023 | TOTAL BORING DEPTH: 81.5

GENERAL LOCATION: ACCESS ROAD, APPROX. 1,650 FEET EAST OF PASEO LADERO AND 60 FEET SOUTH OF TELEGRAPH CYN.

APPROXIMATE SURFACE ELEV.: +323 FEET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING

DRILLING METHOD: 8-INCH HSA/4-INCH MUD ROTARY | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
40	10	100+	0.0		Brown to light yellow brown, damp, very dense, fine- to medium-grained with trace of coarse sand and fine gravel, Silty Sand (SM).	14.4		
45	11	100+	0.0		Pale brown to light yellow brown, damp, hard, medium to high plasticity Claystone (CL/CH). Very high cohesion.	17.5	113.3	
50	12	96	0.1			18.7		
55	13	100+	0.1		Pale brown, damp, very dense, fine- to coarse-grained with trace of fine sub-angular gravel, Silty Sand (SM). Few fines, soil is weakly cemented.	15.2	115.3	
60	14	100+	0.0		Mottled brown, pinkish gray and grayish brown, damp, very dense, fine- to coarse-grained with trace of fine gravel, Silty-Clayey sand (SC-SM).	15.1		
65	15	100+	0.1		Pinkish brown to pale greenish gray, damp, very dense, fine- to coarse-grained with trace of sub- angular/sub-rounded gravel up to 1.5" in maximum dimension, Silty Sand (SM).	12.3	119.4	
70	16	100+	0.1		Pinkish gray and light greenish gray, damp, hard, Claystone (CL/CH). Very high cohesion.	18.1		

PROJECT NO. 223 GS-22

ALLIED GEOTECHNICAL ENGINEERS, INC.

FIGURE A-16-2

BORING NO. B-13

DATE OF DRILLING: 06/26/2023 | TOTAL BORING DEPTH: 81.5 FEET

GENERAL LOCATION: ACCESS ROAD, APPROX. 1,650 FEET EAST OF PASEO LADERO AND 60 FEET SOUTH OF TELEGRAPH CYN.

APPROXIMATE SURFACE ELEV.: +323 FEET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING

DRILLING METHOD: 8-INCH HSA/4-INCH MUD ROTARY | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
75	17	100+	0.1		Pinkish gray to light brown color.	19.7	106.9	
76								
77								
78								
79								
80								
81	18	78	0.0			19.9		
82								

NOTES

Boring terminated at a depth of 81.5 feet.
No groundwater or seepage was encountered during drilling.

PROJECT NO. 223 GS-22 | ALLIED GEOTECHNICAL ENGINEERS, INC. | FIGURE A-16-3

BORING NO. B-14

DATE OF DRILLING: 10/12/2023 | TOTAL BORING DEPTH: 61.5 FEET

GENERAL LOCATION: LANDSCAPE AREA 20 FEET NORTH OF TELEGRAPH CYN ROAD AND 1,300 FEET EAST OF PASEO LADERA

APPROXIMATE SURFACE ELEV.: +308 FET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING

DRILLING METHOD: 8-INCH HSA/4-INCH MUD ROTARY | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
1–3					**FILL** brown to dark grown, damp, Clayey Sand (SC).			Begin soil boring using 8-inch hollow stem auger.
4–9	1, 2, 3	4	0.5		**YOUNG ALLUVIAL DEPOSITS** Pale brown to grayish brown, damp to wet, loose, fine-grained, Silty-Clayey Sand (SC-SM), with trace of caliche cement.	18.4		
10–14	4	13	0.1		Pale brown to brown, damp to wet, medium dense, fine- to medium-grained, Silty Sand (SM). Appreciable fines, with caliche vein fillings and 1/8-1/4-inch nodules.	22.2	92.2	At 10-feet, switch to 4 inch mud rotary drilling.
15–19	5	6	0.3		Brown to dark grayish brown, wet, medium stiff, Sandy Clay (CL), becoming dark brown at 16-feet. Sample contains caliche vein fillings and nodules.	24.1		
20–24	6	33	0.6		Pale brown to grayish brown with local black oxide staining, wet, medium dense to dense, fine-coarse-grained Silty-Clayey Sand (SC-SM). Soil grades to a Sandy Clay (CL).	17.0	115.0	
25–27	7	17	0.6		Light brown to brown, wet, stiff, Sandy Clay (CL). Contains 1/8-inch caliche nodules and vein fillings.	20.6		
28			?		? ?			?
29–34	8	100+	0.7		**OTAY FORMATION** Light yellow brown, damp, very dense, fine to coarse-grained, Silty Sand (SM). Moderately cemented.	12.5	123.5	
35–37	9	96	0.8		Light yellow brown, damp, hard, low plasticity, Sandy Silt (ML).	18.5		

PROJECT NO. 223 GS-22

ALLIED GEOTECHNICAL ENGINEERS, INC.

FIGURE A-17-1

BORING NO. B-14

DATE OF DRILLING: 10/12/2023 | TOTAL BORING DEPTH: 61.5 FEET

GENERAL LOCATION: LANDSCAPE AREA 20 FEET NORTH OF TELEGRAPH CYN ROAD AND 1,300 FEET EAST OF PASEO LADERA

APPROXIMATE SURFACE ELEV.: +308 FET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING

DRILLING METHOD: 8-INCH HSA/4-INCH MUD ROTARY | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
40	10	62	0.5		Light brown to brown, damp, hard, Sandy Claystone (CL).	22.8		
44					Gravelly layer 44 feet to 45 feet.			
45	11	100+	0.3		Light yellow brown, damp, very dense, fine- to coarse-grained, Silty-Clayey Sand sand (SC-SM). Soil is weak to moderately cemented, with vertical 1/16 to 1/8-inch wide, caliche vein filling.	15.2	119.6	
50	12	100+	0.8			13.0		
53					Gravelly layer 53 feet to 54 feet.			
55	13	100+	0.2		Pinkish gray to pale greenish gray, damp, hard, high-plasticity Clay (CL/CH). Soil displays a waxy texture.	19.1	110.7	
60	14	43	0.2		Soil is damp to wet.	23.1		

NOTES

Boring terminated at a depth of 61.5 feet.
No groundwater or seepage was encountered during drilling.

PROJECT NO. 223 GS-22	ALLIED GEOTECHNICAL ENGINEERS, INC.	FIGURE A-17-2

BORING NO. B-15

DATE OF DRILLING: 10/11/2023 | TOTAL BORING DEPTH: 16.5 FEET

GENERAL LOCATION: SOUTH SIDE OF EAST J STREET, APPROXIMATELY 165 FEET WEST OF RIVER ASH DRIVE

APPROXIMATE SURFACE ELEV.: +395 FEET MSL | DRILLING CONTRACTOR: TRI-COUNTY DRILLING

DRILLING METHOD: 8-INCH HOLLOW STEM AUGER | LOGGED BY: NEB

DEPTH (FEET)	SAMPLES	BLOW COUNTS BLOWS/FOOT	OVM READING (PPM)	GRAPHIC LOG	SOIL DESCRIPTION	FIELD MOISTURE % DRY WT.	DRY DENSITY LBS./CU. FT.	REMARKS
					PAVEMENT SECTION			
1					5.5" A.C., 5' miscellaneous base.			
2					**FILL**			
3					Reddish yellow to yellow brown, damp, fine- to medium-grained, Silty Sand (SM), with a few sub-rounded and sub-angular 1-inch to 2-inch gravel clasts.			
4			?					?
5					**SAN DIEGO FORMATION**			
6	1	100+				12.3	101.8	
7	2				Light gray, pale olive to pale greenish gray, damp, very dense, fine-grained, micaceous, Silty Sand (SM), with some narrow caliche vein fillings. Soil is weak to moderately cemented, with some local strongly cemented zones encountered during drilling.			
8	3							
9								
10					Light gray to pale olive yellow color, soil is medium dense.			
11	4	25				8.4		
12								
13								
14								
15					Whitish gray to light olive gray color, soil is medium dense to dense.			
16	5	30				10.9		
17					**NOTES**			
18					Boring terminated at a depth of 16.5 feet.			
19					No groundwater or seepage was encountered during the drilling operations.			
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								

PROJECT NO. 223 GS-22

ALLIED GEOTECHNICAL ENGINEERS, INC.

FIGURE A-18

APPENDIX B

LABORATORY TESTING

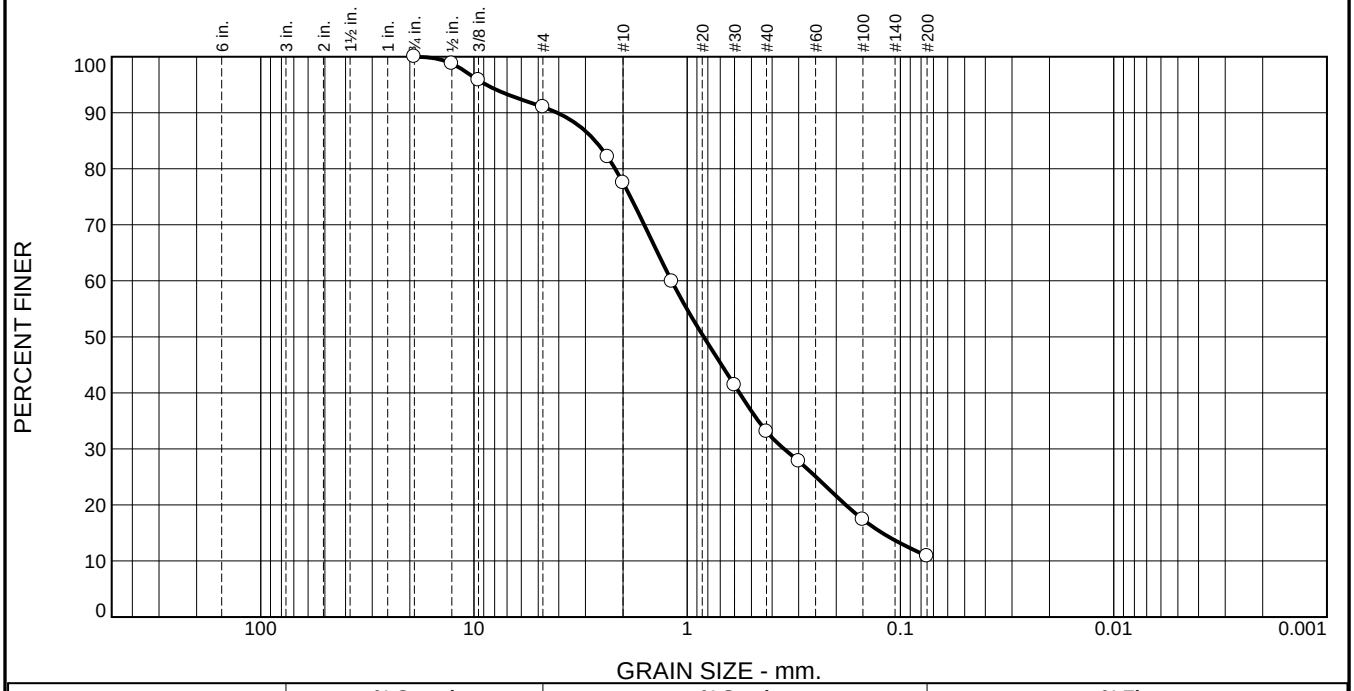
APPENDIX B

LABORATORY TESTING

Selected soil samples were tested in the laboratory to verify visual field classifications and to evaluate certain engineering characteristics. The testing was performed in accordance with the American Society for Testing and Materials (ASTM) or other generally accepted test methods, and included the following:

- Determination of in-place moisture content (ASTM D2216). The final test results are presented on the boring logs;
- Determination of in-place dry density and moisture content (ASTM D2937) based on relatively undisturbed drive samples. The final test results are presented on the boring logs;
- Sieve analyses (ASTM D422). The final test results are plotted as gradation curves on Figures B-1 thorough B-18;
- Maximum density and optimum moisture content (ASTM D1557). The final test results are presented on Figures B-19 through B-25; and
- Direct shear test (ASTM D3080). The test results are presented on Figures B-26 thru B-37.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	9.0	13.5	44.4	22.2	10.9	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.75	100.0		
0.5	98.8		
0.375	95.8		
#4	91.0		
#8	82.1		
#10	77.5		
#16	59.9		
#30	41.4		
#40	33.1		
#50	27.8		
#100	17.4		
#200	10.9		

* (no specification provided)

Material Description

Olive gray to gray, Poorly Graded Sand With Silt

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=**

Coefficients

D_{90}= 4.0761 D_{85}= 2.7027 D_{60}= 1.1842
D_{50}= 0.8371 D_{30}= 0.3516 D_{15}= 0.1217
D_{10}= C_u= C_c=

Remarks

Date Received: 1/31/2024 **Date Tested:** 2/8/2024

Tested By: NEB

Checked By:

Title:

Source of Sample: B-1 **Depth:** 35
Sample Number: 8

Date Sampled: 1/31/2024

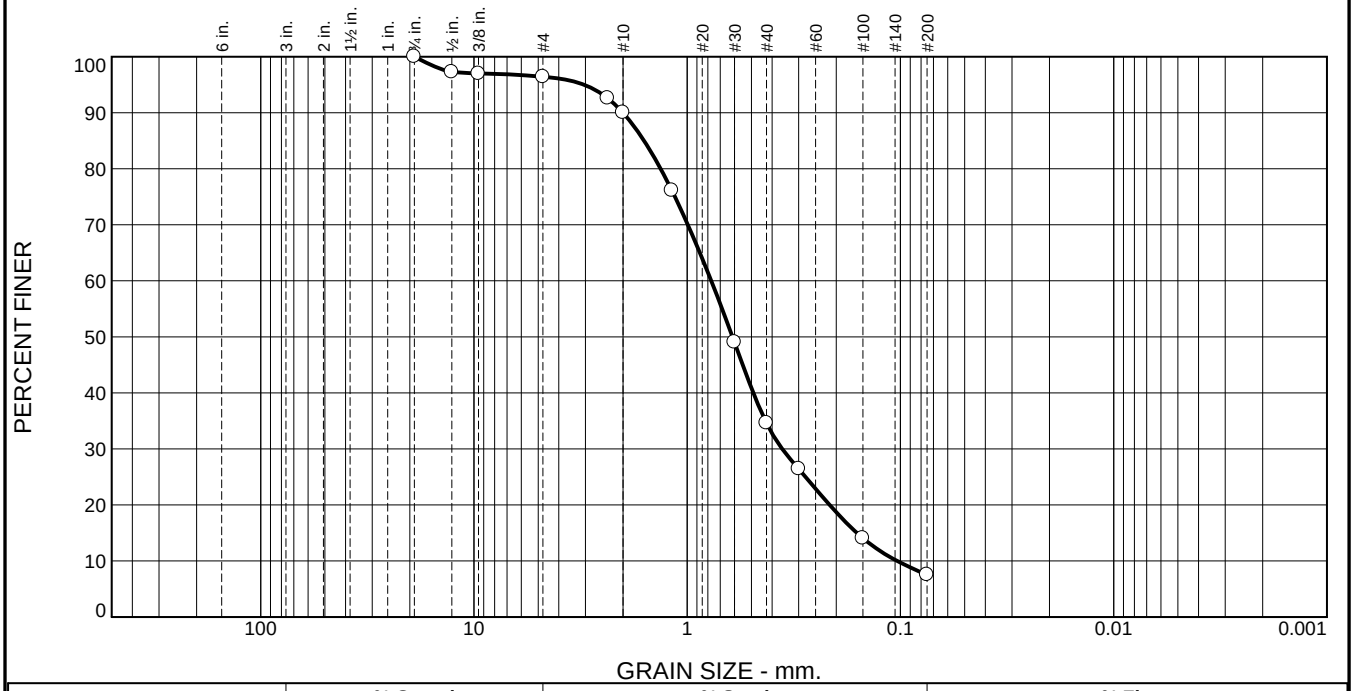
Allied Geotechnical Engineers, Inc.

Santee, CA

Client: RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.6	6.4	55.4	27.1	7.5	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.75	100.0		
0.5	97.3		
0.375	97.0		
#4	96.4		
#8	92.6		
#10	90.0		
#16	76.1		
#30	49.0		
#40	34.6		
#50	26.4		
#100	14.1		
#200	7.5		

* (no specification provided)

Material Description

Gray to olive gray, wet, Poorly Graded Sand With Silt

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=**

Coefficients

D_{90}= 1.9995 D_{85}= 1.5933 D_{60}= 0.7716
D_{50}= 0.6132 D_{30}= 0.3585 D_{15}= 0.1601
D_{10}= 0.1035 C_u= 7.46 C_c= 1.61

Remarks

Date Received: 1/31/2024 **Date Tested:** 2/7/2024

Tested By: NEB

Checked By:

Title:

Source of Sample: B-1 **Depth:** 45
Sample Number: 10

Date Sampled: 1/31/2024

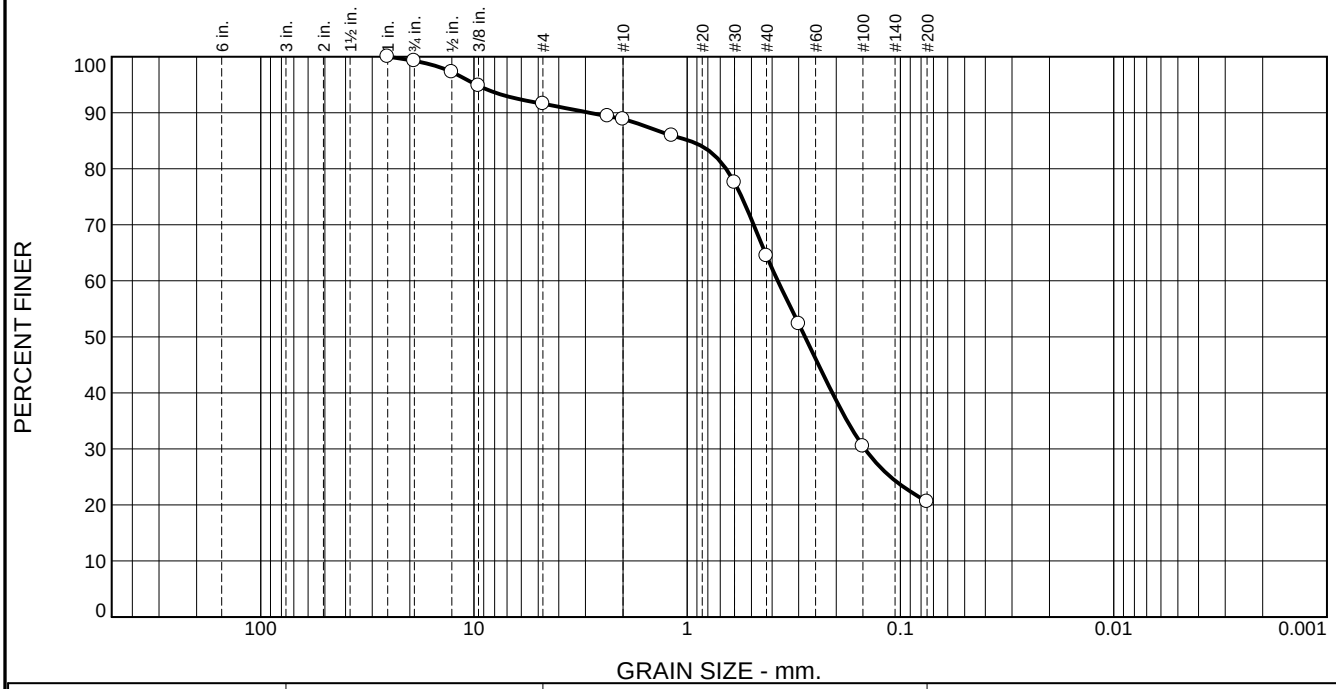
Allied Geotechnical Engineers, Inc.

Santee, CA

Client: RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.7	7.7	2.8	24.3	43.9	20.6	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1	100.0		
.75	99.3		
0.5	97.3		
0.375	94.8		
#4	91.6		
#8	89.4		
#10	88.8		
#16	85.9		
#30	77.6		
#40	64.5		
#50	52.3		
#100	30.5		
#200	20.6		

* (no specification provided)

Material Description

Yellow brown, fine- to medium-grained, Silty Sand

Atterberg Limits (ASTM D 4318)

PL= 2023 **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 2.8733 D_{85}= 0.9764 D_{60}= 0.3763
D_{50}= 0.2801 D_{30}= 0.1468 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 2/18 **Date Tested:** 2/28/2023

Tested By: NEB

Checked By:

Title:

Source of Sample: B-2A **Depth:** 1' **Date Sampled:** 2/18/2023

Allied Geotechnical Engineers, Inc.

