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SECTION H

GEOTECHNICAL REPORT

HESPERIA WATERLINE IMPROVEMENT PROJECT

FOR

COUNTY SERVICE AREA (CSA) 70 J OAK HILLS
HESPERIA, CALIFORNIA

PROJECT NO.: 30.30.0173

NOT FOR BID

Converse Consultants
Geotechnical Engineering
Environmental & Groundwater Science
Inspection & Testing Services

GEOTECHNICAL INVESTIGATION REPORT

CSA 70J HESPERIA WATERLINE REPLACEMENT PROJECT

Approximately 2,800 Linear Feet of 12-inch Diameter Pipeline
Along Rodeo Road and Pitzer Avenue
City of Hesperia, San Bernardino County, California
CONVERSE PROJECT NO. 23-81-343-01

Prepared For:
SAN BERNARDINO COUNTY PUBLIC WORKS – SPECIAL DISTRICT
222 West Hospitality Lane, 2nd Floor
San Bernardino, CA 92415-0450

Presented By:
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May 21, 2024

Converse Consultants
Geotechnical Engineering, Environmental & Groundwater Science, Inspection & Testing Services

May 21, 2024

Ms. Deanna Lestina
Project Manager
San Bernardino County Public Works- Special District
222 West Hospitality Lane, 2nd Floor
San Bernardino, CA 92415-0450

Subject: **GEOTECHNICAL INVESTIGATION REPORT**
CSA 70J Hesperia Waterline Replacement Project
Approximately 2,800 Linear Feet of 12-inch Diameter Pipeline
City of Hesperia, San Bernardino County, CA
Converse Project No. 23-81-343-01

Dear Ms. Lestina:

Converse Consultants (Converse) is pleased to submit this Geotechnical Investigation Report for the CSA 70J Hesperia Waterline Replacement (Along Rodeo Road and Pitzer Avenue) project, located in the City of Hesperia, San Bernardino County, California. This report was prepared in accordance with our proposal dated December 26, 2023, and San Bernardino County Purchase Order Number 4100339826 dated February 13, 2024.

Based upon our field investigation, laboratory data, and analyses, the proposed project is considered feasible from a geotechnical standpoint, provided the recommendations presented in this report are incorporated into the design and construction of the project.

We appreciate the opportunity to be of service to San Bernardino County Public Works- Special District. Should you have any questions, please do not hesitate to contact us at 909-474-2847.

CONVERSE CONSULTANTS

Hashmi S. E. Quazi, PhD, PE, GE
Principal Engineer

Dist.: 1-electronic Pdf/Addressee
HSQ/SM/kvg

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PROFESSIONAL CERTIFICATION

This report has been prepared by the following professionals whose seals and signatures appear herein.

The findings, recommendations, specifications and professional opinions contained in this report were prepared in accordance with the generally accepted professional engineering and engineering geologic principle and practice in this area of Southern California. We make no other warranty, either expressed or implied.

Stephen McPherson, GIT
Staff Geologist

Hashmi S. E. Quazi, PhD, PE, GE
Principal Engineer

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1.0 INTRODUCTION

This geotechnical investigation report is prepared for the installation of Approximately 2,800 Linear Feet of 12-inch Diameter Pipeline along Rodeo Road from Topaz Avenue to Pitzner Avenue, and north along Pitzner Avenue approximately 653 linear feet from Rodeo Road to Wells Fargo Street, located in City of Hesperia, San Bernardino County, California. The pipeline alignment is shown in Figure No. 1, *Approximate Pipeline Alignment Locations Map*.

The purposes of this investigation were to determine the nature and engineering properties of the subsurface soils, and to provide geotechnical recommendations for design and construction of the project.

This report is prepared for the project described herein and is intended for use solely by San Bernardino County Public Works- Special District, , and their authorized agents for design purposes. It should not be used as a bidding document but may be made available to the potential contractors for information on factual data only. For bidding purposes, the contractors should be responsible for making their own interpretation of the data contained in this report.

2.0 PROJECT DESCRIPTION

The waterline improvements are located within the City of Hesperia and will be constructed in accordance with San Bernardino Special Districts (District) Standards for Domestic Water System.

The project will include design and construction of approximately 2,800 linear feet of 12-inch diameter waterlines, service lines and their associated meters. The pipe lengths along each street are as follows.

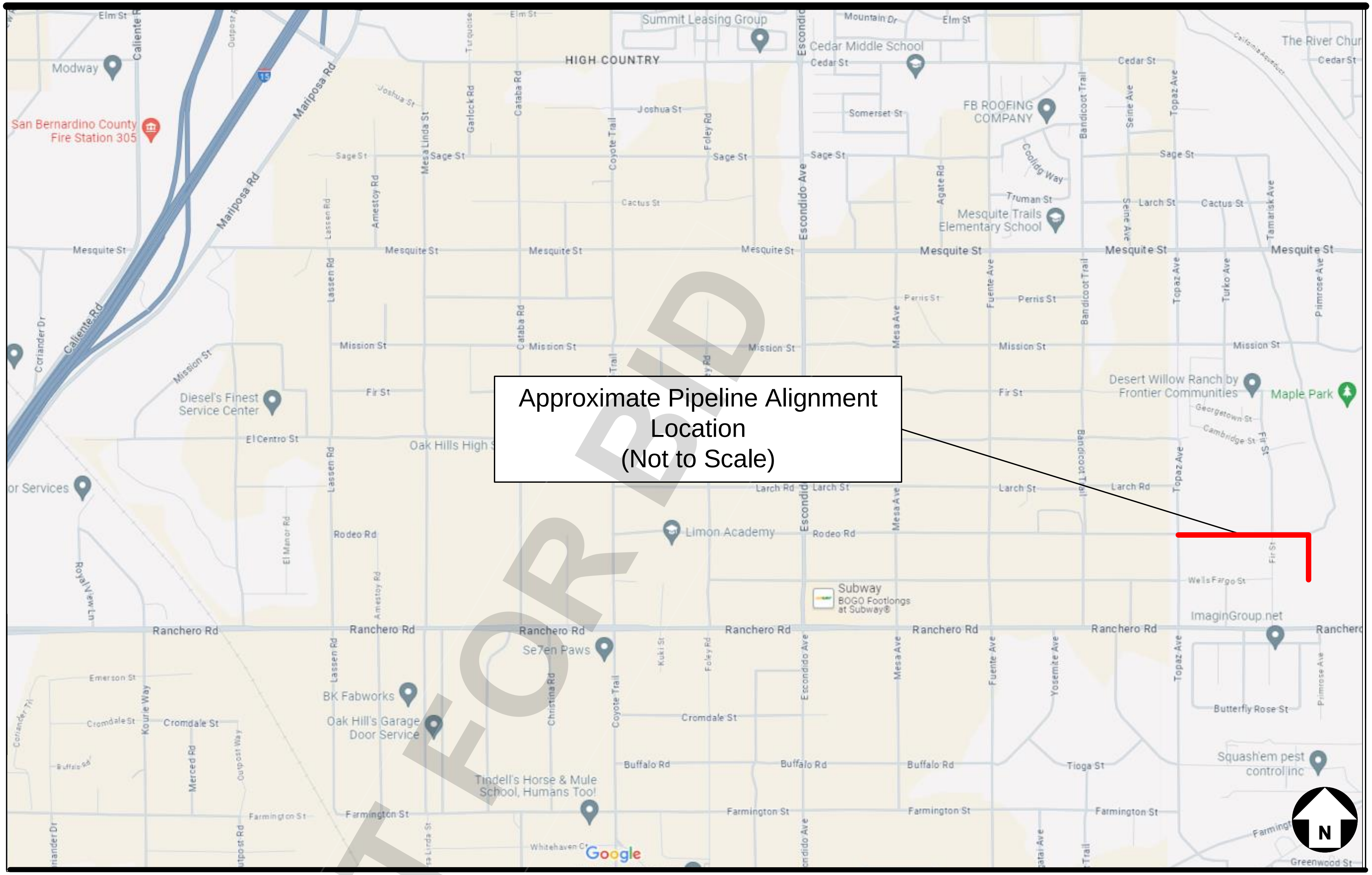
- Rodeo Street: Approximately 2,157 linear feet from Topaz Avenue to Pitzer Avenue.
- Pitzer Avenue: Approximately 653 linear feet of pipeline from Rodeo Street to Wells Fargo Street.