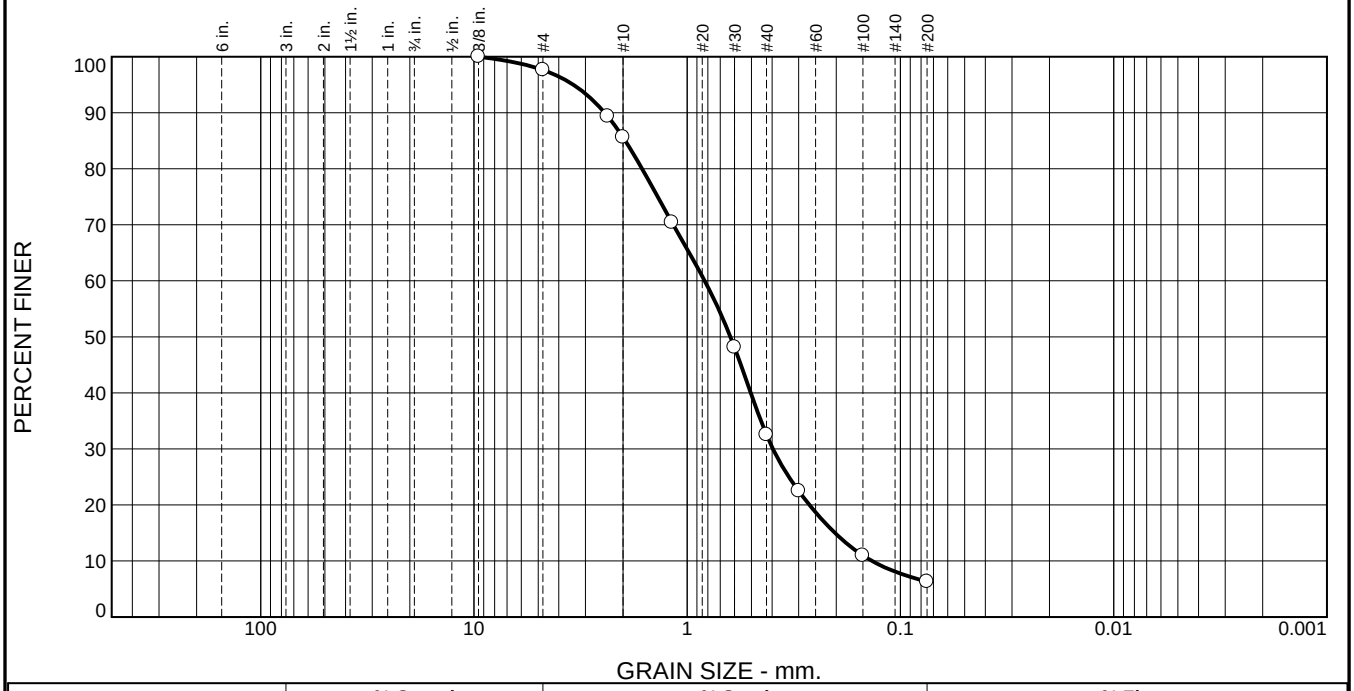
Santee, CA

Client: RICK ENGINEERING COMPANY

Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.4	12.0	53.1	26.2	6.3	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.375	100.0		
#4	97.6		
#8	89.4		
#10	85.6		
#16	70.4		
#30	48.1		
#40	32.5		
#50	22.5		
#100	11.0		
#200	6.3		

* (no specification provided)

Material Description

Gray, fine- to medium-grained, micaceous, Poorly Graded Sand with Silt.

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=**

Coefficients

D_{90}= 2.4368 D_{85}= 1.9519 D_{60}= 0.8283
D_{50}= 0.6270 D_{30}= 0.3966 D_{15}= 0.2028
D_{10}= 0.1360 C_u= 6.09 C_c= 1.40

Remarks

Date Received: 3/18/2023 **Date Tested:** 3/28/2023

Tested By: NEB

Checked By:

Title:

Source of Sample: B-2B **Depth:** 10'
Sample Number: 2

Date Sampled: 3/18/2023

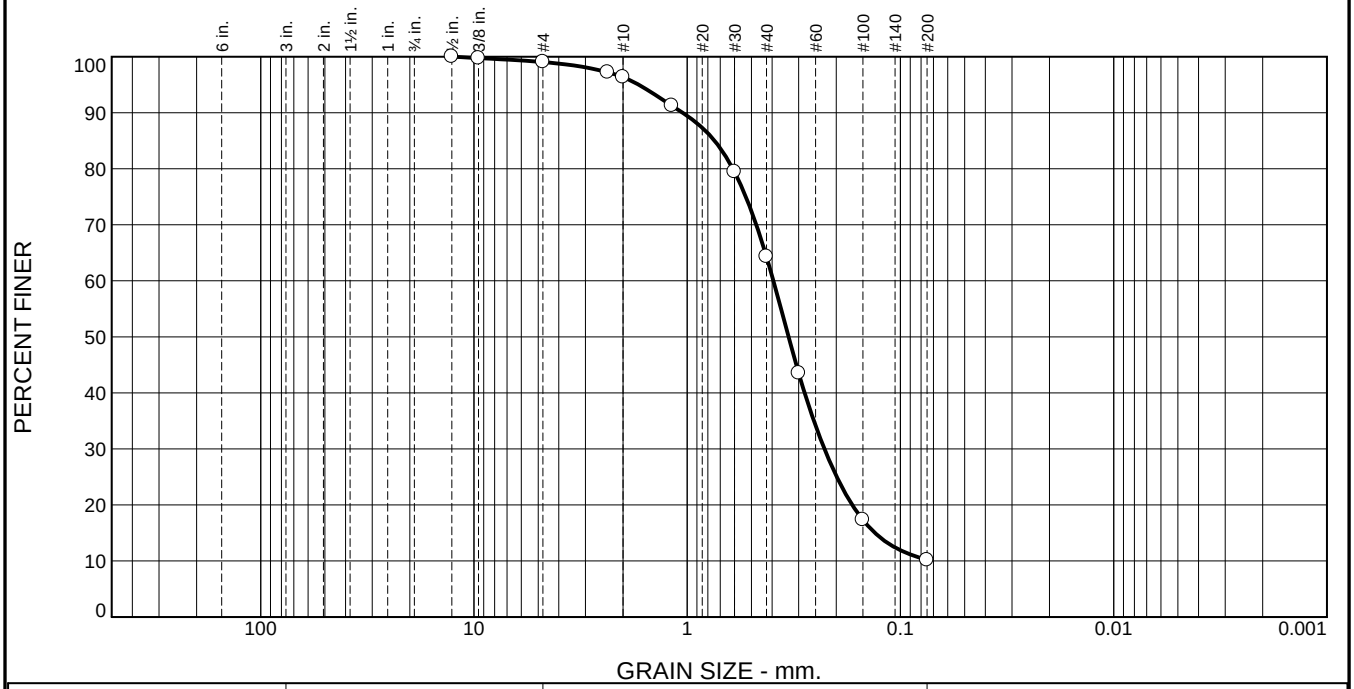
Allied Geotechnical Engineers, Inc.

Santee, CA

Client: RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.0	2.6	32.1	54.1	10.2	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.5	100.0		
0.375	99.7		
#4	99.0		
#8	97.2		
#10	96.4		
#16	91.2		
#30	79.4		
#40	64.3		
#50	43.5		
#100	17.3		
#200	10.2		

* (no specification provided)

Material Description

Dark gray, fine- to medium-grained, micaceous, Poorly Graded Sand with Silt

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=**

Coefficients

D_{90}= 1.0510 D_{85}= 0.7441 D_{60}= 0.3943
D_{50}= 0.3347 D_{30}= 0.2273 D_{15}= 0.1318
D_{10}= C_u= C_c=

Remarks

Date Received: 3/18/2023 **Date Tested:** 3/28/2023

Tested By: NEB

Checked By:

Title:

Source of Sample: B-2B **Depth:** 40'
Sample Number: 8

Date Sampled: 3/18/2023

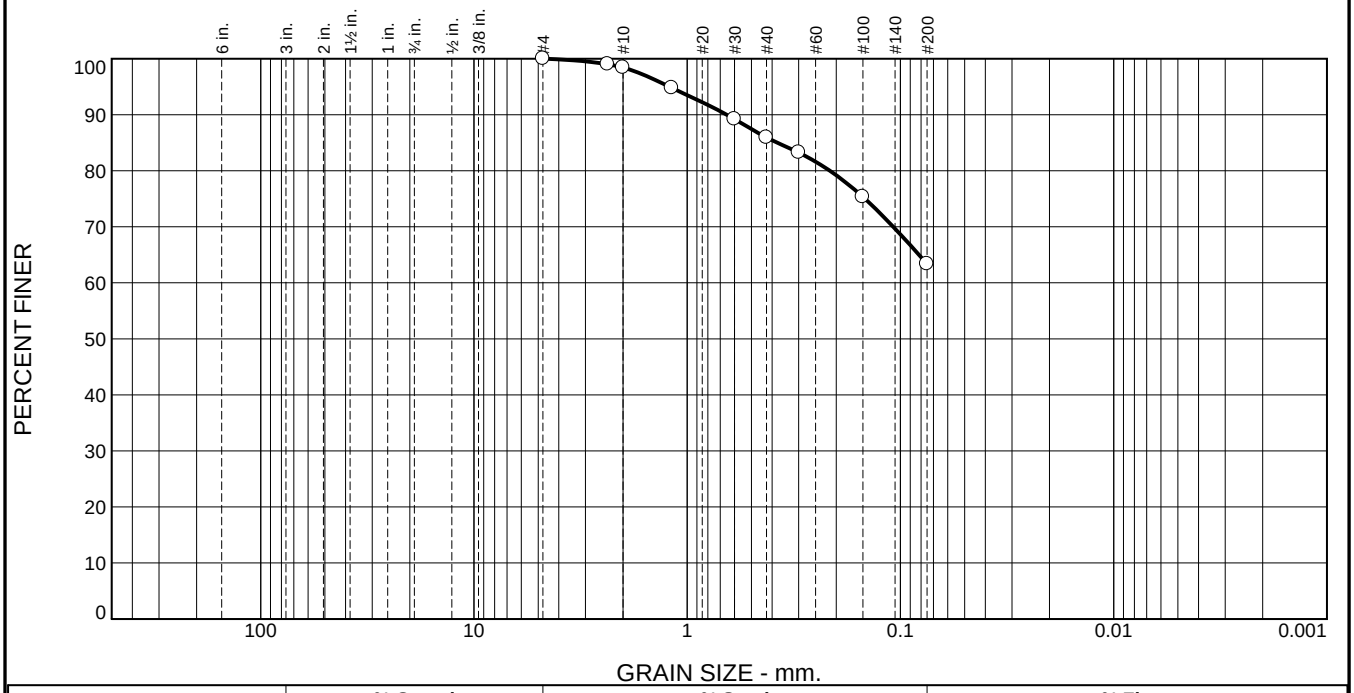
Allied Geotechnical Engineers, Inc.

Santee, CA

Client: RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-5

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.6	12.5	22.5	63.4	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#8	99.0		
#10	98.4		
#16	94.8		
#30	89.2		
#40	85.9		
#50	83.2		
#100	75.3		
#200	63.4		

* (no specification provided)

Material Description

Pinkish brown to greenish gray, wet, very stiff, medium to high plasticity Sandy Clay (CL/CH).

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= CL-CH **AASHTO (M 145)=**

Coefficients

D_{90}= 0.6530 D_{85}= 0.3779 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: _____ **Date Tested:** _____

Tested By: _____

Checked By: _____

Title: _____

Source of Sample: B-2B **Depth:** 55'
Sample Number: 11

Date Sampled:

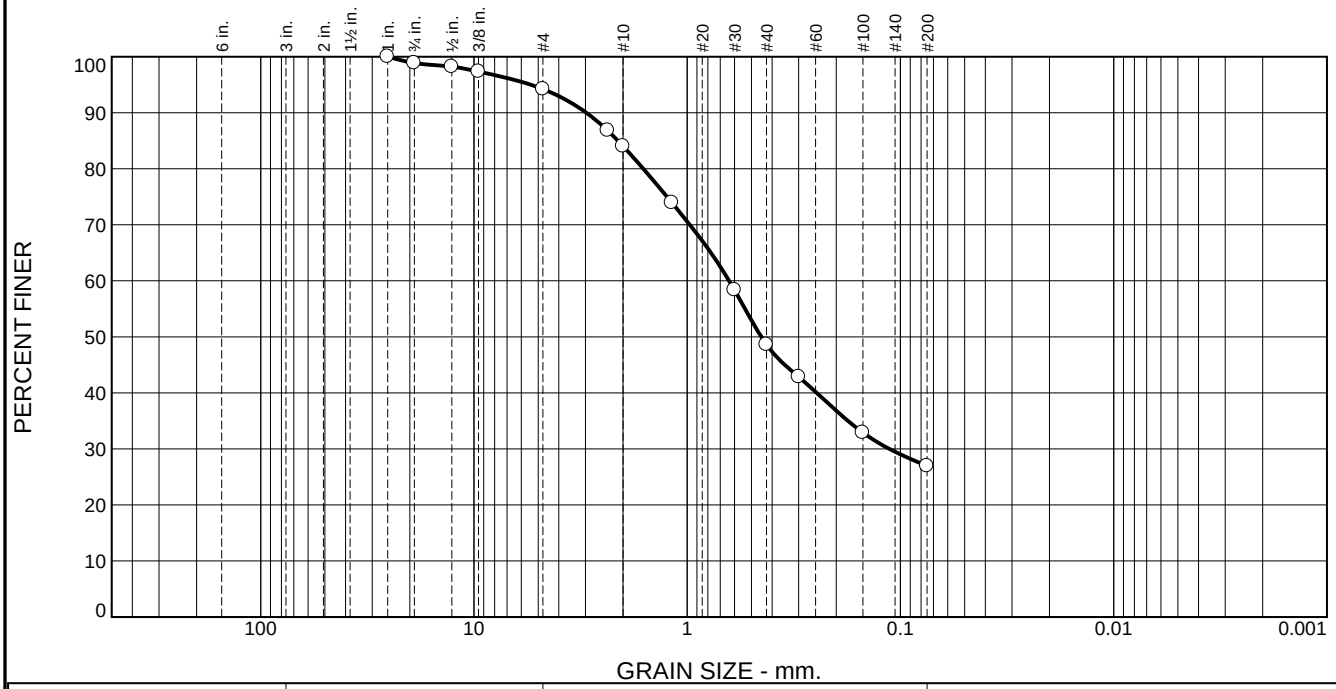
Allied Geotechnical Engineers, Inc.

Santee, CA

Client: RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-6

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.1	4.7	10.2	35.4	21.6	27.0	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1	100.0		
.75	98.9		
0.5	98.2		
0.375	97.3		
#4	94.2		
#8	86.8		
#10	84.0		
#16	73.9		
#30	58.4		
#40	48.6		
#50	42.9		
#100	32.9		
#200	27.0		

* (no specification provided)

Material Description

Yellow brown to pale reddish yellow, fine- to coarse-grained, Silty Sand.

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 2.9738 D_{85}= 2.1130 D_{60}= 0.6357
D_{50}= 0.4498 D_{30}= 0.1127 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 4/24/2023 **Date Tested:** 6/8/2023

Tested By: NEB

Checked By:

Title:

Source of Sample: B-5 **Depth:** 5'
Sample Number: 1

Date Sampled: 4/24/2023

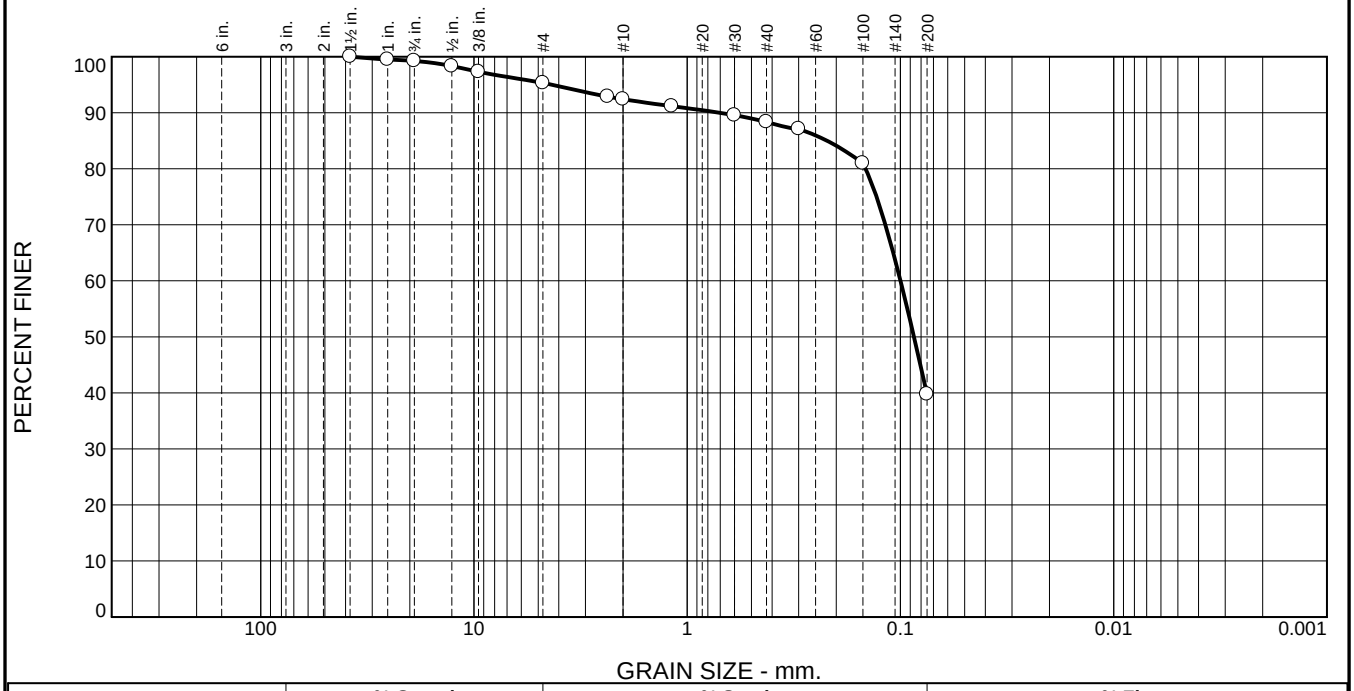
Allied Geotechnical Engineers, Inc.

Santee, CA

Client: RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-7

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.8	3.9	2.9	4.1	48.6	39.7	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1	99.5		
.75	99.2		
0.5	98.3		
0.375	97.3		
#4	95.3		
#8	92.9		
#10	92.4		
#16	91.2		
#30	89.6		
#40	88.3		
#50	87.1		
#100	81.0		
#200	39.7		

* (no specification provided)

Material Description

Pale olive yellow to olive,fine-grained Silty Sand, with intermixed chunks of bluish gray, reddish yellow and light gray Silty sand

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 0.7074 D_{85}= 0.2210 D_{60}= 0.0999
D_{50}= 0.0864 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 10/11/2023 **Date Tested:** 11/15/2023

Tested By: NEB

Checked By:

Title:

Source of Sample: B-7 **Depth:** 6
Sample Number: 2

Date Sampled: 10/11/2023

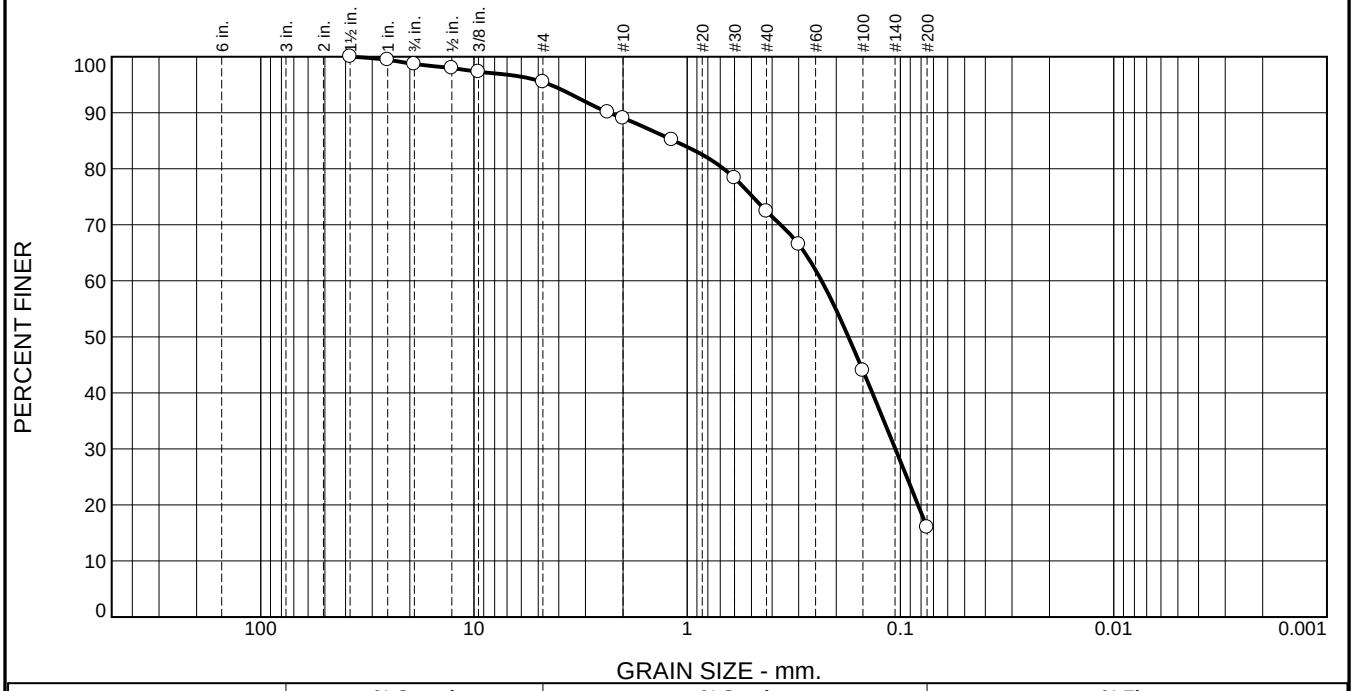
Allied Geotechnical Engineers, Inc.

Santee, CA

Client: RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-8

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.3	3.2	6.5	16.6	56.4	16.0	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1	99.4		
.75	98.7		
0.5	98.0		
0.375	97.3		
#4	95.5		
#8	90.1		
#10	89.0		
#16	85.2		
#30	78.4		
#40	72.4		
#50	66.5		
#100	44.0		
#200	16.0		

* (no specification provided)

Material Description

Reddish brown to orange, fine to medium-grained, micaceous, Silty Sand (SM).

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 2.3282 D_{85}= 1.1550 D_{60}= 0.2343
D_{50}= 0.1754 D_{30}= 0.1056 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 10/22/2023 **Date Tested:** 11/23/2023

Tested By: NEB

Checked By:

Title:

Source of Sample: B-8 **Depth:** 1
Sample Number: 1

Date Sampled: 10/22/2023

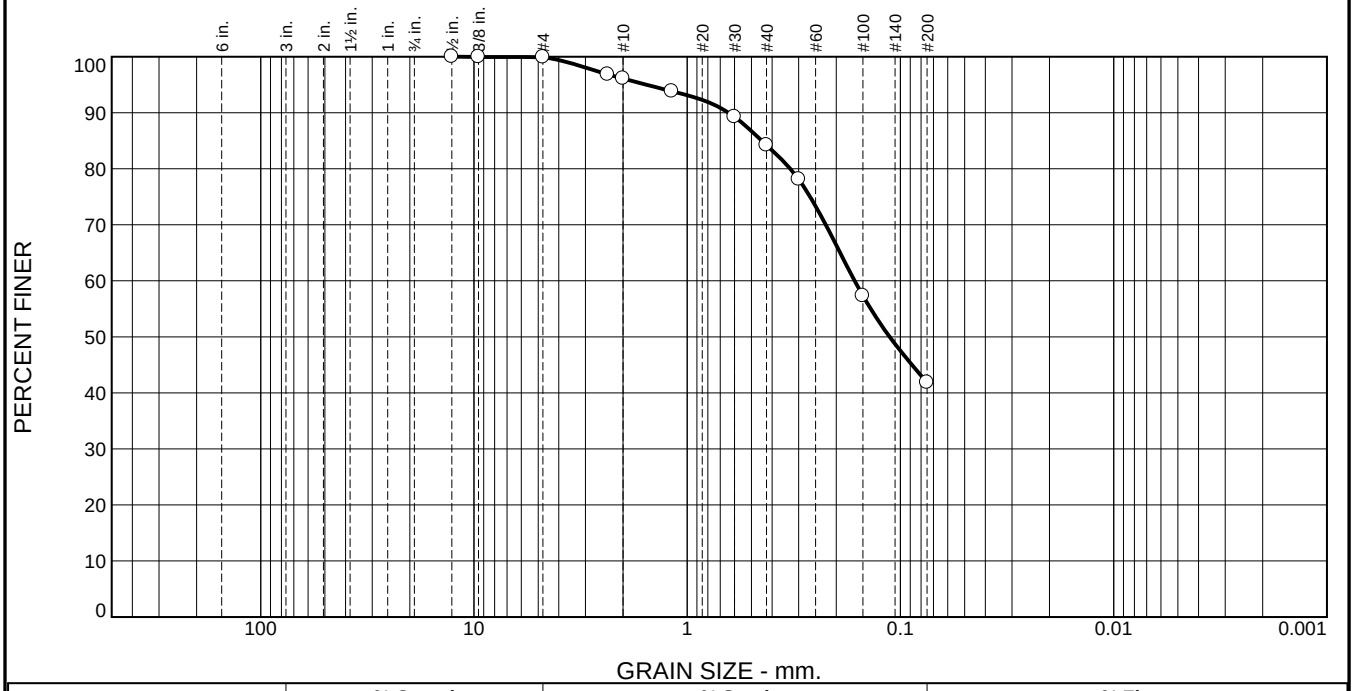
Allied Geotechnical Engineers, Inc.

Santee, CA

Client: RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-9

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	3.8	11.9	42.4	41.8	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.5	100.0		
0.375	100.0		
#4	99.9		
#8	96.8		
#10	96.1		
#16	93.8		
#30	89.3		
#40	84.2		
#50	78.1		
#100	57.3		
#200	41.8		

* (no specification provided)

Material Description

Pale olive, Clayey Sand with caliche

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SC **AASHTO (M 145)=**

Coefficients

D_{90}= 0.6399 D_{85}= 0.4471 D_{60}= 0.1640
D_{50}= 0.1123 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1/30/2024 **Date Tested:** 2/7/2024

Tested By: NEB

Checked By:

Title:

Source of Sample: B-11 **Depth:** 7
Sample Number: 2

Date Sampled: 1/30/2024

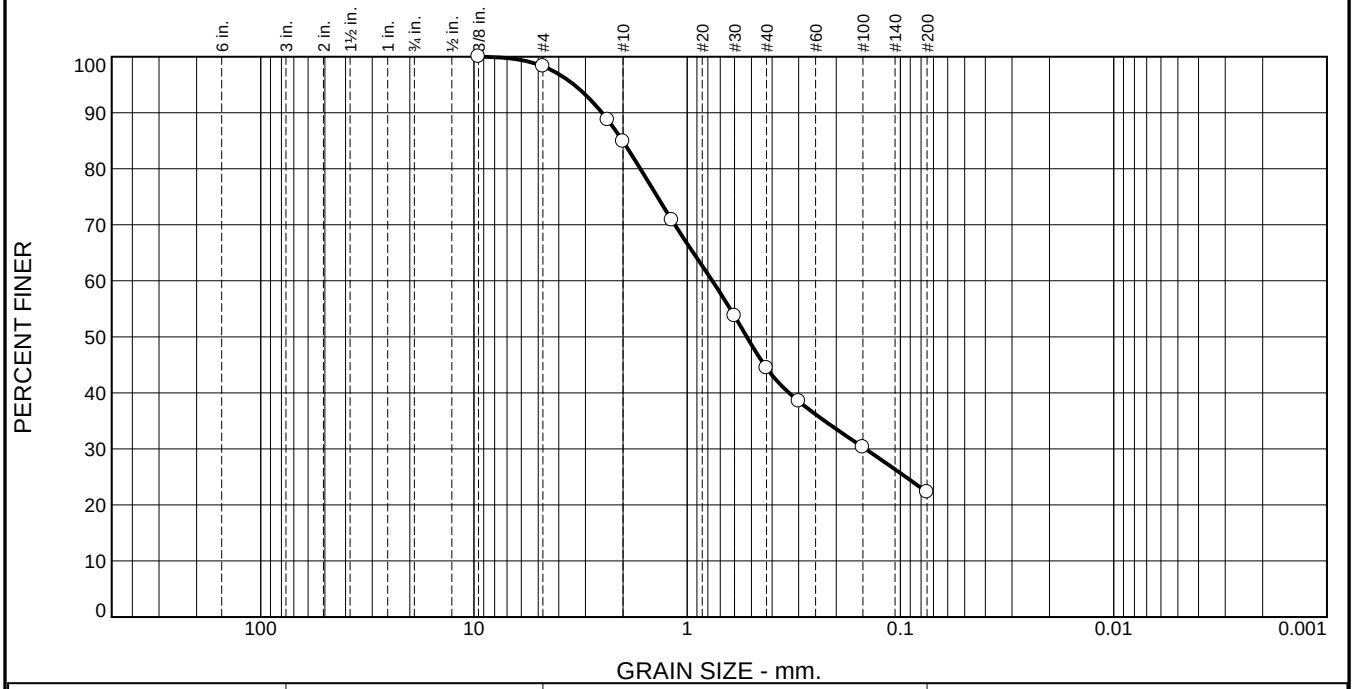
Allied Geotechnical Engineers, Inc.

Santee, CA

Client: RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-10

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.7	13.4	40.5	22.1	22.3	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.375	100.0		
#4	98.3		
#8	88.7		
#10	84.9		
#16	70.8		
#30	53.7		
#40	44.4		
#50	38.5		
#100	30.3		
#200	22.3		

* (no specification provided)

Material Description

Brown to brownish yellow, Silty-Clayey Sand

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SC-SM **AASHTO (M 145)=**

Coefficients

D_{90}= 2.5072 D_{85}= 2.0096 D_{60}= 0.7630
D_{50}= 0.5256 D_{30}= 0.1459 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1/30/2024 **Date Tested:** 2/8/2024

Tested By: NEB

Checked By:

Title:

Source of Sample: B-12 **Depth:** 65.5 **Date Sampled:** 1/30/2024

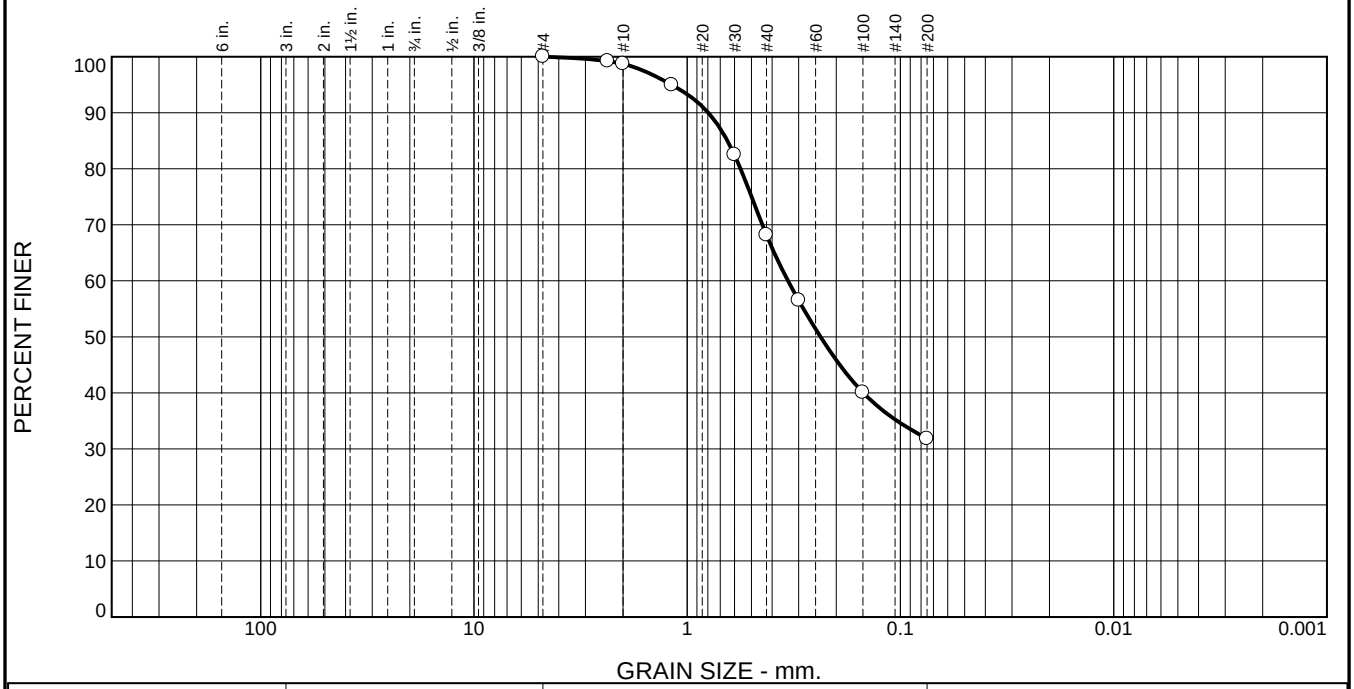
Allied Geotechnical Engineers, Inc.

Santee, CA

Client: RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-11

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.3	30.5	36.4	31.8	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#8	99.2		
#10	98.7		
#16	94.9		
#30	82.5		
#40	68.2		
#50	56.5		
#100	40.1		
#200	31.8		

* (no specification provided)

Material Description

White to pale brown, Clayey Sand with caliche

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SC **AASHTO (M 145)=**

Coefficients

D_{90}= 0.7967 D_{85}= 0.6476 D_{60}= 0.3370
D_{50}= 0.2370 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1/30/2024 **Date Tested:** 2/7/2024

Tested By: NEB

Checked By:

Title:

Source of Sample: B-12 **Depth:** 6
Sample Number: 2

Date Sampled: 1/30/2024

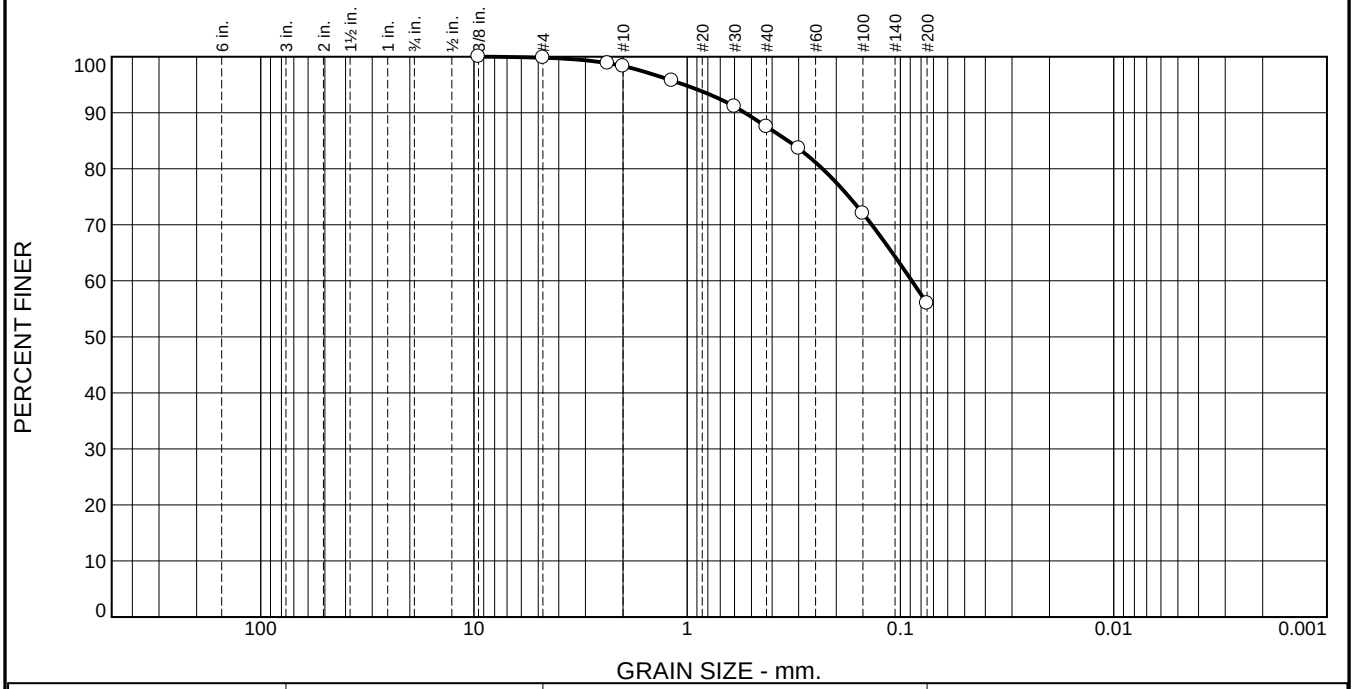
Allied Geotechnical Engineers, Inc.

Santee, CA

Client: RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-12

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	1.5	10.8	31.5	56.0	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.375	100.0		
#4	99.8		
#8	98.8		
#10	98.3		
#16	95.7		
#30	91.1		
#40	87.5		
#50	83.6		
#100	72.0		
#200	56.0		

* (no specification provided)

Material Description

Brown to olive brown, Sandy Claystone

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= CL-CH **AASHTO (M 145)=**

Coefficients

D_{90}= 0.5366 D_{85}= 0.3370 D_{60}= 0.0885
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 1/30/2024 **Date Tested:** 2/7/2024

Tested By: NEB

Checked By:

Title:

Source of Sample: B-12 **Depth:** 50 **Date Sampled:** 1/30/2024

Sample Number: 12

Allied Geotechnical Engineers, Inc.

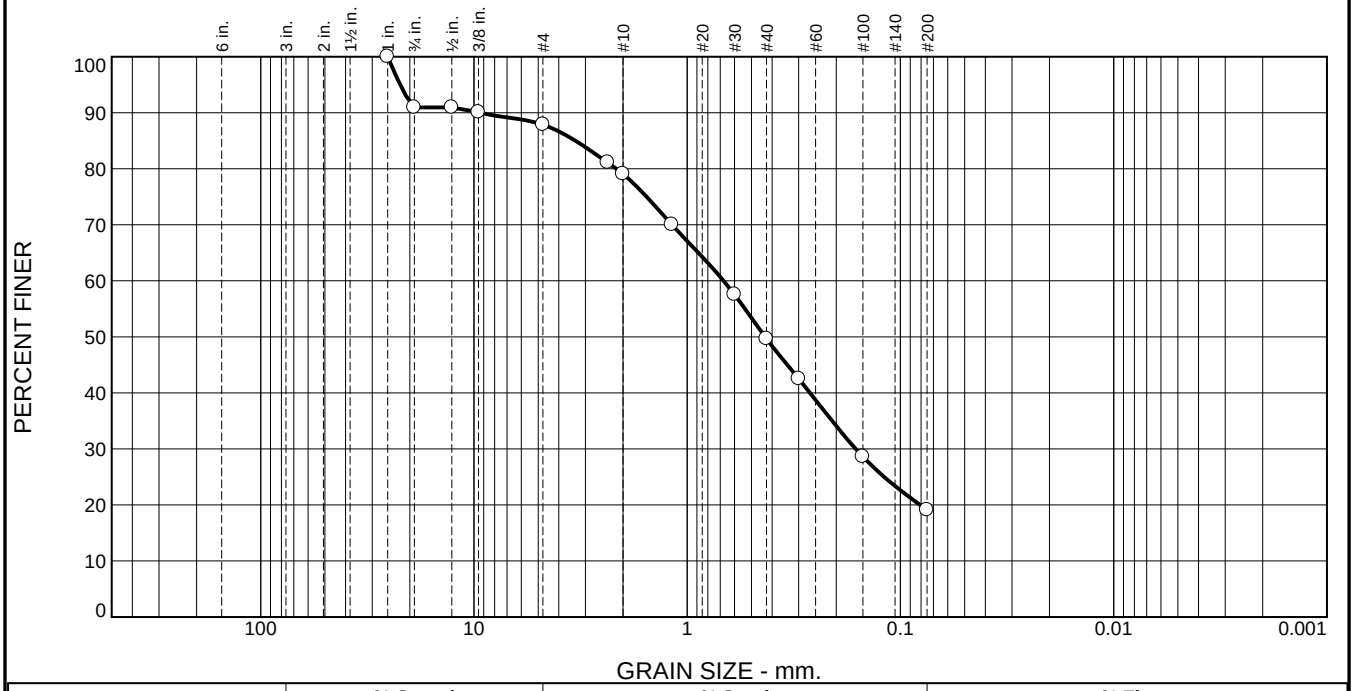
Santee, CA

Client: RICK ENGINEERING COMPANY

Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-13

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.1	3.0	8.8	29.4	30.6	19.1	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1	100.0		
.75	90.9		
0.5	90.9		
0.375	90.1		
#4	87.9		
#8	81.1		
#10	79.1		
#16	70.0		
#30	57.5		
#40	49.7		
#50	42.5		
#100	28.6		
#200	19.1		

* (no specification provided)

Material Description

Pale brown to light yellow brown, fine- to coarse-grained Silty Sand with some gravel.