3.0 ALIGNMENT CONDITIONS

The surface conditions of the streets along the pipeline alignments are described below.

Rodeo Road from Topaz Avenue to Pitzner Avenue,

- Un-paved road with 1 lane in each direction. Rural residential homes on the south side of road and vacant lot on north side of road.
- Drilling will require the closure of one lane.



Project: Hesperia Waterline Replacement Project

Location: Approximately 2,800 Linear Feet of 12-inch Diameter Pipeline
City of Hesperia, San Bernardino County, California

For: San Bernardini County Public Works-Special District

Approximate Pipeline alignment Locations Map

Project No.
23-81-101-01

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Figure No.
1

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- Very Light traffic was observed at the time of the visit.

Pitzner Avenue, from Rodeo Road to Wells Fargo Street

- Un-paved road with 1 lane in each direction.
- Vacant lot on both the east and west side of the Avenue.
- High tension high voltage wires to the east of the alignment
- Drilling will require the closure of one lane.
- Very light traffic was observed at time of visit.

Photographs No. 1 and 2 depict the present conditions along Rodeo Road and Pitzner Avenue.

Photograph No. 1, Current alignment conditions at BH-01 on Rodeo Road, view to east.

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Photograph No. 2, Current alignment conditions at BH-04 on Rodeo Road, view to east.

Photograph No. 3, Current alignment conditions at BH-05 on Pitzner Avenue, view to north.

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4.0 SCOPE OF WORK

The scope of this investigation included project set-up, subsurface exploration, laboratory testing, engineering analysis, and preparation of this report as described in the following sections.

4.1 Project Set-up

As part of the project set-up, staff personnel from our office conducted the following.

- Obtained a permit from the City of Hesperia.
- Coordinated access to the project area with you and the District representative.
- Conducted a field reconnaissance to map the surface condition and stake/mark subsurface locations in the field such that drill rig access to all the locations is available.
- Notified Underground Service Alert (USA) at least 48 hours prior to drilling to clear the boring locations of any conflict with existing underground utilities.
- Engaged a California licensed driller**.**

4.2 Subsurface Exploration

On April 5, 2024, Converse Consultants was scheduled to drill five exploratory borings (BH-01 through BH-05). The drillers encountered and penetrated an unmarked 12-inch-high pressure water line belonging to the County of San Bernardino. Drilling was canceled and rescheduled for April 9, 2024.

Five exploratory borings (BH-01 through BH-05) were drilled on April 9, 2024, and along the pipeline alignment to investigate the present subsurface conditions. The borings were drilled to depths between 15.5 and 16.5 feet below ground surface (bgs). The borings were drilled using a truck-mounted drill rig equipped with 8-inch diameter hollow-stem augers. Boring details are presented in Table No. 1, *Summary of Borings* below.

Table No. 1, Summary of Borings

Boring No.	Street Name	Coordinates	Proposed Depth (ft)	Drilled Depth (ft)
BH-01	Rodeo Road	34.3868 °N, 117.3548°W	15.0	15.5
BH-02	Rodeo Road	34.3868°N, 117.3529°W	15.0	16.0
BH-03	Rodeo Road	34.3868°N, 117.3514°W	15.0	16.5
BH-04	Rodeo Road	34.3868°N, 117.3496°W	15.0	16.5
BH-05	Pitzner Avenue	34.3859°N, 117.3487°W	15.0	16.5

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Approximate boring locations are indicated in Figure No. 2, *Approximate Boring Locations Map*. For a description of the field exploration and sampling program, see Appendix A, *Field Exploration*.

4.3 Laboratory Testing

Representative soil samples of the pipeline alignments were tested in the laboratory to aid in the soils classification and to evaluate the relevant engineering properties of the soils. These tests included the following.

- In-situ moisture contents and dry densities (ASTM D2216-19 and 2937-17e2)
- Expansion index (EI) (ASTM D4829-21)
- Sand Equivalent (SE) (ASTM 2419-22)
- R-value (R) (California Test CT301)
- Soil corrosivity (CR) (California Tests 643, 422, and 417)
- Grain size distribution (PA) (ASTM D6913/D6913M-17)
- Maximum dry density and optimum-moisture content (CP) (ASTM D1557-12(2021))
- Direct shear strength (DS) (ASTM D3080/D3080M-23)

For *in-situ* moisture and dry density data, see the Logs of Boring in Appendix A, *Field Exploration*. For a description of the laboratory test methods and test results, see Appendix B, *Laboratory Testing Program.*

4.4 Analysis and Report Preparation

Data obtained from the field exploration and laboratory testing program was compiled and evaluated. Geotechnical analyses of the compiled data were performed, and this report was prepared to present our findings, conclusions, and recommendations for the project.

5.0 SURFACE AND SUBSURFACE CONDITIONS

A general description of the surface and subsurface conditions, various materials and groundwater conditions encountered at each location during our field exploration is discussed below.

5.1 Subsurface Profile

Based on the exploratory borings and laboratory test results, the subsurface soils consist primarily of a mixture of sand, silty sand, gravel and cobbles. Scattered to few gravels up to 3 inches in maximum dimension and scattered cobbles up to 3.5 inches in largest dimension was encountered in the borings.

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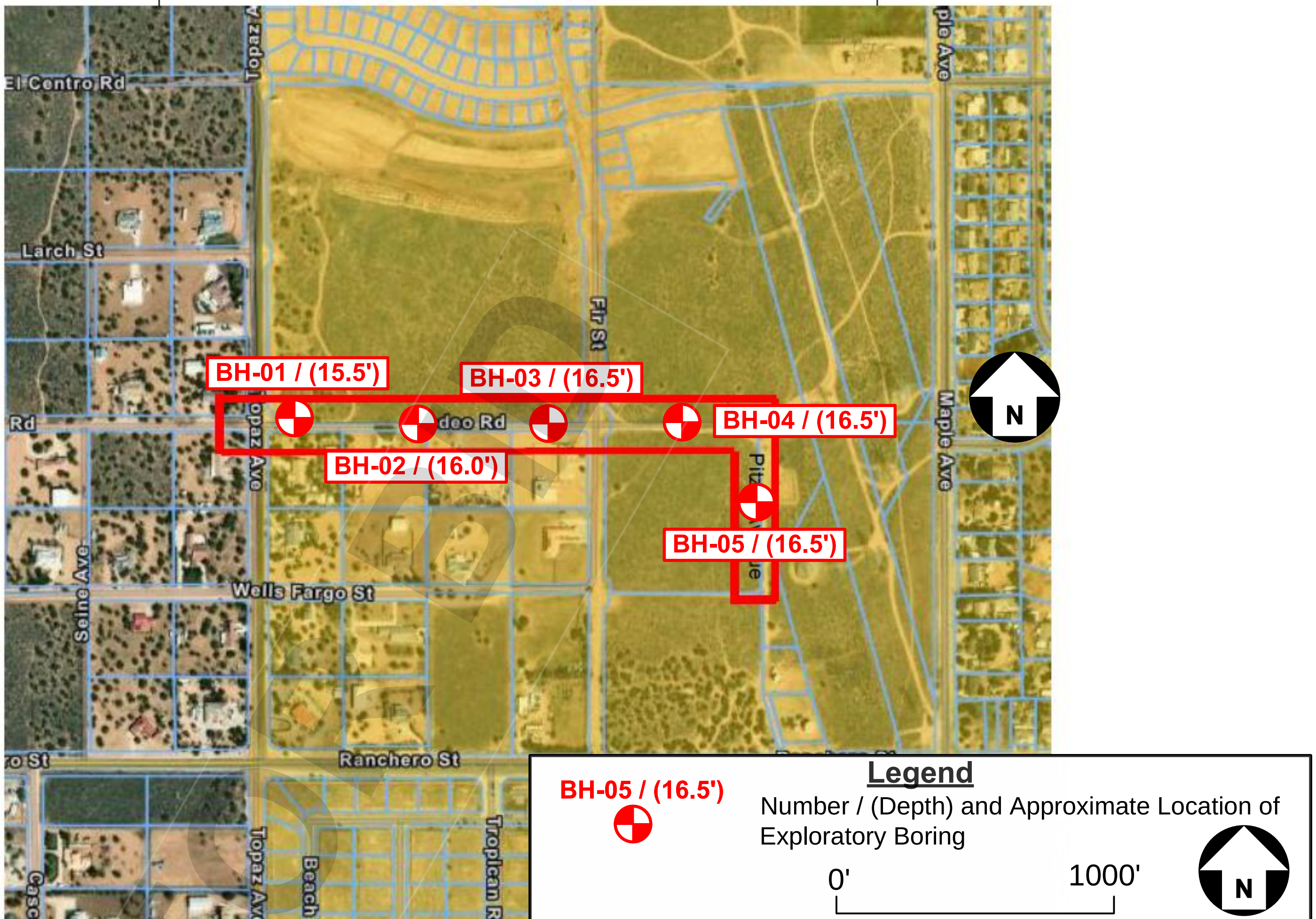
Exhibit A