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 9.3263 D_{85}= 3.3449 D_{60}= 0.6755
D_{50}= 0.4313 D_{30}= 0.1622 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 6/26/2023 **Date Tested:** 8/15/2023

Tested By: NEB

Checked By:

Title:

Source of Sample: B-13 **Depth:** 25'
Sample Number: 7

Date Sampled: 6/26/2023

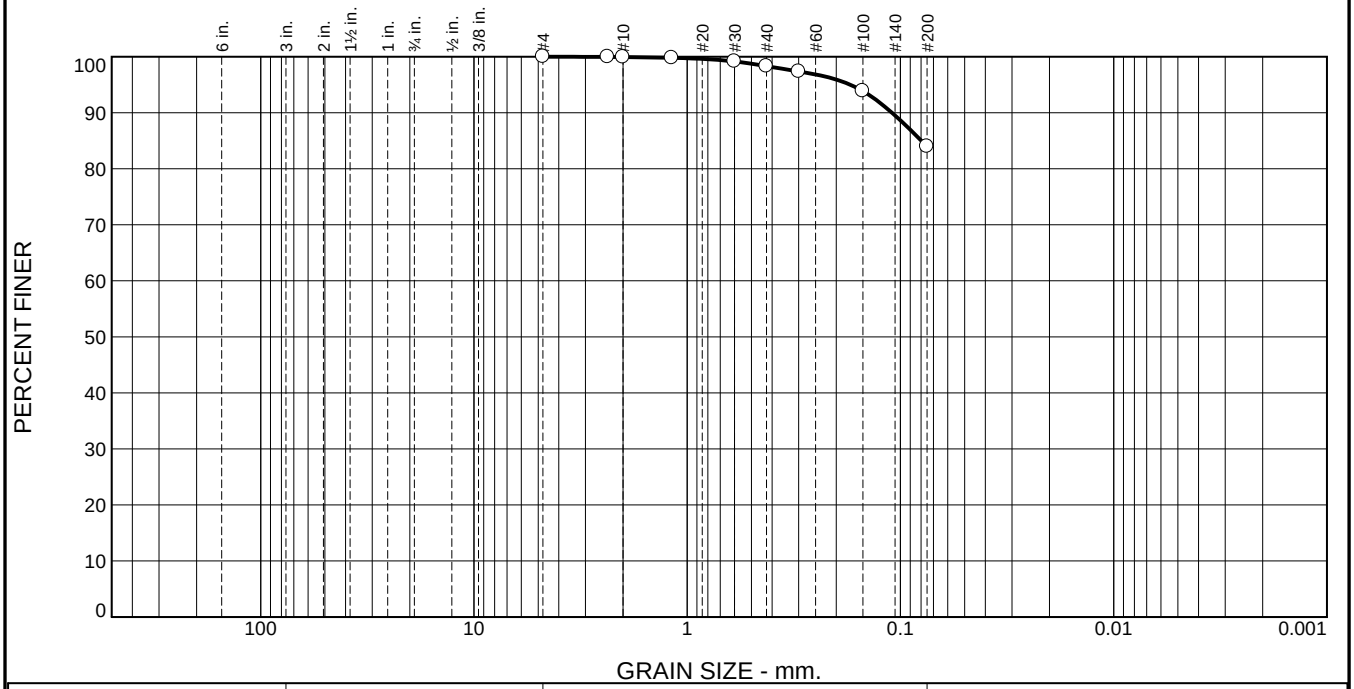
Allied Geotechnical Engineers, Inc.

Santee, CA

Client: RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-14

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	1.6	14.3	84.0	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#8	99.9		
#10	99.9		
#16	99.8		
#30	99.1		
#40	98.3		
#50	97.4		
#100	93.9		
#200	84.0		

* (no specification provided)

Material Description

Brown to light brown, hard, Claystone (CL/CH)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= CL-CH **AASHTO (M 145)=**

Coefficients

D_{90}= 0.1096 D_{85}= 0.0797 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 6/26/2023 **Date Tested:** 7/17/2023

Tested By: NEB

Checked By:

Title:

Source of Sample: B-13 **Depth:** 45'
Sample Number: 11

Date Sampled: 6/26/2023

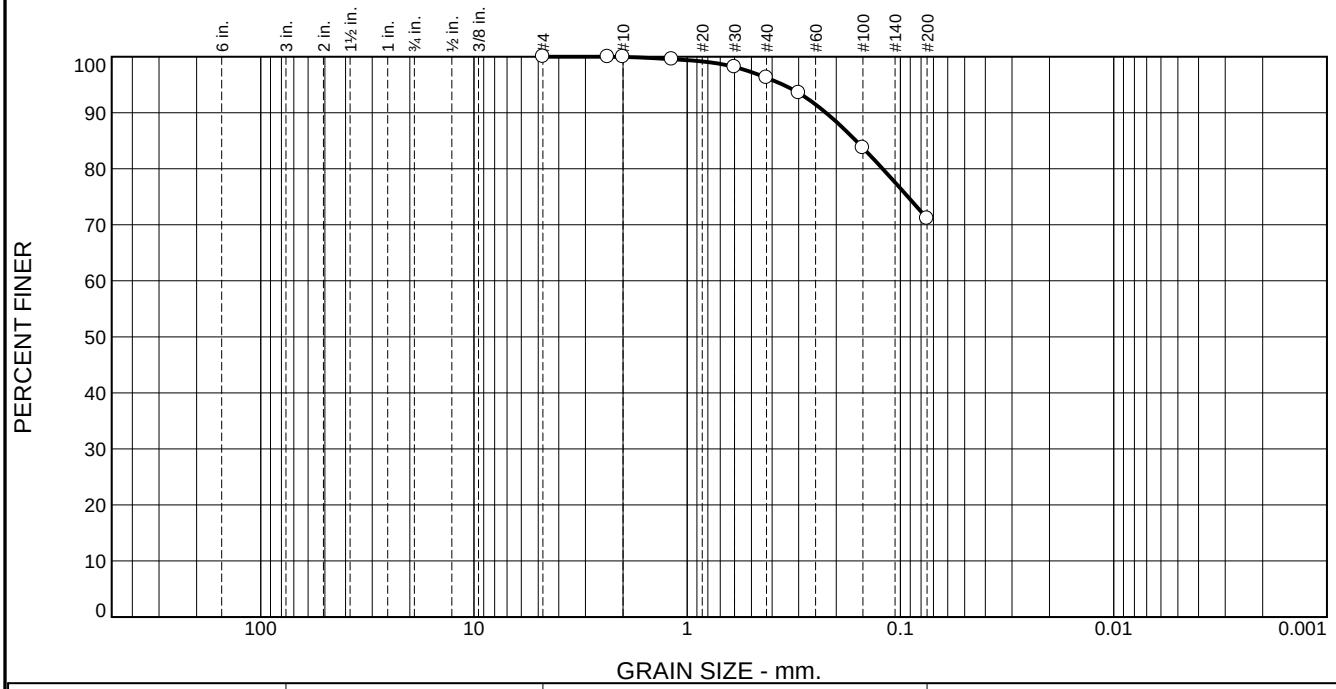
Allied Geotechnical Engineers, Inc.

Santee, CA

Client: RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-15

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	3.7	25.1	71.1	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#8	100.0		
#10	99.9		
#16	99.5		
#30	98.2		
#40	96.2		
#50	93.5		
#100	83.7		
#200	71.1		

* (no specification provided)

Material Description

Pinkish gray and light greenish gray, hard, Claystone (CL/CH)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= 0.2236 D_{85}= 0.1617 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 6/26/2023 **Date Tested:** 7/28/2023

Tested By: NEB

Checked By:

Title:

Source of Sample: B-13 **Depth:** 75' **Date Sampled:** 6/26/2023

Sample Number: 17

Allied Geotechnical Engineers, Inc.

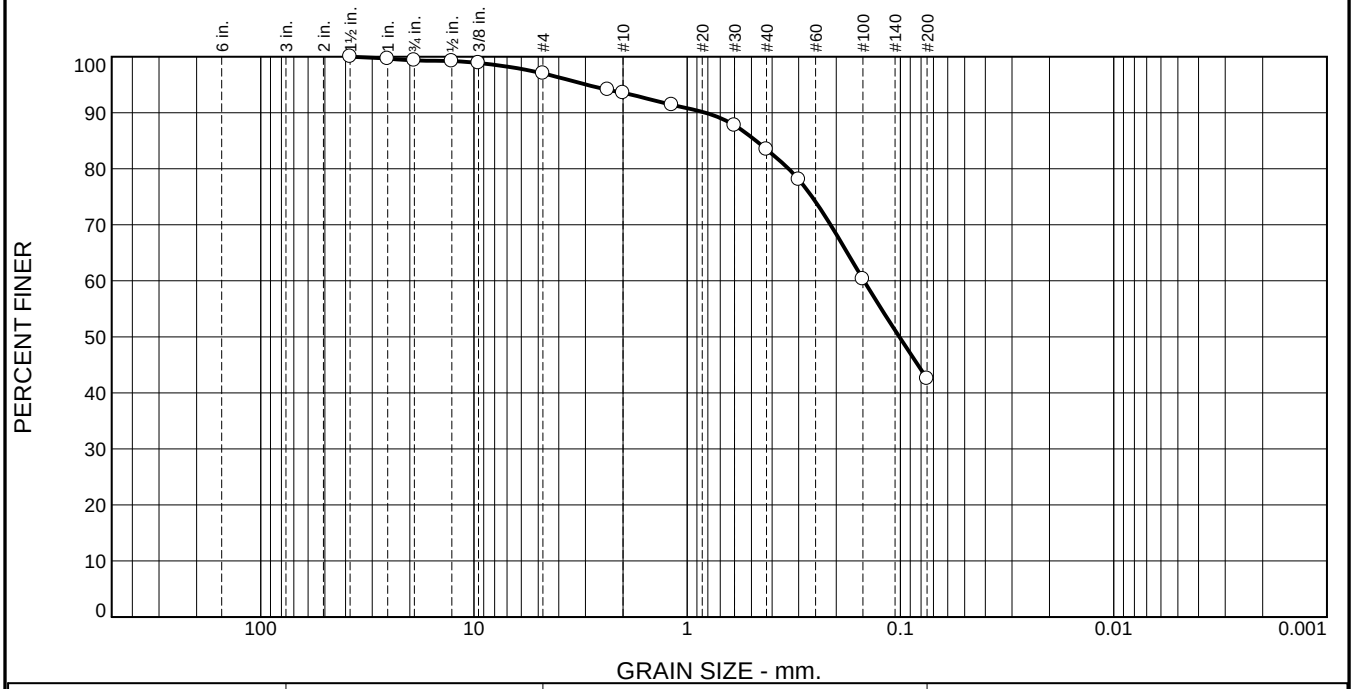
Santee, CA

Client: RICK ENGINEERING COMPANY

Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-16

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.7	2.3	3.5	10.0	41.0	42.5	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100.0		
1	99.6		
.75	99.3		
0.5	99.2		
0.375	98.9		
#4	97.0		
#8	94.1		
#10	93.5		
#16	91.4		
#30	87.8		
#40	83.5		
#50	78.1		
#100	60.3		
#200	42.5		

* (no specification provided)

Material Description

Pale brown to grayish brown, Clayey Sand

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 0.8230 D_{85}= 0.4763 D_{60}= 0.1483
D_{50}= 0.1012 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 10/12/2023 **Date Tested:** 11/18/2023

Tested By: NEB

Checked By:

Title:

Source of Sample: B-14 **Depth:** 6
Sample Number: 3

Date Sampled: 10/12/2023

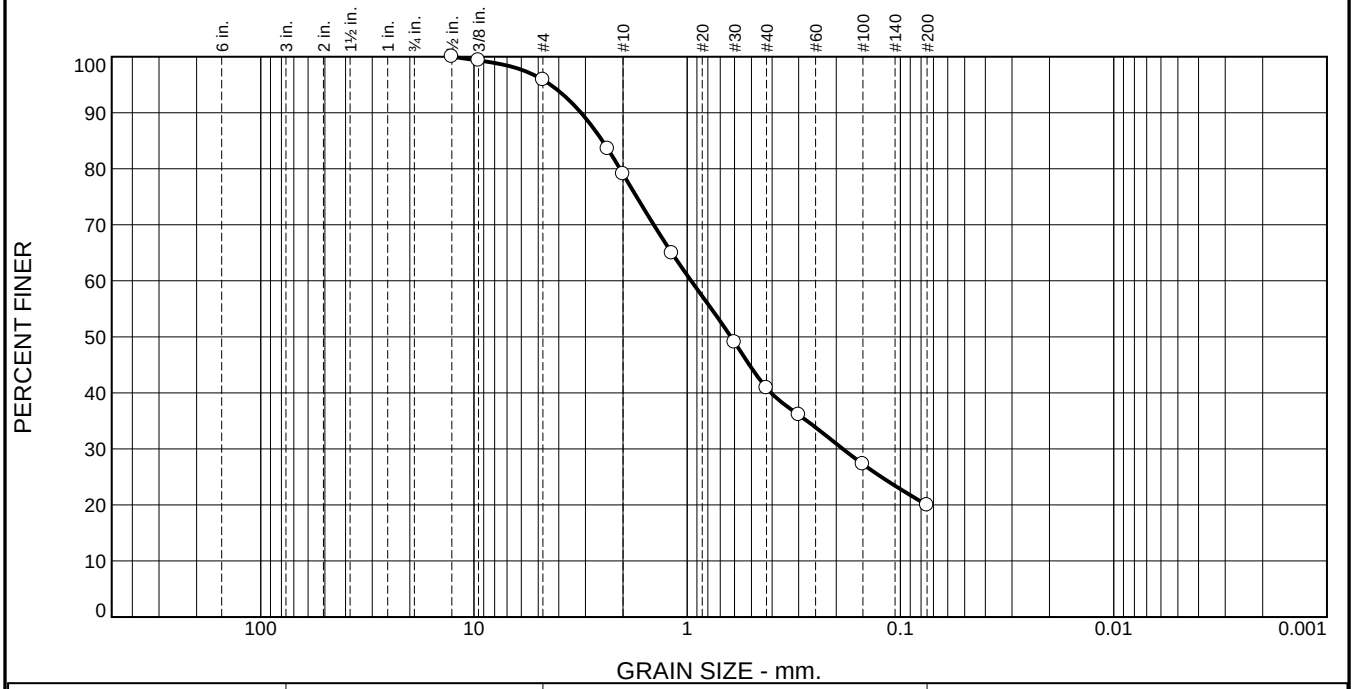
Allied Geotechnical Engineers, Inc.

Santee, CA

Client: RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-17

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.1	16.8	38.2	20.9	20.0	

Test Results (ASTM D 422 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.5	100.0		
0.375	99.3		
#4	95.9		
#8	83.6		
#10	79.1		
#16	65.0		
#30	49.0		
#40	40.9		
#50	36.1		
#100	27.3		
#200	20.0		

* (no specification provided)

Material Description

Light yellow brown, fine- to coarse-grained, Silty Sand.

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 3.1488 D_{85}= 2.4985 D_{60}= 0.9581
D_{50}= 0.6236 D_{30}= 0.1862 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: 10/12/2023 **Date Tested:** 11/23/2023

Tested By: NEB

Checked By:

Title:

Source of Sample: B-14 **Depth:** 50
Sample Number: 12

Date Sampled: 10/12/2023

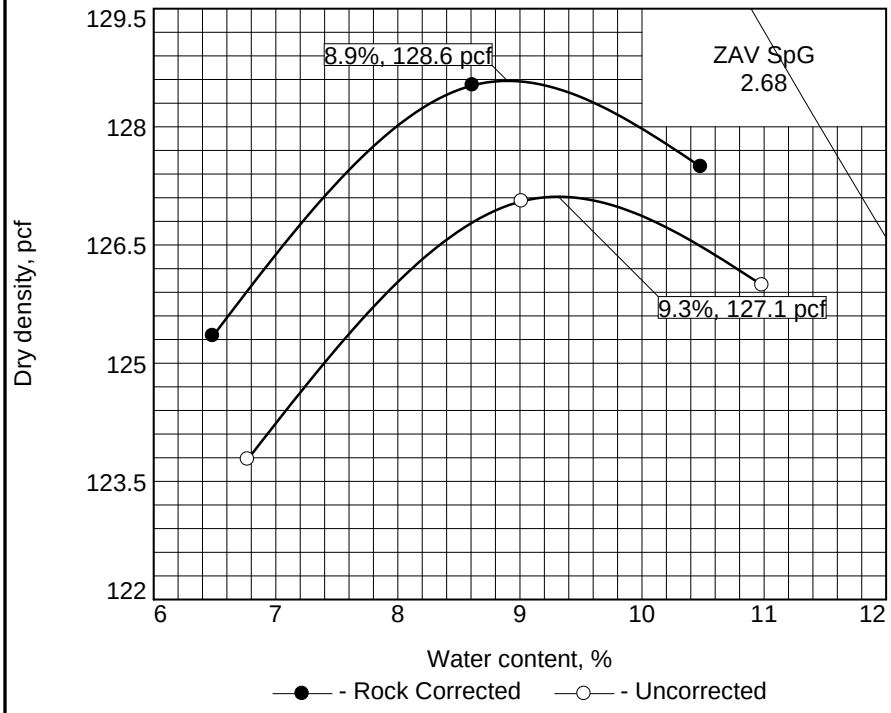
Allied Geotechnical Engineers, Inc.

Santee, CA

Client: RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

Project No: 223 GS-22 **Figure** B-18

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 1557-91 Procedure B Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Preparation Method
Hammer Wt. 10 lb.
Hammer Drop 18 in.
Number of Layers five
Blows per Layer 25
Mold Size 0.03333 cu. ft.

Test Performed on Material Passing 3/8 in. **Sieve**

NM **LL** **PI**
Sp.G. (ASTM D 854) 2.68
%>3/8 in. 5.2 **%<No.200** 20.6
USCS **AASHTO**
Date Sampled 2/18/2023
Date Tested
Tested By NEB

TESTING DATA

	1	2	3	4	5	6
WM + WS	6024.0	6120.0	6140.0			
WM	4026.0	4026.0	4026.0			
WW + T #1	544.8	474.6	562.6			
WD + T #1	514.7	441.3	513.9			
TARE #1	70.1	71.9	70.6			
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	6.5	8.6	10.5			
DRY DENSITY	125.3	128.5	127.5			

ROCK CORRECTED TEST RESULTS	UNCORRECTED
Maximum dry density = 128.6 pcf	127.1 pcf
Optimum moisture = 8.9 %	9.3 %

Material Description
Yellow brown, fine- to medium-grained, Silty Sand

Remarks:

Project No. 223 GS-22 **Client:** RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

○ **Source of Sample:** B-2A **Depth:** 1'

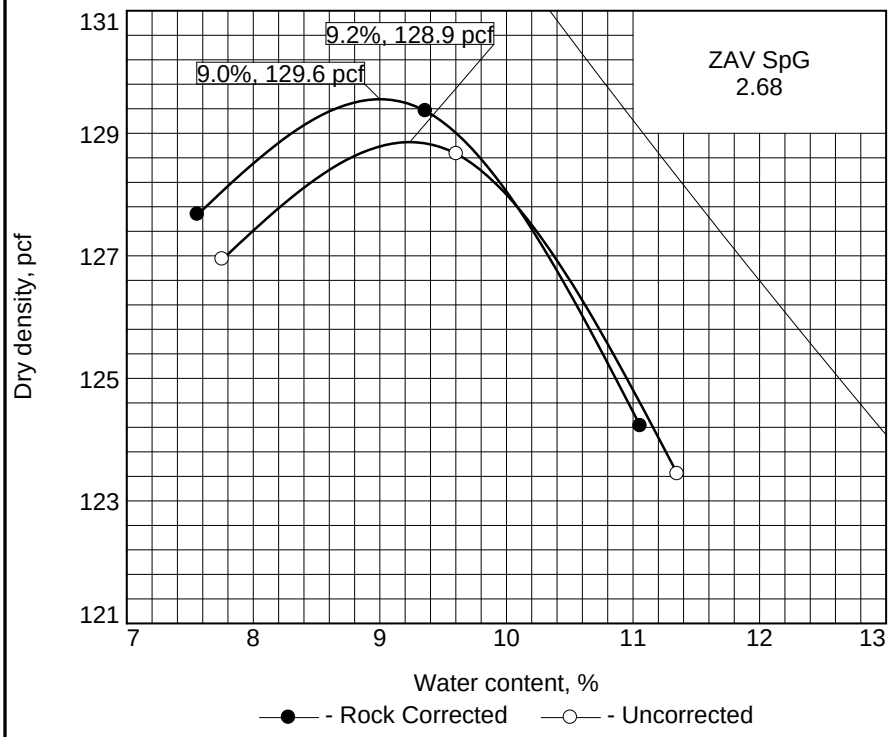
Checked by:
Title:

Allied Geotechnical Engineers, Inc.

Santee, CA

Figure B-19

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 1557-91 Procedure B Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Preparation Method
Hammer Wt. 10 lb.
Hammer Drop 18 in.
Number of Layers five
Blows per Layer 25
Mold Size 0.03333 cu. ft.

Test Performed on Material Passing 3/8 in. **Sieve**

NM 7.3 **LL** **PI**
Sp.G. (ASTM D 854) 2.68
%>3/8 in. 2.7 **%<No.200** 27.0
USCS **AASHTO**
Date Sampled 4/24/2023
Date Tested
Tested By NEB

TESTING DATA

	1	2	3	4	5	6
WM + WS	6094.0	6158.0	6104.0			
WM	4026.0	4026.0	4026.0			
WW + T #1	491.3	479.8	442.8			
WD + T #1	460.4	443.1	404.5			
TARE #1	62.0	61.1	67.1			
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	7.6	9.4	11.1			
DRY DENSITY	127.7	129.4	124.2			

ROCK CORRECTED TEST RESULTS	UNCORRECTED
Maximum dry density = 129.6 pcf	128.9 pcf
Optimum moisture = 9.0 %	9.2 %

Material Description
Yellow brown to pale reddish yellow, fine- to coarse-grained, Silty Sand.

Remarks:

Project No. 223 GS-22 **Client:** RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

○ **Source of Sample:** B-5 **Depth:** 5' **Sample Number:** 1

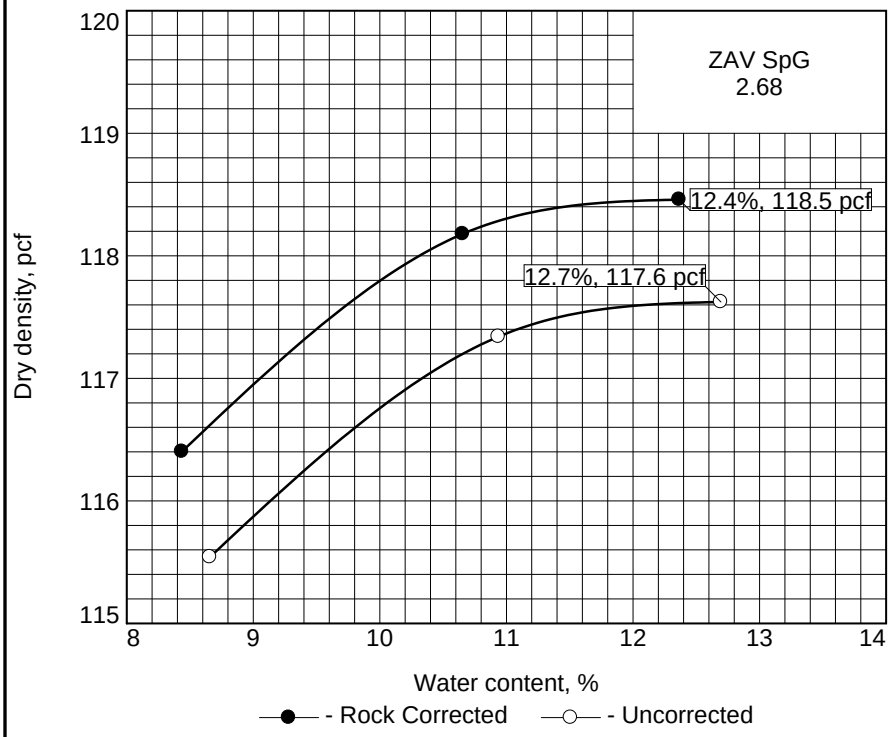
Checked by:
Title:

Allied Geotechnical Engineers, Inc.

Santee, CA

Figure B-20

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 1557-91 Procedure B Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Preparation Method
Hammer Wt. 10 lb.
Hammer Drop 18 in.
Number of Layers five
Blows per Layer 25
Mold Size 0.03333 cu. ft.

Test Performed on Material Passing 3/8 in. **Sieve**

NM **LL** **PI**
Sp.G. (ASTM D 854) 2.68
%>3/8 in. 2.7 **%<No.200** 39.7
USCS **AASHTO**
Date Sampled 10/11/2023
Date Tested
Tested By NEB

TESTING DATA

	1	2	3	4	5	6
WM + WS	5924.0	5994.0	6030.0			
WM	4026.0	4026.0	4026.0			
WW + T #1	468.8	451.9	492.4			
WD + T #1	434.9	411.4	444.2			
TARE #1	43.3	41.1	64.5			
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	8.4	10.7	12.4			
DRY DENSITY	116.4	118.2	118.5			

ROCK CORRECTED TEST RESULTS	UNCORRECTED
Maximum dry density = 118.5 pcf	117.6 pcf
Optimum moisture = 12.4 %	12.7 %

Material Description
Pale olive yellow to olive,fine-grained Silty Sand, with intermixed chunks of bluish gray, reddish yellow and light gray Silty sand

Remarks:

Project No. 223 GS-22 **Client:** RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

○ **Source of Sample:** B-7 **Depth:** 6 **Sample Number:** 2

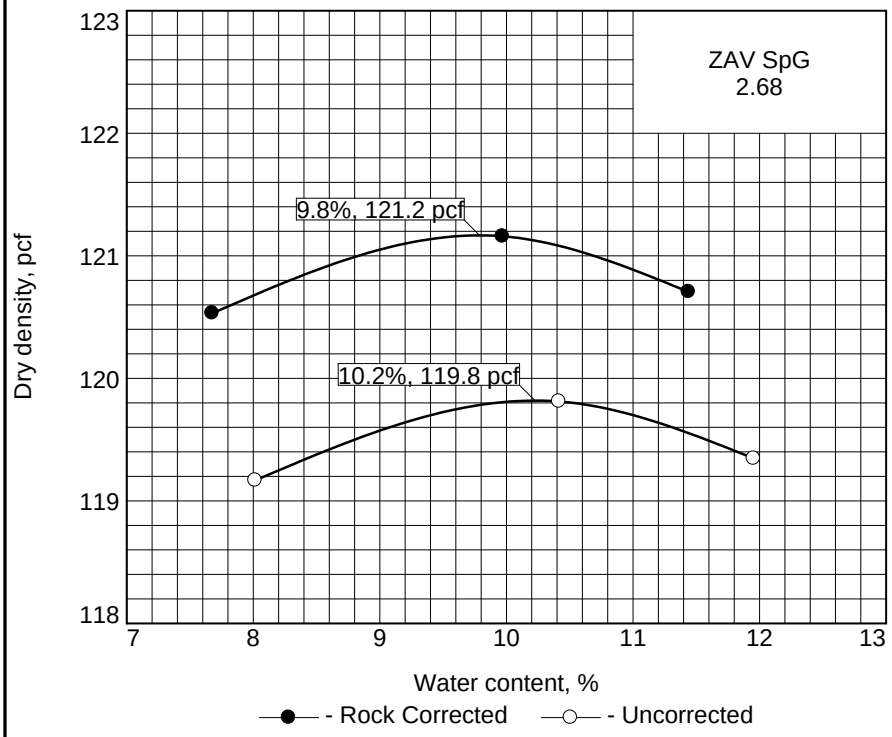
Checked by:
Title:

Allied Geotechnical Engineers, Inc.

Santee, CA

Figure B-21

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 1557-91 Procedure A Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Preparation Method
Hammer Wt. 10 lb.
Hammer Drop 18 in.
Number of Layers five
Blows per Layer 25
Mold Size 0.03333 cu. ft.

Test Performed on Material Passing #4 **Sieve**

NM **LL** **PI**
Sp.G. (ASTM D 854) 2.68
%>#4 4.5 **%<No.200** 16.0
USCS **AASHTO**
Date Sampled 10/22/2023
Date Tested
Tested By NEB

TESTING DATA

	1	2	3	4	5	6
WM + WS	5972.0	6026.0	6046.0			
WM	4026.0	4026.0	4026.0			
WW + T #1	530.0	476.9	520.0			
WD + T #1	496.0	438.1	471.8			
TARE #1	71.8	65.6	68.6			
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	7.7	10.0	11.4			
DRY DENSITY	120.5	121.2	120.7			

ROCK CORRECTED TEST RESULTS	UNCORRECTED
Maximum dry density = 121.2 pcf	119.8 pcf
Optimum moisture = 9.8 %	10.2 %

Material Description
Reddish brown to orange, fine to medium-grained, micaceous, Silty Sand (SM).

Remarks:

Project No. 223 GS-22 **Client:** RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

○ **Source of Sample:** B-8 **Depth:** 1 **Sample Number:** 1

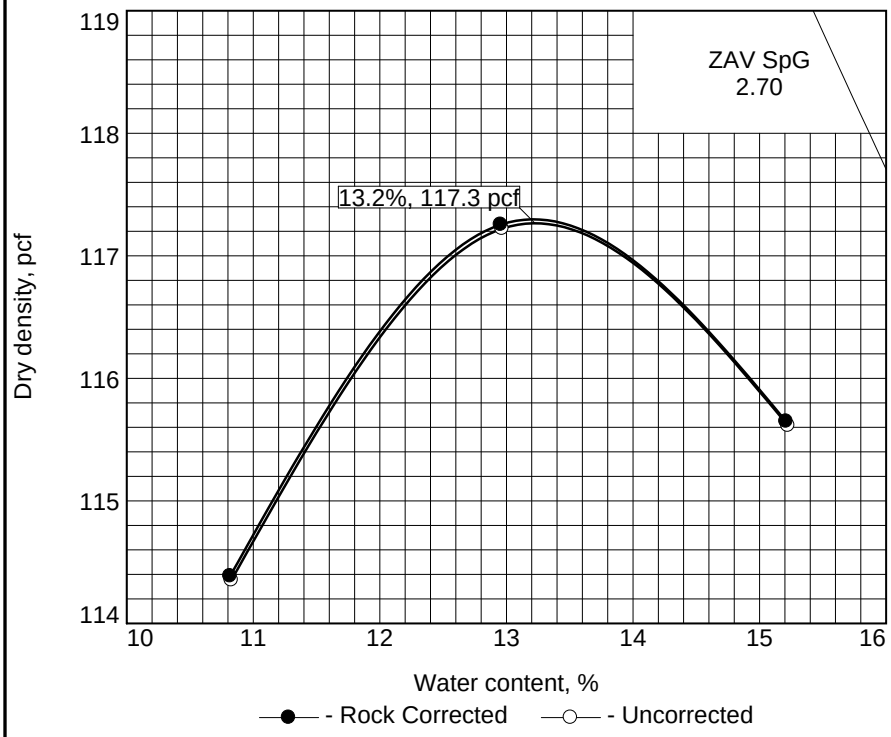
Checked by:
Title:

Allied Geotechnical Engineers, Inc.

Santee, CA

Figure B-22

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 1557-91 Procedure A Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Preparation Method
Hammer Wt. 10 lb.
Hammer Drop 18 in.
Number of Layers five
Blows per Layer 25
Mold Size 0.03333 cu. ft.

Test Performed on Material Passing #4 **Sieve**

NM **LL** **PI**
Sp.G. (ASTM D 854) 2.70
%>#4 0.1 **%<No.200** 41.8
USCS SC **AASHTO**
Date Sampled 1/30/2024
Date Tested
Tested By NEB

TESTING DATA

	1	2	3	4	5	6
WM + WS	5942.0	6028.0	6040.0			
WM	4026.0	4026.0	4026.0			
WW + T #1	491.4	466.7	415.4			
WD + T #1	450.3	419.9	370.0			
TARE #1	70.7	59.0	71.8			
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	10.8	13.0	15.2			
DRY DENSITY	114.4	117.3	115.6			

ROCK CORRECTED TEST RESULTS	UNCORRECTED
Maximum dry density = 117.3 pcf	117.3 pcf
Optimum moisture = 13.2 %	13.2 %

Material Description
Pale olive, Clayey Sand with caliche

Remarks:

Project No. 223 GS-22 **Client:** RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

○ **Source of Sample:** B-11 **Depth:** 7 **Sample Number:** 2

Checked by:
Title:

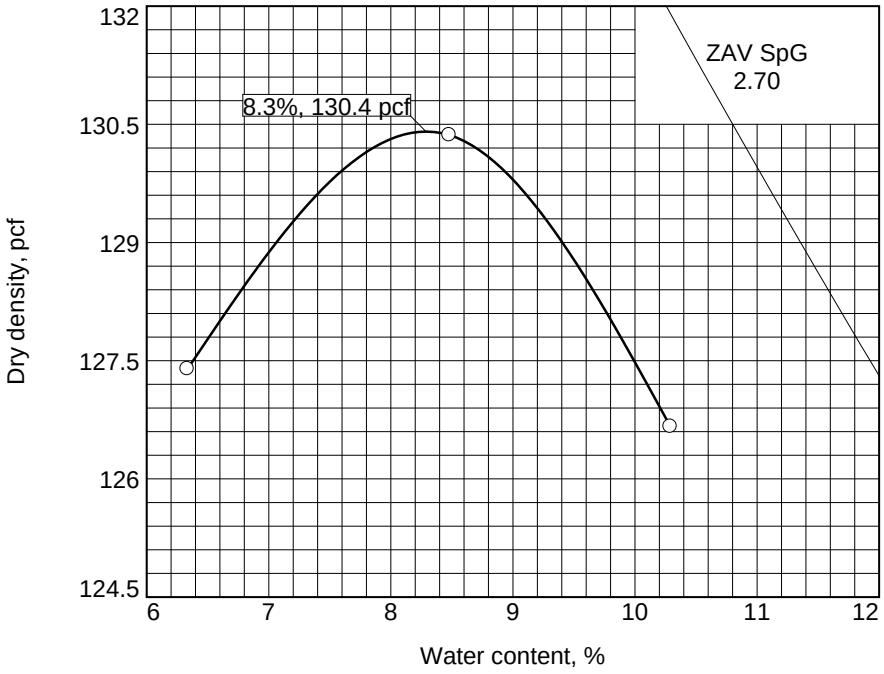
Allied Geotechnical Engineers, Inc.

Santee, CA

Figure B-23

COMPACTION TEST REPORT

Curve No.



Test Specification:
ASTM D 1557-91 Procedure A Modified

Preparation Method
Hammer Wt. 10 lb.
Hammer Drop 18 in.
Number of Layers five
Blows per Layer 25
Mold Size 0.03333 cu. ft.

Test Performed on Material Passing #4 **Sieve**

NM **LL** **PI**
Sp.G. (ASTM D 854) 2.70
%>#4 0.0 **%<No.200** 31.8
USCS SC **AASHTO**
Date Sampled 1/30/2024
Date Tested
Tested By NEB

TESTING DATA

	1	2	3	4	5	6
WM + WS	6074.0	6164.0	6138.0			
WM	4026.0	4026.0	4026.0			
WW + T #1	535.1	493.9	440.6			
WD + T #1	507.5	460.7	405.8			
TARE #1	71.8	69.2	67.6			
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	6.3	8.5	10.3			
DRY DENSITY	127.4	130.4	126.7			

TEST RESULTS

Maximum dry density = 130.4 pcf

Optimum moisture = 8.3 %

Material Description

White to pale brown, Clayey Sand with caliche

Remarks:

Project No. 223 GS-22 **Client:** RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

○ **Source of Sample:** B-12 **Depth:** 6 **Sample Number:** 2

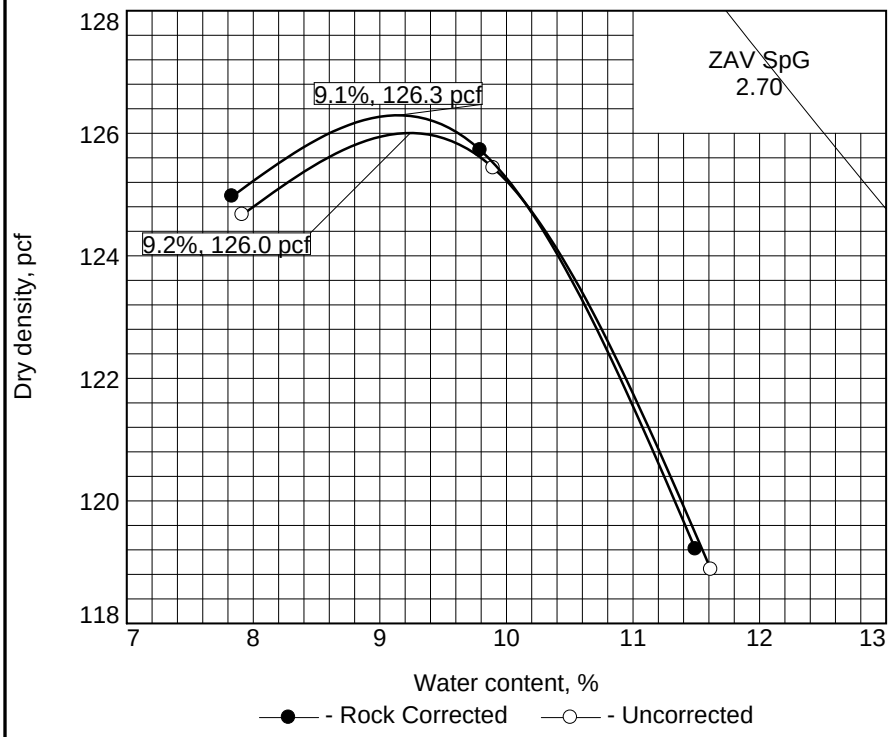
Checked by:
Title:

Allied Geotechnical Engineers, Inc.

Santee, CA

Figure B-24

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 1557-91 Procedure B Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Preparation Method
Hammer Wt. 10 lb.
Hammer Drop 18 in.
Number of Layers five
Blows per Layer 25
Mold Size 0.03333 cu. ft.