SAN BERNARDINO COUNTY
DEPARTMENT OF PUBLIC WORKS
SPECIAL DISTRICTS

CSA 70J

SAN BERNARDINO COUNTY

LOCATION MAP

CSA 70J HESPERIA WATERLINE IMPROVEMENT PROJECT
Hesperia, CA

Project: Hesperia Waterline Replacement Project
Location: Approximately 2,800 Linear Feet of 12-inch Diameter Pipeline
City of Hesperia, San Bernardino County, California

For: San Bernardini County Public Works-Special District

Approximate Boring Locations Map

Project No.
23-81-101-01

Converse Consultants

Figure No.
2

Discernible fill soils were not identified in our subsurface exploration; however, the site may have been previously graded for the existing pavement and fill soil is likely present. If present, the fill soils were likely derived from on-site sources and are similar to the native alluvial soils in composition and density.

For a detailed description of the subsurface materials encountered in the exploratory borings, see Drawings No. A-2 through A-6 *Logs of Borings,* in Appendix A, *Field Exploration.*

5.2 Expansive Soils

Expansive soils are characterized by their ability to undergo significant volume changes (shrink or swell) due to variations in moisture content. Changes in soil moisture content can result from precipitation, landscape irrigation, utility leakage, roof drainage, perched groundwater, drought, or other factors and may result in unacceptable settlement or heave of structures or concrete slabs supported on grade. Depending on the extent and location below finish subgrade, expansive soils can have a detrimental effect on structures.

Based on the laboratory test results, the expansion indices of the upper 0 to 10 feet soils ranged from 4 to 13, corresponding to very low expansion potentials.

5.3 Excavatability

The subsurface soil materials are expected to be excavatable by conventional heavy-duty earth moving and trenching equipment. <u>Excavation will likely be difficult where concentration of gravel and cobbles are encountered.</u>

The phrase "conventional heavy-duty excavation equipment" is intended to include commonly used equipment such as excavators and trenching machines. It does not include hydraulic hammers ("breakers"), jackhammers, blasting, or other specialized equipment and techniques used to excavate hard earth materials. Selection of an appropriate excavation equipment model should be done by an experienced earthwork contractor and may require test excavations in representative areas.

5.4 Subsurface Variations

Based on results of the subsurface exploration and our experience, some variations in the continuity and nature of subsurface conditions within the pipeline alignments should be anticipated. Because of the uncertainties involved in the nature and depositional characteristics of the earth material, care should be exercised in interpolating or extrapolating subsurface conditions between or beyond the boring locations.

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6.0 LABORATORY TEST RESULTS

Results of physical and chemical tests performed for this project are presented below.

6.1 Physical Testing

Discussions of the various test results are presented below.

- In-situ Moisture and Dry Density – *In-situ* dry density and moisture content of the alignment soils were determined in accordance with ASTM D2216-19 and 2937-17e2. Dry densities of the upper 10 feet soils ranged from 96 to 130 pounds per cubic foot (pcf) with moisture contents of 3 to 10 percent. Results are presented in the log of borings in Appendix A, *Field Exploration.*
- Expansion Index (EI) – Two representative soil samples were tested to evaluate the expansion potential in accordance with ASTM Standard D4829-21. The test results showed an EI of 4 and 13, corresponding to very low expansion potential.
- Sand Equivalent (SE) – Two representative bulk soil samples were tested to evaluate sand equivalent (SE) in accordance with the ASTM Standard 2419-22 test method. The measured sand equivalent test results were 16 and 24.
- R-Value (R) – One representative bulk sample was tested in accordance with Caltrans Test Method 301. The results of the R-value test was 72.
- Grain Size Analysis (PA) – Three representative soil samples were tested to determine the relative grain size distribution in accordance with the ASTM Standard ASTM D6913/D6913M-17. The test results are graphically presented in Drawing No. B-1, *Grain Size Distribution Results.*
- Maximum Dry Density and Optimum Moisture Content (CP) – Typical moisture-density relationship test was conducted on one representative sample in accordance with ASTM D1557-12(2021). The test results are presented in Drawing No. B-2, *Moisture-Density Relationship Results*, in Appendix B, *Laboratory Testing Program*. The laboratory maximum dry density was 133.0 (135.0 with rock correction) pcf and the optimum moisture content of 6.5 (6.0 with rock correction).
- Direct Shear (DS) – Two direct shear tests were performed in accordance with ASTM Standard ASTM D3080/D3080M-23 on relatively undisturbed ring samples under soaked condition. The test results are presented in Drawing No. B-3 and B-4, *Direct Shear Test Results* in Appendix B, *Laboratory Testing Program*.

For additional information on the subsurface conditions, see the Logs of Borings in Appendix A, *Field Exploration*.

6.2 Chemical Testing - Corrosivity Evaluation

One representative soil sample was tested to determine minimum electrical resistivity, pH, chemical contents, including soluble sulfate and chloride concentrations. The purpose of these tests was to determine the corrosion potential of the alignment soils when placed

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in contact with common pipe materials. The tests were performed by Keegan Labs (Pomona, CA) in accordance with California Test Methods 643, 422, and 417. The test results are presented in Appendix B, *Laboratory Testing Program* and summarized below.

- The pH measurements of the tested sample was 7.4.
- The sulfate contents of the tested sample was 0.0025 percent by weight (25 ppm).
- The chloride concentrations of the tested sample was 28 ppm.
- The minimum electrical resistivity when saturated was 9,550 ohm-cm.

7.0 EARTHWORK RECOMMENDATIONS

Earthwork recommendations for the project are presented below.

7.1 General

This section contains our general recommendations regarding earthwork and grading for the proposed improvements. These recommendations are based on the results of our field exploration, laboratory tests, our experience with similar projects, and data evaluation as presented in the preceding sections. These recommendations may require modification by the geotechnical consultant based on findings during the final investigation or observation of the actual field conditions during grading.

All existing underground utilities and appurtenances (if any) should be located at the site. Such utilities should either be protected in-place or removed and replaced during construction as required by the project specifications. All excavations should be conducted in such a manner as not to cause loss of bearing and/or lateral support of existing structures or utilities.