Test Performed on Material Passing 3/8 in. **Sieve**

NM **LL** **PI**
Sp.G. (ASTM D 854) 2.70
%>3/8 in. 1.1 **%<No.200** 42.5
USCS **AASHTO**
Date Sampled 10/12/2023
Date Tested
Tested By NEB

TESTING DATA

	1	2	3	4	5	6
WM + WS	6060.0	6110.0	6032.0			
WM	4026.0	4026.0	4026.0			
WW + T #1	494.0	446.7	420.6			
WD + T #1	462.8	412.9	384.3			
TARE #1	68.6	71.4	71.8			
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	7.8	9.8	11.5			
DRY DENSITY	125.0	125.7	119.2			

ROCK CORRECTED TEST RESULTS	UNCORRECTED
Maximum dry density = 126.3 pcf	126.0 pcf
Optimum moisture = 9.1 %	9.2 %

Material Description
Pale brown to grayish brown, Clayey Sand

Remarks:

Project No. 223 GS-22 **Client:** RICK ENGINEERING COMPANY
Project: OTAY 2ND PIPELINE PHASE 4

○ **Source of Sample:** B-14 **Depth:** 6 **Sample Number:** 3

Checked by:
Title:

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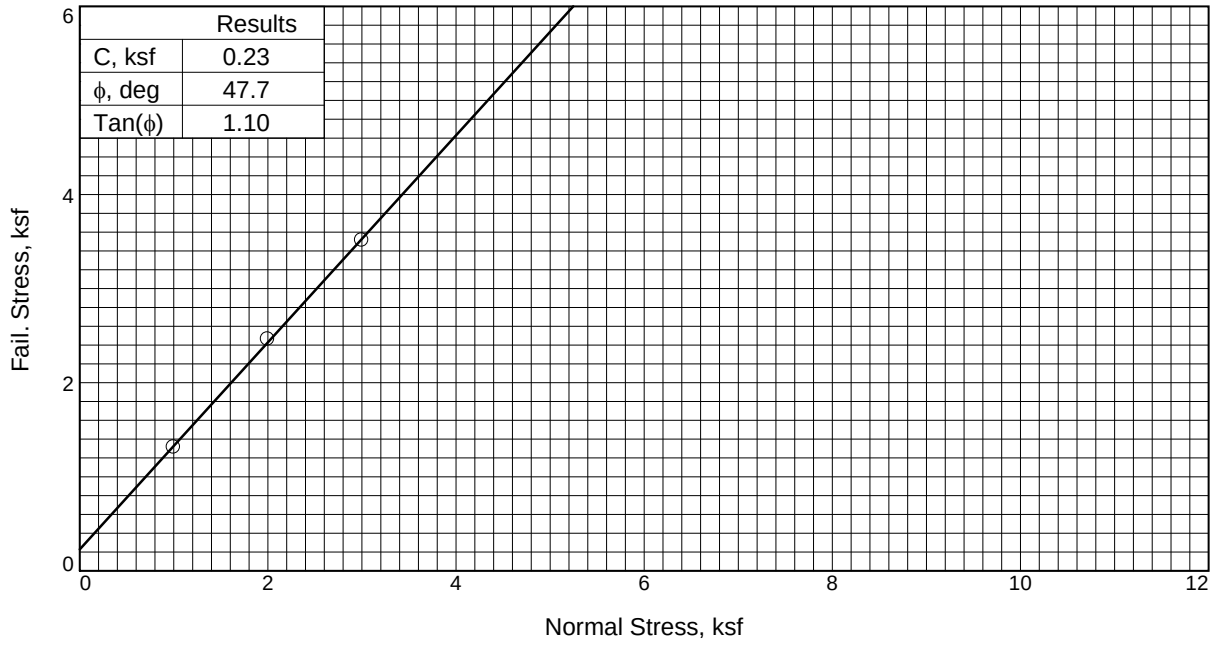
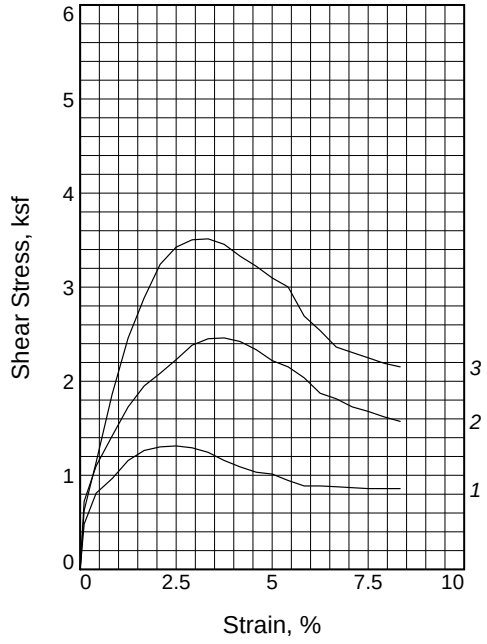
Figure B-25





Sample No.		1	2	3
Initial	Water Content, %	18.4	17.5	17.0
	Dry Density, pcf	115.5	119.2	119.0
	Saturation, %	108.5	114.1	110.1
	Void Ratio	0.4589	0.4146	0.4166
	Diameter, in.	2.40	2.40	2.40
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	18.6	17.5	17.0
	Dry Density, pcf	115.5	119.2	119.0
	Saturation, %	109.4	114.1	110.1
	Void Ratio	0.4589	0.4146	0.4166
	Diameter, in.	2.40	2.40	2.40
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	3.00
Fail. Stress, ksf		1.31	2.46	3.51
Strain, %		2.5	3.8	3.3
Ult. Stress, ksf				
Strain, %				
Strain rate, in./min.		0.006	0.006	0.006

Sample Type: In-situ ring
Description: Olive gray to gray, silty sand (SM)

Specific Gravity= 2.70
Remarks:

Figure B-26

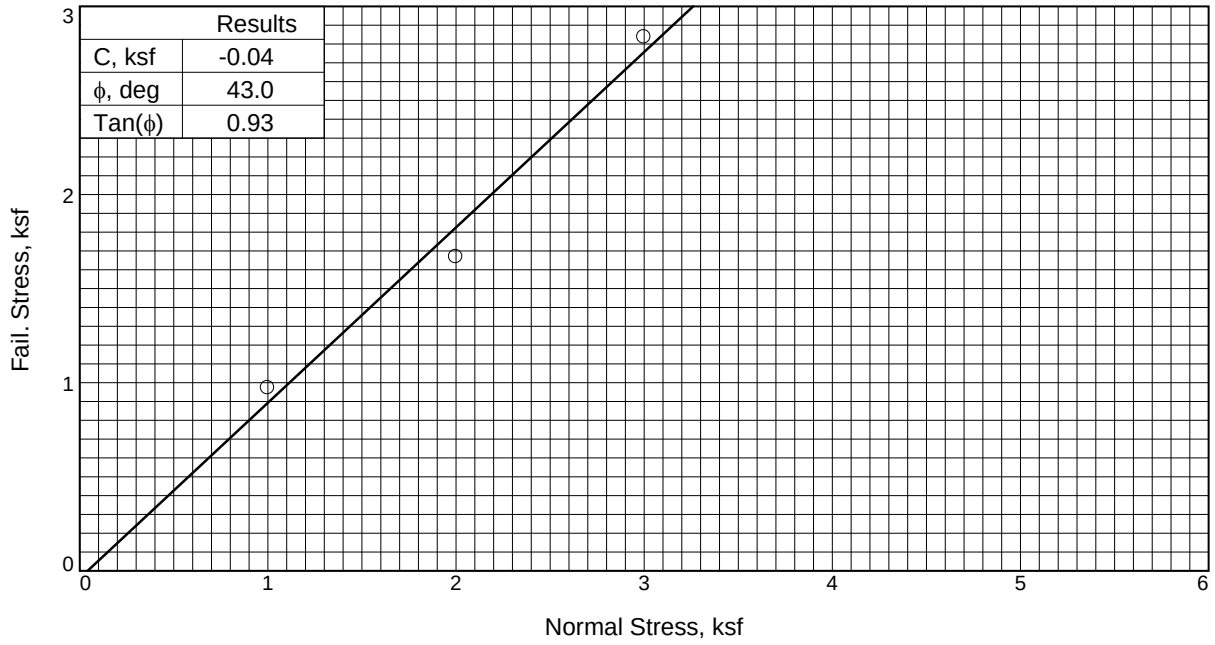
Client: RICK ENGINEERING COMPANY

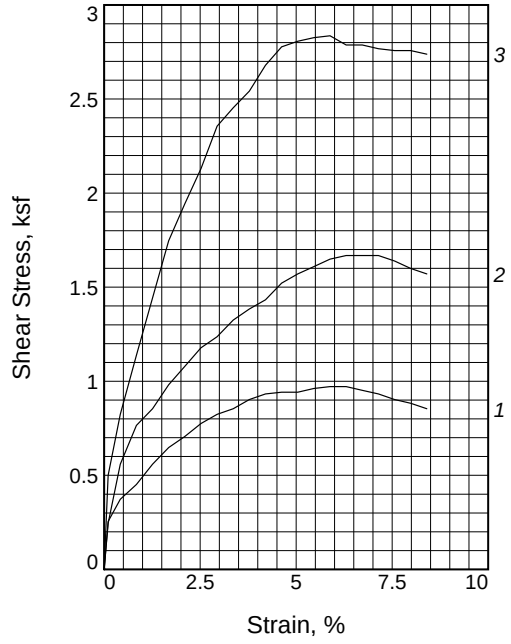
Project: OTAY 2ND PIPELINE PHASE 4

Source of Sample: B-1 **Depth:** 30
Sample Number: 7
Proj. No.: 223 GS-22 **Date Sampled:** 1/31/2024

DIRECT SHEAR TEST REPORT
Allied Geotechnical Engineers, Inc.
Santee, CA

Tested By: NEB





Sample No.		1	2	3
Initial	Water Content, %	33.7	31.0	24.3
	Dry Density, pcf	93.1	92.7	104.7
	Saturation, %	111.1	101.1	106.3
	Void Ratio	0.8242	0.8327	0.6214
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	33.7	31.2	24.3
	Dry Density, pcf	93.1	92.7	104.7
	Saturation, %	111.1	102.0	106.3
	Void Ratio	0.8242	0.8327	0.6214
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	3.00
Fail. Stress, ksf		0.97	1.67	2.84
Strain, %		5.9	6.3	5.9
Ult. Stress, ksf				
Strain, %				
Strain rate, in./min.		0.006	0.006	0.006

Sample Type: In-situ ring
Description: Dark gray, micaceous, Silty Sand (SM)

Specific Gravity= 2.72
Remarks:

Figure B-27

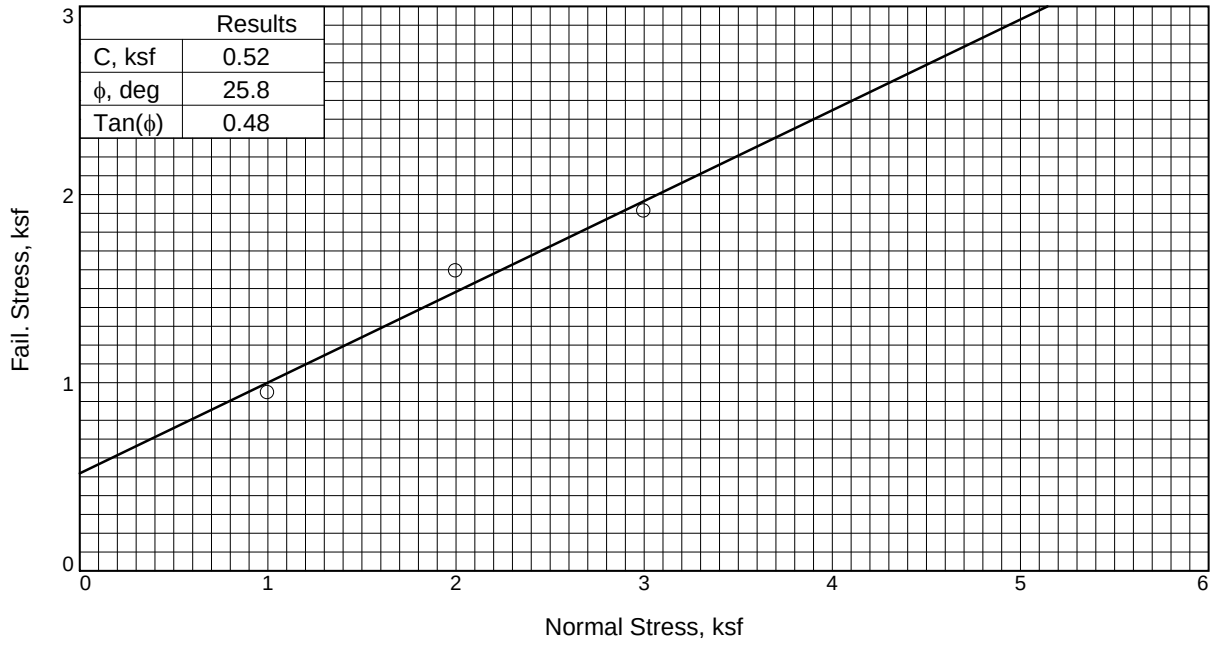
Client: RICK ENGINEERING COMPANY

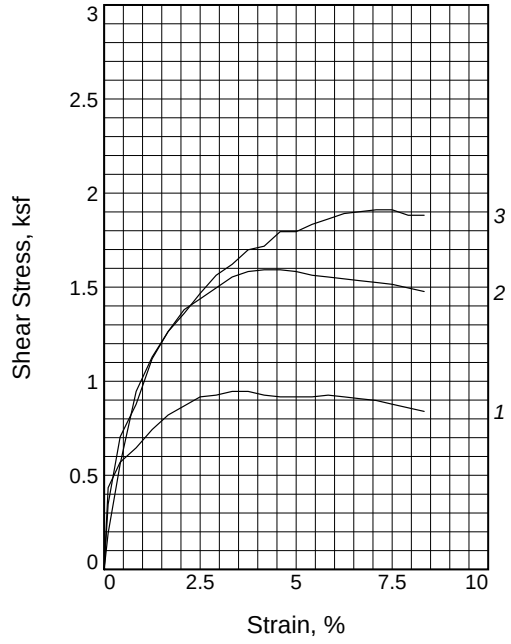
Project: OTAY 2ND PIPELINE PHASE 4

Source of Sample: B-1 **Depth:** 40
Sample Number: 9
Proj. No.: 223 GS-22 **Date Sampled:** 1/31/2024

DIRECT SHEAR TEST REPORT
Allied Geotechnical Engineers, Inc.
Santee, CA

Tested By: NEB





Sample No.		1	2	3
Initial	Water Content, %	24.6	18.9	27.3
	Dry Density, pcf	102.7	113.1	100.4
	Saturation, %	102.5	102.6	107.2
	Void Ratio	0.6528	0.5014	0.6916
	Diameter, in.	2.40	2.40	2.40
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	25.7	19.7	28.4
	Dry Density, pcf	100.7	110.9	98.4
	Saturation, %	102.1	100.6	106.6
	Void Ratio	0.6859	0.5315	0.7255
	Diameter, in.	2.40	2.40	2.40
	Height, in.	1.02	1.02	1.02
Normal Stress, ksf		1.00	2.00	3.00
Fail. Stress, ksf		0.95	1.59	1.91
Strain, %		3.3	4.2	7.1
Ult. Stress, ksf				
Strain, %				
Strain rate, in./min.		0.006	0.006	0.006

Sample Type: In-situ ring
Description: Pale olive gray to pinkish brown, Sandy Clay (CL/CH).

Specific Gravity= 2.72
Remarks: Specimen #2 has higher sand content

Figure B-28

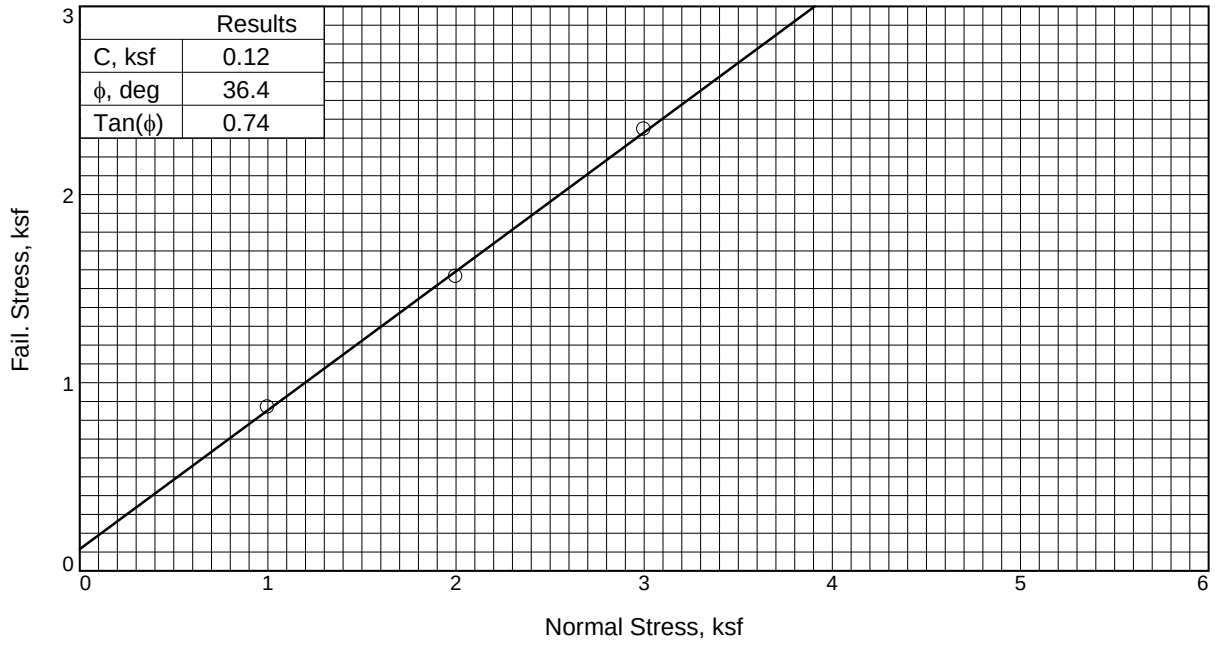
Client: RICK ENGINEERING COMPANY

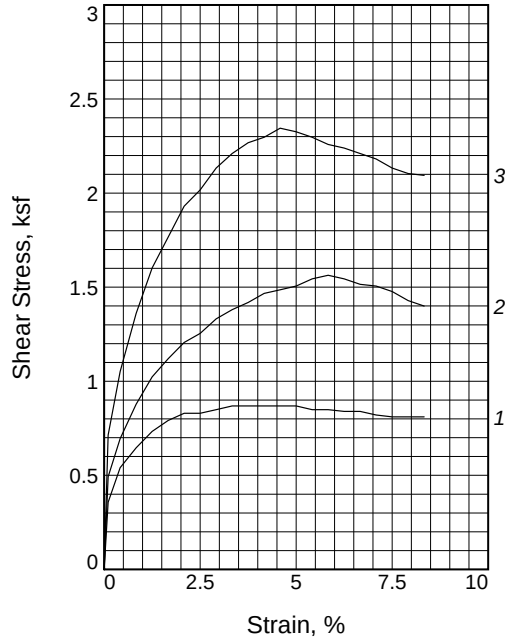
Project: OTAY 2ND PIPELINE PHASE 4

Source of Sample: B-1 **Depth:** 50
Sample Number: 11
Proj. No.: 223 GS-22 **Date Sampled:** 1/31/2024

DIRECT SHEAR TEST REPORT
Allied Geotechnical Engineers, Inc.
Santee, CA

Tested By: NEB





Sample No.		1	2	3
Initial	Water Content, %	30.6	28.3	32.1
	Dry Density, pcf	96.1	99.6	97.3
	Saturation, %	109.5	110.5	118.5
	Void Ratio	0.7543	0.6920	0.7315
	Diameter, in.	2.40	2.40	2.40
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	30.6	28.3	32.1
	Dry Density, pcf	96.1	99.6	97.3
	Saturation, %	109.5	110.5	118.5
	Void Ratio	0.7543	0.6920	0.7315
	Diameter, in.	2.40	2.40	2.40
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	3.00
Fail. Stress, ksf		0.87	1.56	2.35
Strain, %		3.3	5.8	4.6
Ult. Stress, ksf				
Strain, %				
Strain rate, in./min.		0.007	0.007	0.007

Sample Type: In-situ ring
Description: Grayish brown to medium gray, fine to medium grained, micaceous, Poorly Graded Sand

Specific Gravity= 2.70
Remarks:

Figure B-29

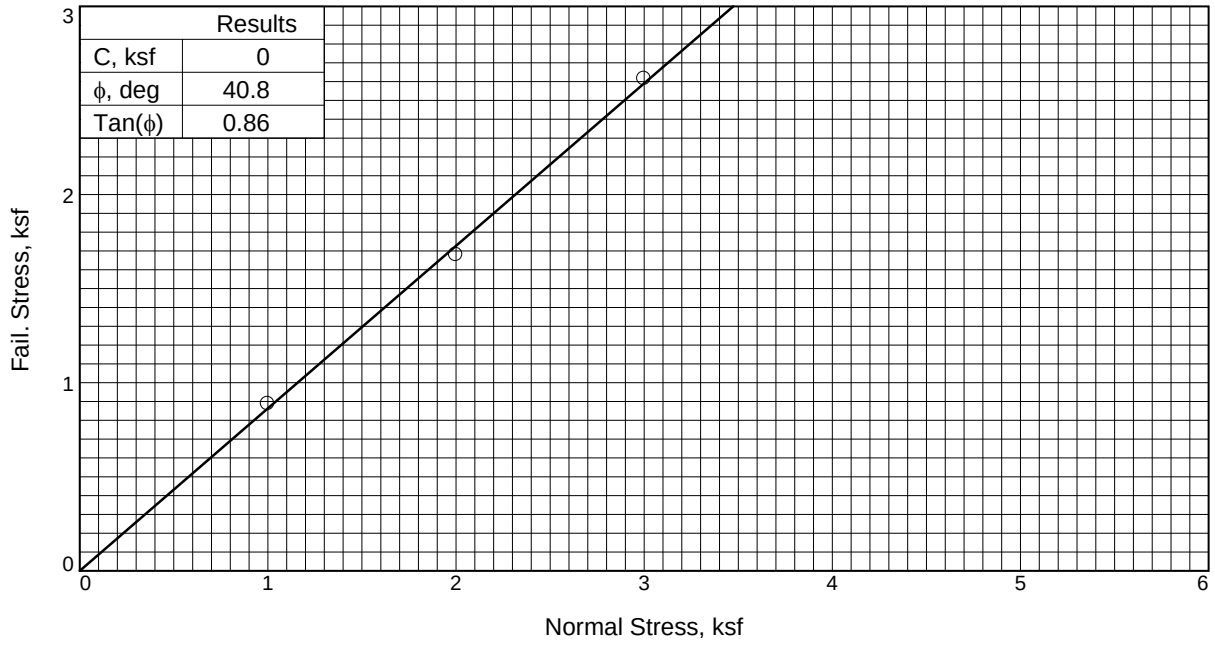
Client: RICK ENGINEERING COMPANY

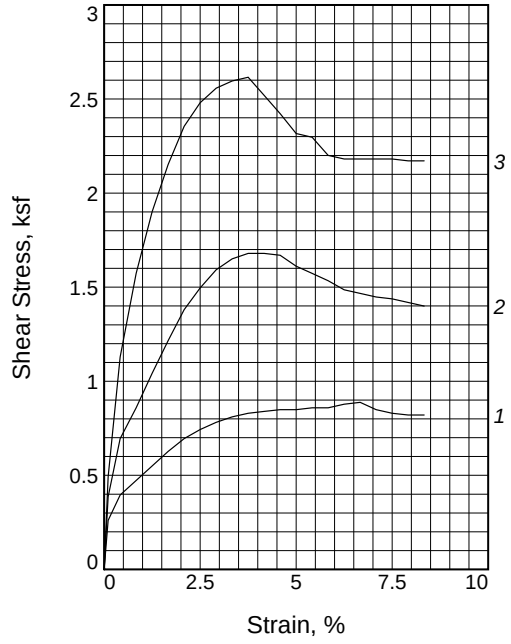
Project: OTAY 2ND PIPELINE PHASE 4

Source of Sample: B-2A **Depth:** 17'
Sample Number: 5
Proj. No.: 223 GS-22 **Date Sampled:** 2/18/2023

DIRECT SHEAR TEST REPORT
Allied Geotechnical Engineers, Inc.
Santee, CA

Tested By: NEB





Sample No.		1	2	3
Initial	Water Content, %	7.4	7.4	7.6
	Dry Density, pcf	96.3	97.3	100.3
	Saturation, %	27.0	27.7	30.3
	Void Ratio	0.7382	0.7187	0.6682
	Diameter, in.	2.40	2.40	2.40
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	24.7	23.4	20.9
	Dry Density, pcf	96.3	97.3	100.3
	Saturation, %	89.6	87.1	83.9
	Void Ratio	0.7382	0.7187	0.6682
	Diameter, in.	2.40	2.40	2.40
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	3.00
Fail. Stress, ksf		0.89	1.68	2.62
Strain, %		6.7	3.8	3.8
Ult. Stress, ksf				
Strain, %				
Strain rate, in./min.		0.007	0.007	0.007

Sample Type: In-situ ring
Description: Pale yellow, fine- to medium-grained, locally coarse-grained, Silty Sandstone (SM).

Specific Gravity= 2.68
Remarks:

Figure B-30

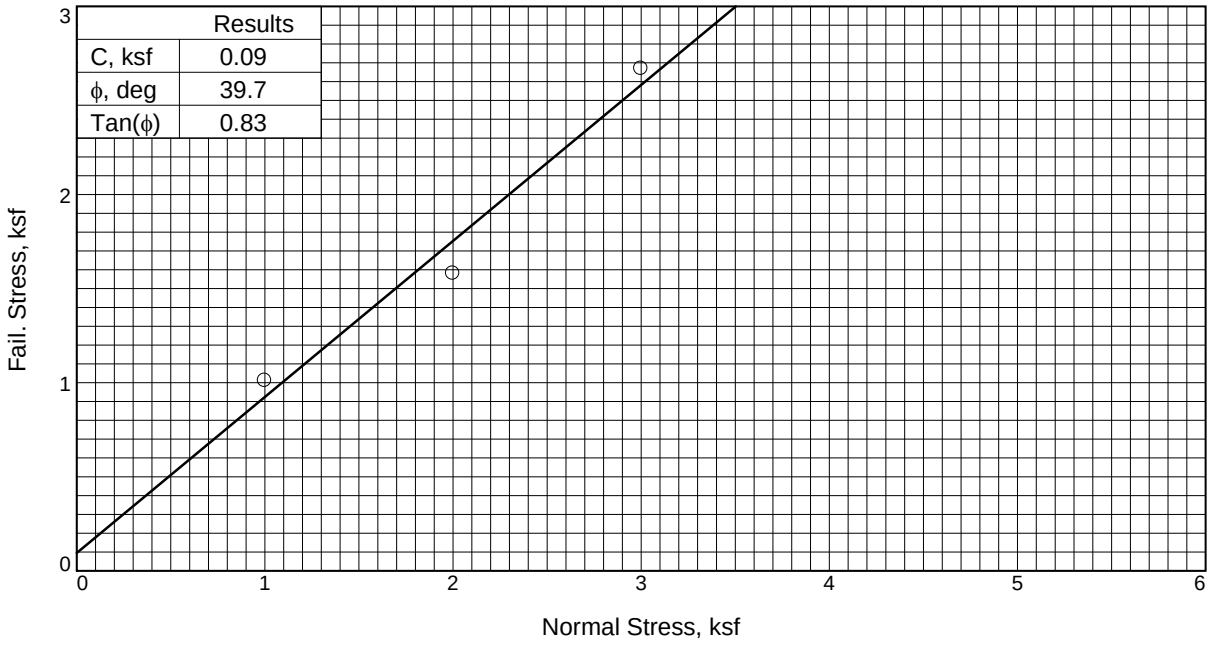
Client: RICK ENGINEERING COMPANY

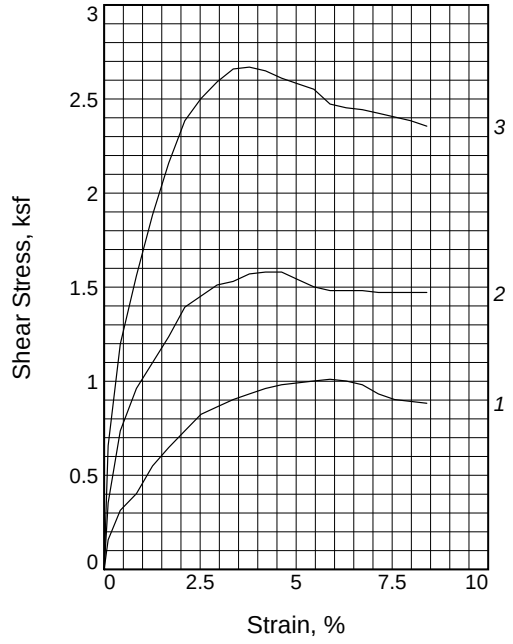
Project: OTAY 2ND PIPELINE PHASE 4

Source of Sample: B-5 **Depth:** 10'
Sample Number: 3
Proj. No.: 223 GS-22 **Date Sampled:** 4/24/2023

DIRECT SHEAR TEST REPORT
Allied Geotechnical Engineers, Inc.
Santee, CA

Tested By: NEB





Sample No.		1	2	3
Initial	Water Content, %	17.1	16.9	16.3
	Dry Density, pcf	107.4	105.2	102.7
	Saturation, %	82.3	76.4	69.6
	Void Ratio	0.5581	0.5910	0.6295
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	20.7	20.4	20.3
	Dry Density, pcf	107.4	105.2	102.7
	Saturation, %	99.6	92.7	86.3
	Void Ratio	0.5581	0.5910	0.6295
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	3.00
Fail. Stress, ksf		1.01	1.58	2.67
Strain, %		5.9	4.2	3.8
Ult. Stress, ksf				
Strain, %				
Strain rate, in./min.		0.006	0.006	0.006

Sample Type: In-situ ring
Description: Brown and grayish brown, fine- to medium-grained, Silty Sand with trace of fine sub-

Specific Gravity= 2.68
Remarks:

Client: RICK ENGINEERING COMPANY

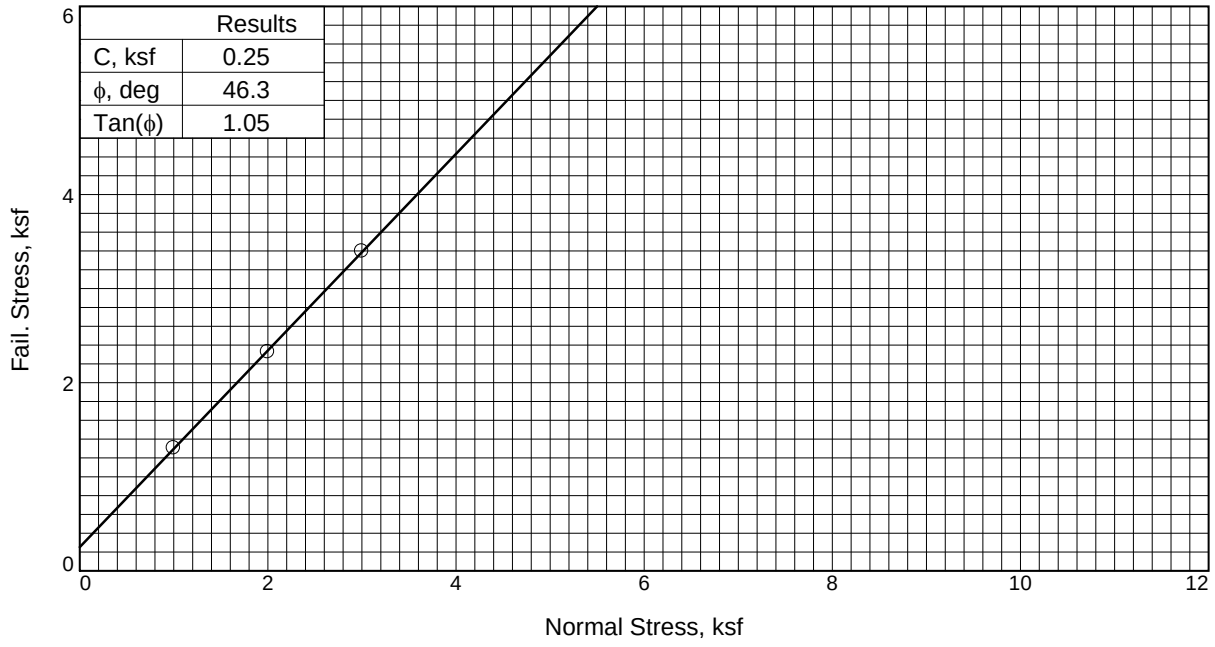
Project: OTAY 2ND PIPELINE PHASE 4

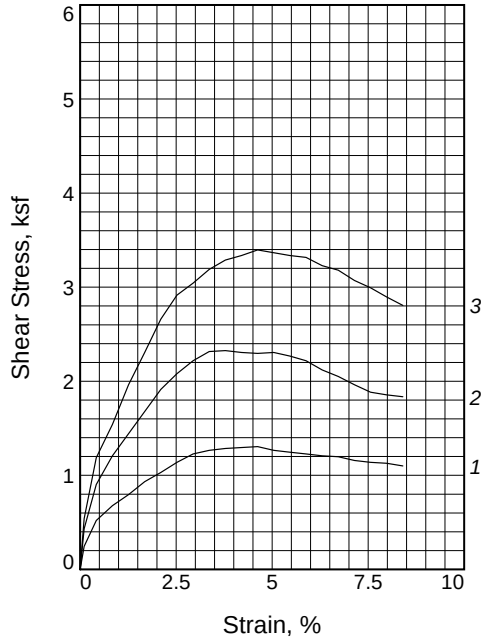
Source of Sample: B-7 **Depth:** 20
Sample Number: 6
Proj. No.: 223 GS-22 **Date Sampled:** 10/11/2023

DIRECT SHEAR TEST REPORT
Allied Geotechnical Engineers, Inc.
Santee, CA

Figure B-31

Tested By: NEB





Sample No.		1	2	3
Initial	Water Content, %	13.4	14.5	15.9
	Dry Density, pcf	115.0	111.4	115.6
	Saturation, %	77.7	76.1	93.9
	Void Ratio	0.4657	0.5130	0.4581
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	14.7	16.8	16.4
	Dry Density, pcf	115.0	111.4	115.6
	Saturation, %	85.5	88.6	96.5
	Void Ratio	0.4657	0.5130	0.4581
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	3.00
Fail. Stress, ksf		1.31	2.33	3.40
Strain, %		4.6	3.8	4.6
Ult. Stress, ksf				
Strain, %				
Strain rate, in./min.		0.006	0.006	0.006

Sample Type: In-situ ring
Description: Brown, Well-Graded Sand With Silt (SW-SM).

Specific Gravity= 2.70
Remarks:

Figure B-32

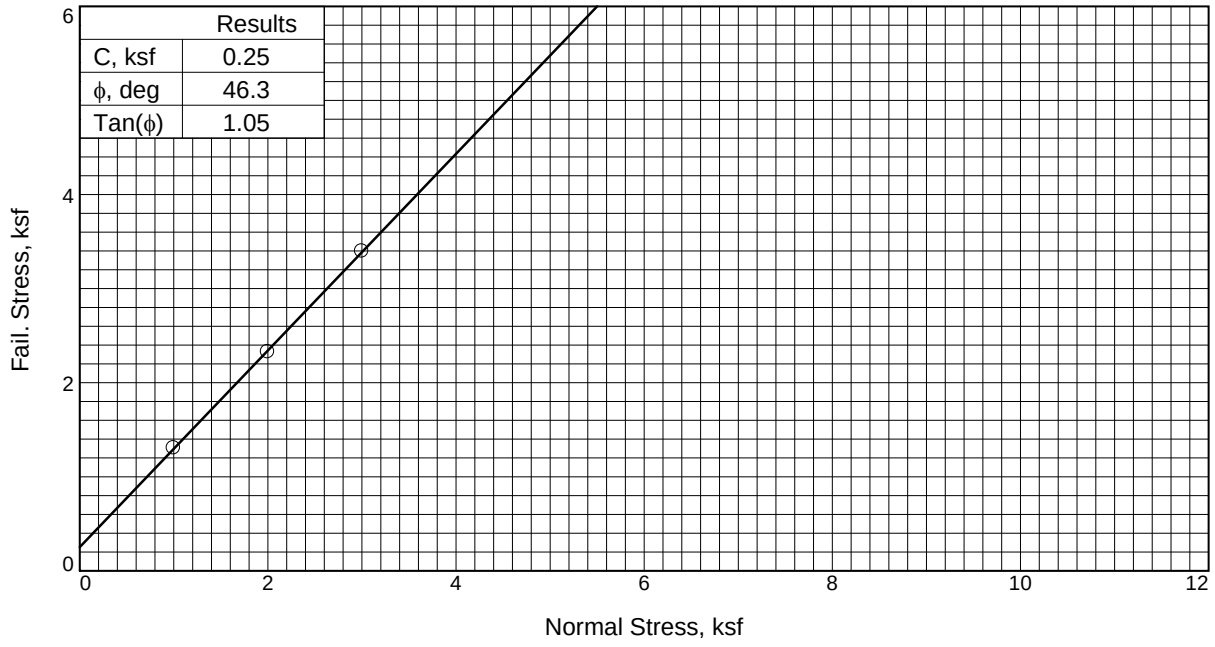
Client: RICK ENGINEERING COMPANY

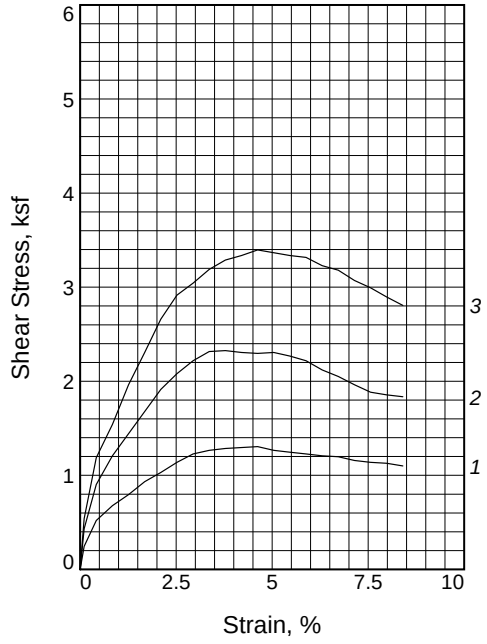
Project: OTAY 2ND PIPELINE PHASE 4

Source of Sample: B-12 **Depth:** 60
Sample Number: 14
Proj. No.: 223 GS-22 **Date Sampled:** 1/30/2024

DIRECT SHEAR TEST REPORT
Allied Geotechnical Engineers, Inc.
Santee, CA

Tested By: NEB





Sample No.		1	2	3
Initial	Water Content, %	13.4	14.5	15.9
	Dry Density, pcf	115.0	111.4	115.6
	Saturation, %	77.7	76.1	93.9
	Void Ratio	0.4657	0.5130	0.4581
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	14.7	16.8	16.4
	Dry Density, pcf	115.0	111.4	115.6
	Saturation, %	85.5	88.6	96.5
	Void Ratio	0.4657	0.5130	0.4581
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	3.00
Fail. Stress, ksf		1.31	2.33	3.40
Strain, %		4.6	3.8	4.6
Ult. Stress, ksf				
Strain, %				
Strain rate, in./min.		0.006	0.006	0.006

Sample Type: In-situ ring
Description: Brown, Well-Graded Sand With Silt (SW-SM).

Specific Gravity= 2.70
Remarks:

Figure B-32

Client: RICK ENGINEERING COMPANY

Project: OTAY 2ND PIPELINE PHASE 4

Source of Sample: B-12 **Depth:** 60
Sample Number: 14
Proj. No.: 223 GS-22 **Date Sampled:** 1/30/2024

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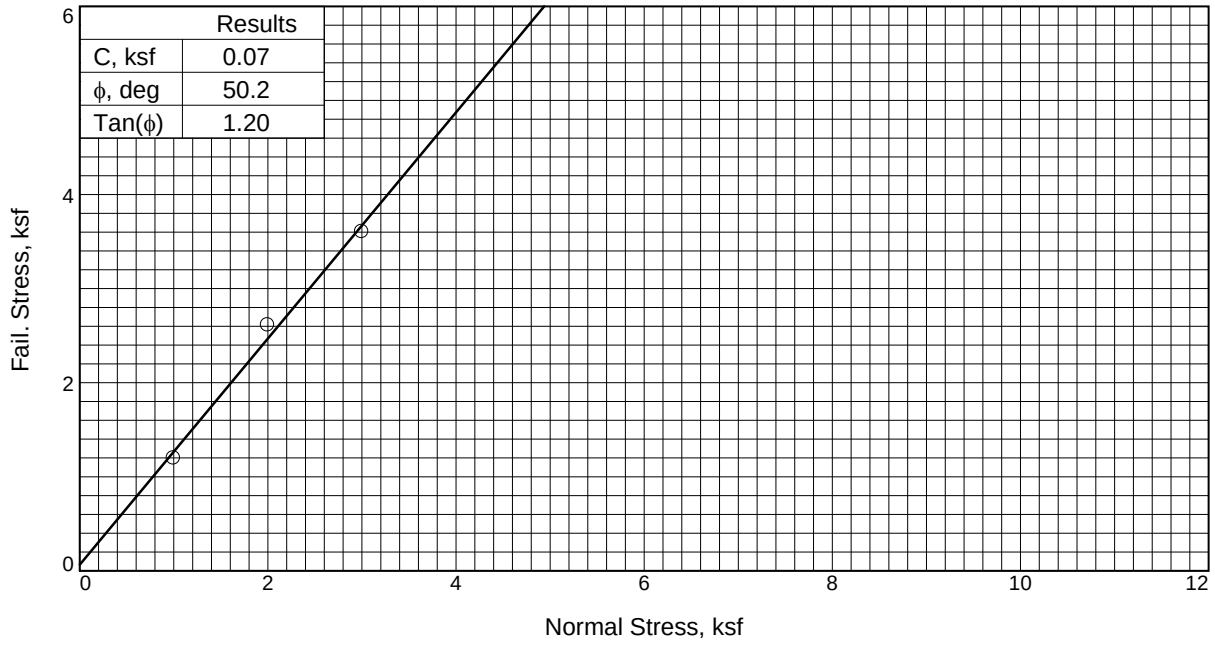
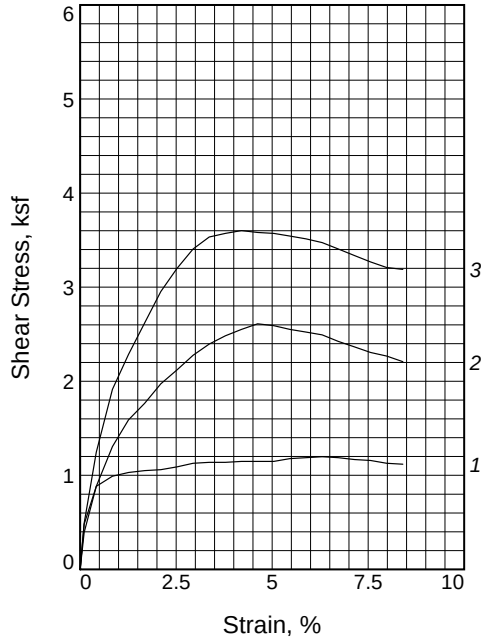
Allied Geotechnical Engineers, Inc.
Santee, CA

Tested By: NEB





Sample No.		1	2	3
Initial	Water Content, %	12.1	11.2	10.6
	Dry Density, pcf	114.9	115.8	121.3
	Saturation, %	70.3	66.1	73.3
	Void Ratio	0.4668	0.4559	0.3901
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	16.0	15.4	14.1
	Dry Density, pcf	114.9	115.8	121.3
	Saturation, %	92.7	91.1	97.8
	Void Ratio	0.4668	0.4559	0.3901
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	3.00
Fail. Stress, ksf		1.20	2.61	3.60
Strain, %		6.3	4.6	4.2
Ult. Stress, ksf				
Strain, %				
Strain rate, in./min.		0.006	0.006	0.006

Sample Type: In-siu ring
Description: Pale brown to light yellow brown, fine- to coarse-grained Silty Sand with some gravel.

Specific Gravity= 2.70
Remarks:

Figure B-33

Client: RICK ENGINEERING COMPANY

Project: OTAY 2ND PIPELINE PHASE 4

Source of Sample: B-13 **Depth:** 25'
Sample Number: 7
Proj. No.: 223 GS-22 **Date Sampled:** 6/26/2023

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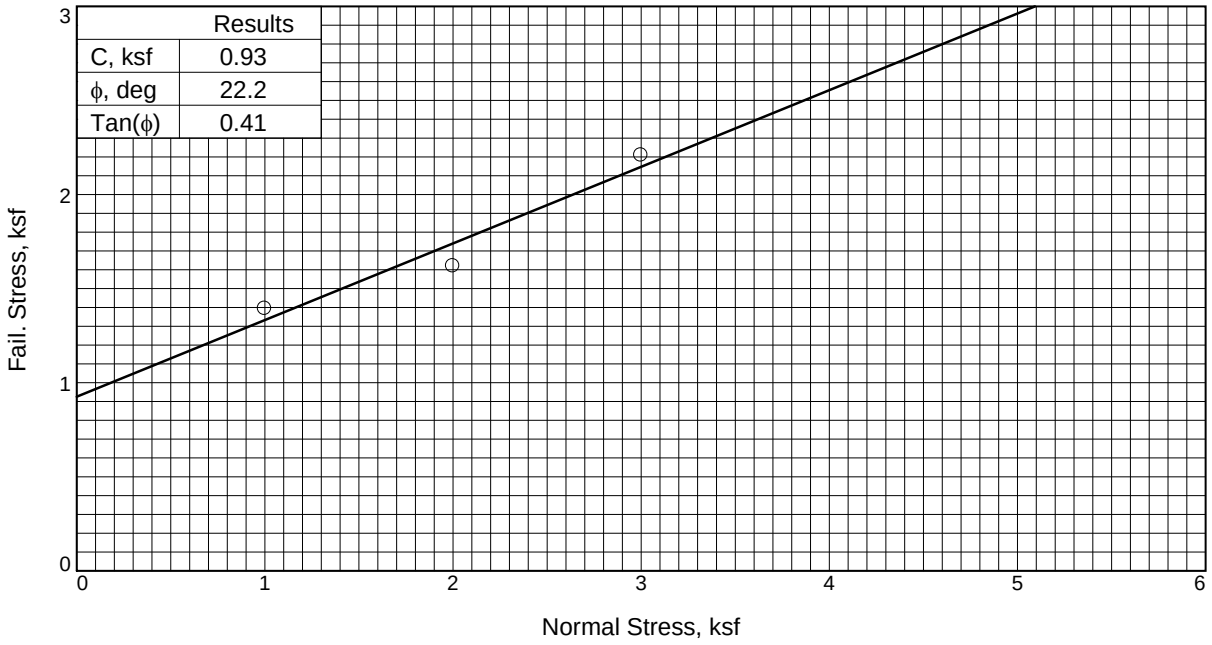

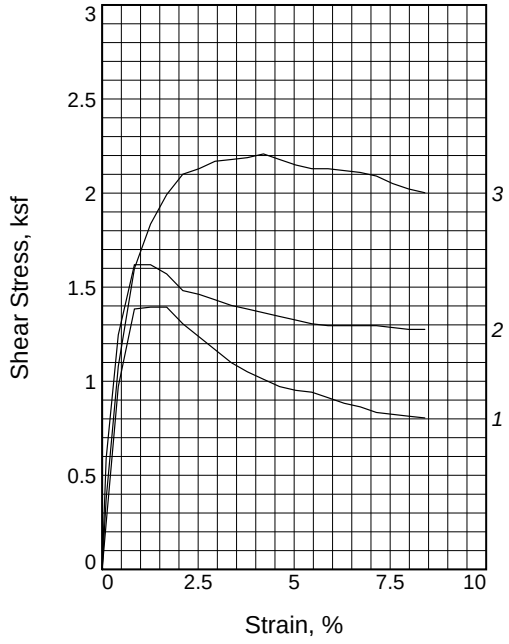

Sample No.		1	2	3
Initial	Water Content, %	17.6	18.5	18.5
	Dry Density, pcf	114.4	108.0	109.8
	Saturation, %	100.3	88.9	93.2
	Void Ratio	0.4733	0.5610	0.5354
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	22.1	24.7	24.2
	Dry Density, pcf	105.9	100.9	101.6
	Saturation, %	100.8	99.4	99.2
	Void Ratio	0.5912	0.6702	0.6582
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.08	1.07	1.08
Normal Stress, ksf		1.00	2.00	3.00
Fail. Stress, ksf		1.39	1.62	2.21
Strain, %		1.3	0.8	4.2
Ult. Stress, ksf				
Strain, %				
Strain rate, in./min.		0.006	0.006	0.006

Sample Type: In-situ ring
Description: Brown to light brown, hard, Claystone (CL/CH)

Specific Gravity= 2.70
Remarks:

Figure B-34

Client: RICK ENGINEERING COMPANY

Project: OTAY 2ND PIPELINE PHASE 4

Source of Sample: B-13 **Depth:** 45'
Sample Number: 11
Proj. No.: 223 GS-22 **Date Sampled:** 6/26/2023

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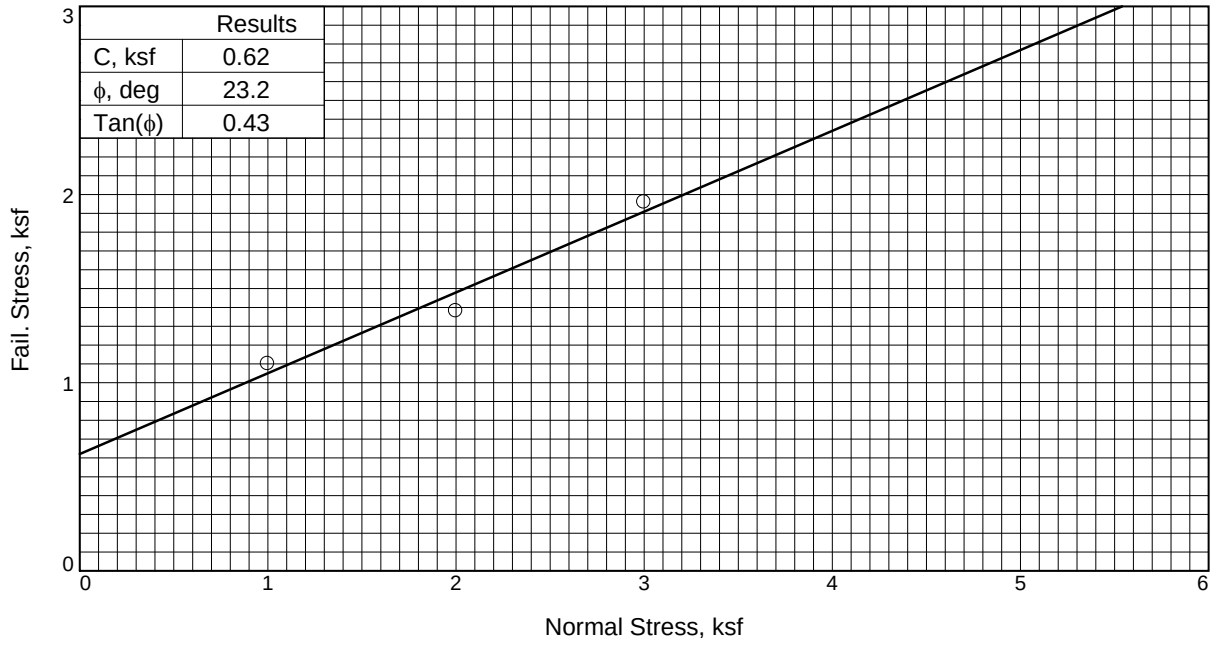

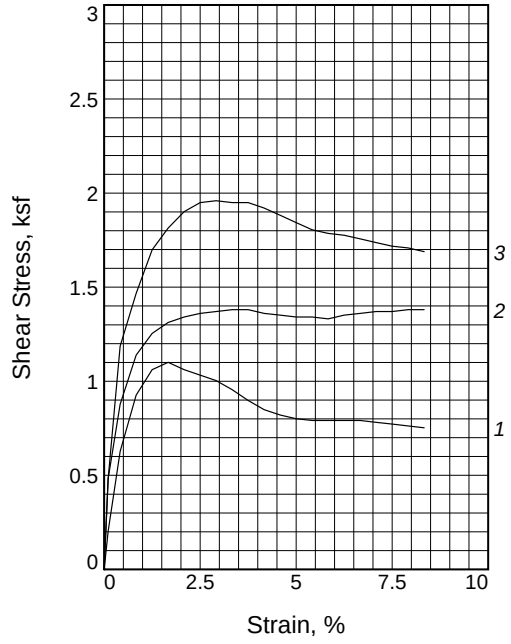

Sample No.		1	2	3
Initial	Water Content, %	20.5	19.6	19.2
	Dry Density, pcf	102.6	103.8	110.5
	Saturation, %	86.1	85.0	98.7
	Void Ratio	0.6433	0.6234	0.5256
	Diameter, in.	2.40	2.40	2.40
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	28.4	28.3	25.8
	Dry Density, pcf	95.0	95.3	99.5
	Saturation, %	99.0	99.3	100.6
	Void Ratio	0.7748	0.7695	0.6934
	Diameter, in.	2.40	2.40	2.40
	Height, in.	1.08	1.09	1.11
Normal Stress, ksf		1.00	2.00	3.00
Fail. Stress, ksf		1.10	1.38	1.96
Strain, %		1.7	3.3	2.9
Ult. Stress, ksf				
Strain, %				
Strain rate, in./min.		0.006	0.006	0.006

Sample Type: In-situ ring
Description: Pinkish gray and light greenish gray, hard, Claystone (CL/CH)

Specific Gravity= 2.70
Remarks:

Client: RICK ENGINEERING COMPANY

Project: OTAY 2ND PIPELINE PHASE 4

Source of Sample: B-13 **Depth:** 75'
Sample Number: 17
Proj. No.: 223 GS-22 **Date Sampled:** 6/26/2023

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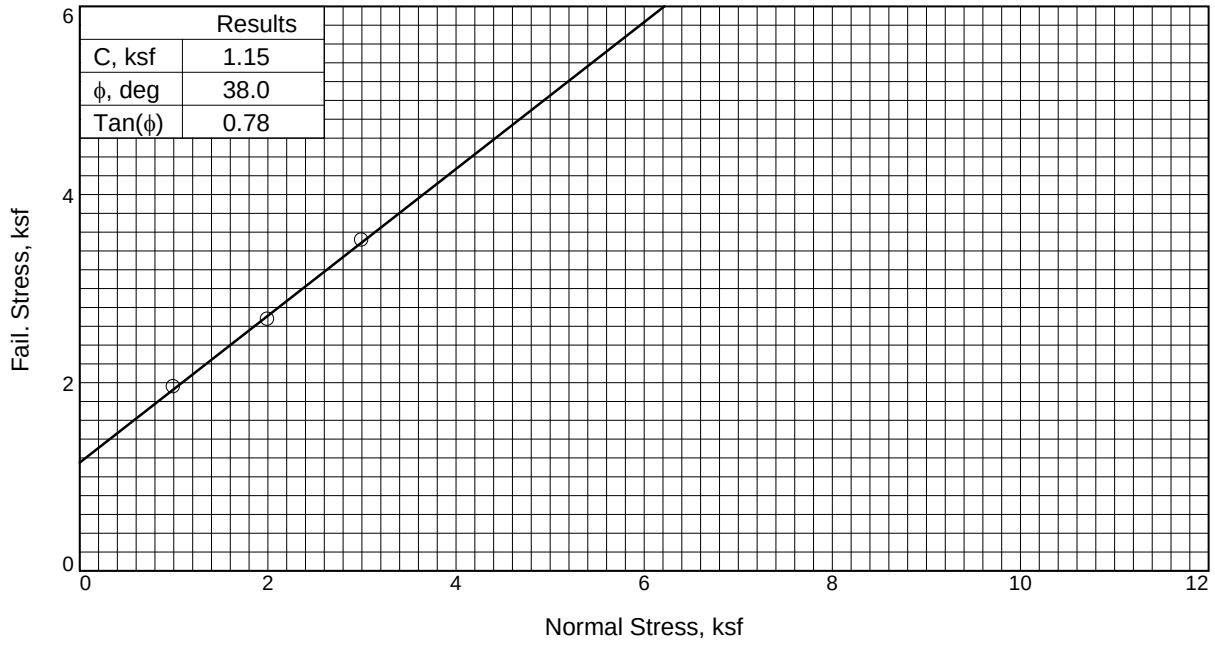
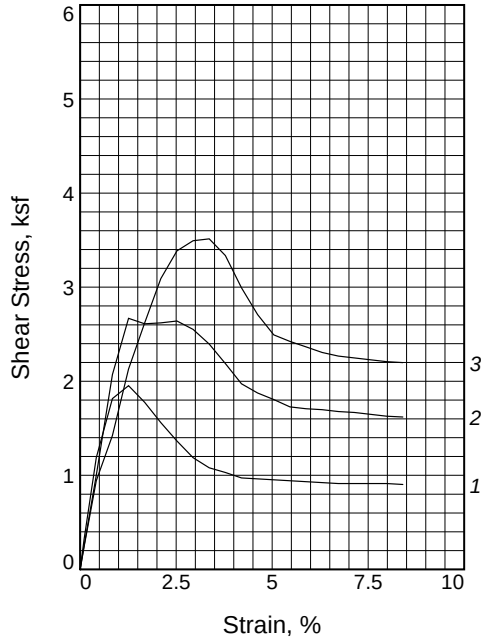
Figure B-35

Tested By: NEB





Sample No.		1	2	3
Initial	Water Content, %	15.2	15.2	15.2
	Dry Density, pcf	119.4	119.1	115.9
	Saturation, %	99.7	98.7	90.5
	Void Ratio	0.4120	0.4151	0.4538
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	16.5	16.3	16.5
	Dry Density, pcf	117.0	116.8	115.9
	Saturation, %	101.2	99.4	98.0
	Void Ratio	0.4403	0.4434	0.4538
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.02	1.02	1.00
Normal Stress, ksf		1.00	2.00	3.00
Fail. Stress, ksf		1.95	2.67	3.51
Strain, %		1.3	1.3	3.4
Ult. Stress, ksf				
Strain, %				
Strain rate, in./min.		0.007	0.007	0.007

Sample Type: In-situ ring
Description: Light yellow brown, fine- to coarse-grained, Silty-Clayey Sand (SC-SM).

Specific Gravity= 2.70
Remarks:

Figure B-36

Client: RICK ENGINEERING COMPANY

Project: OTAY 2ND PIPELINE PHASE 4

Source of Sample: B-14 **Depth:** 45
Sample Number: 11
Proj. No.: 223 GS-22 **Date Sampled:** 10/12/2023

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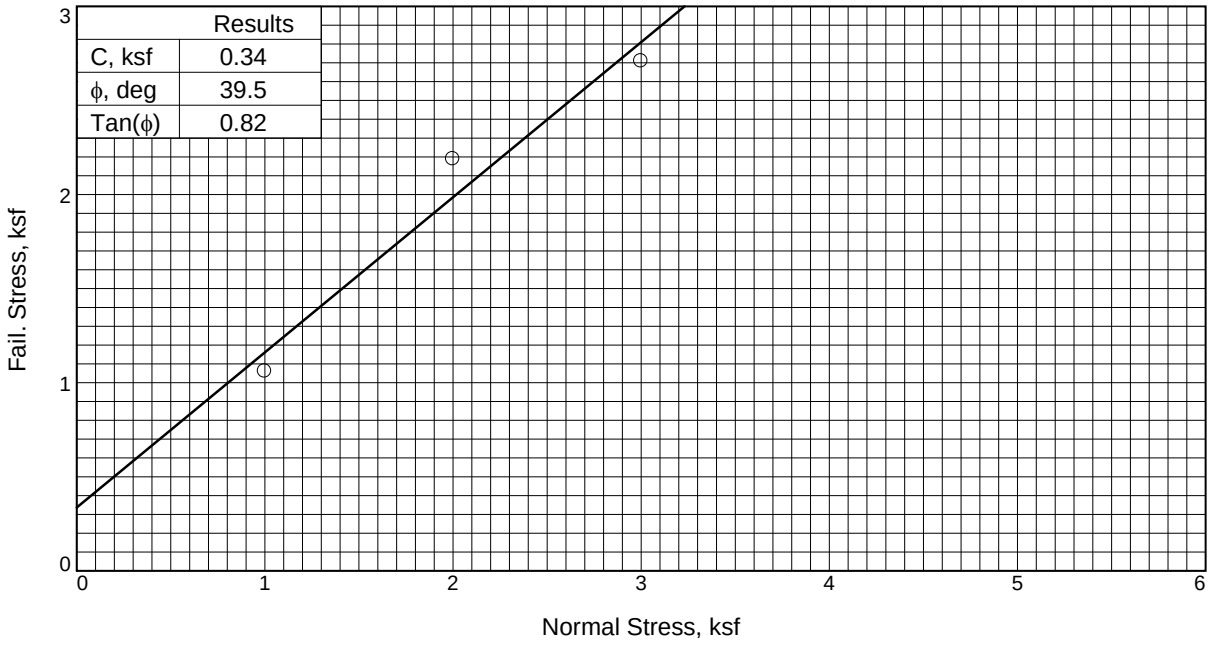
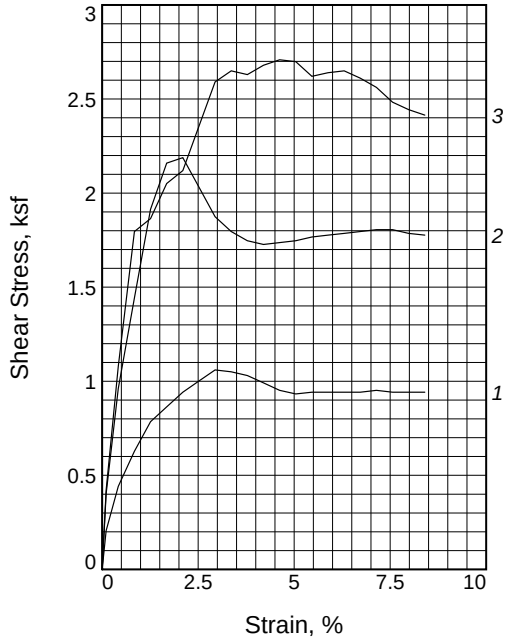
Santee, CA

Tested By: NEB





Sample No.		1	2	3
Initial	Water Content, %	14.1	13.4	13.5
	Dry Density, pcf	99.6	100.4	98.6
	Saturation, %	55.6	53.9	52.1
	Void Ratio	0.6800	0.6656	0.6960
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	24.6	24.0	24.0
	Dry Density, pcf	99.6	100.4	98.6
	Saturation, %	96.9	96.4	92.3
	Void Ratio	0.6800	0.6656	0.6960
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	3.00
Fail. Stress, ksf		1.06	2.19	2.71
Strain, %		2.9	2.1	4.6
Ult. Stress, ksf				
Strain, %				
Strain rate, in./min.		0.007	0.007	0.007

Sample Type: In-situ ring
Description: Light gray, pale olive to pale greenish gray, fine-grained, micaceous, Silty Sand (SM).

Specific Gravity= 2.68
Remarks:

Figure B-37

Client: RICK ENGINEERING COMPANY

Project: OTAY 2ND PIPELINE PHASE 4

Source of Sample: B-15 **Depth:** 5
Sample Number: 1
Proj. No.: 223 GS-22 **Date Sampled:** 10/11/2023

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Santee, CA

Tested By: NEB