Migration of fines from the surrounding native soils, in the case of water leaks from the pipe, must be considered in selecting the gradation of the materials placed within the trench, including bedding, pipe zone and trench zone backfill, as defined in the following sections. Such migration of fines may deteriorate pipe support and may result in settlement/ground loss at the surface.

It should be the responsibility of the contractor to maintain safe working conditions during all phases of construction.

Observations and field tests should be performed by the project soils consultant to confirm that the required degree of compaction has been obtained. Where compaction is less than specified, additional compaction effort should be made with adjustment of the moisture content as necessary, until the specified compaction is obtained.

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7.2 Pipeline Subgrade Preparation

The final subgrade surface should be level, firm, uniform, free of loose materials, and properly graded to provide uniform bearing and support to the entire section of the pipe placed on bedding material. Protruding oversize particles, larger than 3 inches in dimension, if any, should be removed from the trench bottom and replaced with compacted on-alignment materials.

Any loose, soft and/or unsuitable materials encountered at the pipe sub-grade should be removed and replaced with an adequate bedding material.

During the digging of depressions for proper sealing of the pipe joints, the pipe should rest on a prepared bottom as near its full length as is practicable.

7.3 Pipe Bedding

Bedding is defined as the material supporting and surrounding the pipe to 1 foot above the pipe. Pipe bedding should follow City of Hesperia Standards Drawing S-2 (attached in Appendix C). Additional information for pipe bedding is provided below.

To provide uniform and firm support for the pipe, compacted granular materials such as clean sand, gravel or ¾-inch crushed aggregate, or crushed rock may be used as pipe bedding material. The sand equivalent of the site soils was tested and found to be 16 to 24. Typically, soils with sand equivalent value of 30 or more are used as pipe bedding material. The pipe designer should determine if the soils are suitable as pipe bedding material.

The type and thickness of the granular bedding placed underneath and around the pipe, if any, should be selected by the pipe designer. The load on the rigid pipes and deflection of flexible pipes and, hence, the pipe design, depends on the type and the amount of bedding placed underneath and around the pipe.

Bedding materials should be vibrated in-place to achieve compaction. Care should be taken to densify the bedding material below the spring line of the pipe. Prior to placing the pipe bedding material, the pipe subgrade should be uniform and properly graded to provide uniform bearing and support to the entire section of the pipe placed on bedding material. During the digging of depressions for proper sealing of the pipe joints, the pipe should rest on a prepared bottom as near its full length as is practicable.

Migration of fines from the surrounding native and/or fill soils must be considered in selecting the gradation of any imported bedding material. We recommend that the pipe bedding material should satisfy the following criteria to protect migration of fine materials.

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i. $\frac{D15(F)}{D85(B)} \leq 5$

ii. $\frac{D50(F)}{D50(B)} < 25$

iii. Bedding Materials must have less than 5 percent passing No. 200 sieve (0.0074 mm) to avoid internal movement of fines.

Where,
F = Bedding Material
B = Surrounding Native and/or Fill Soils
*D*15(F) = Particle size through which 15% of bedding material will pass
*D*85(B) = Particle size through which 85% of surrounding soil will pass
*D*50(F) = Particle size through which 50% of bedding material will pass
*D*50(B) = Particle size through which 50% of surrounding soil will pass

If the above criteria do not satisfy, commercially available geofabric used for filtration purposes (such as Mirafi 140N or equivalent) may be wrapped around the bedding material encasing the pipe to separate the bedding material from the surrounding native or fill soils.

7.4 Trench Zone Backfill

The trench zone is defined as the portion of the trench above the pipe bedding extending up to the final grade level of the trench surface. Excavated on-site soils free of oversize particles and deleterious matter may be used to backfill the trench zone. Trench zone backfill should follow City of Hesperia Standard drawings S-6 and ST-6 (attached in Appendix C). Additional trench backfill recommendations are presented below.

- Trench excavations to receive backfill should be free of trash, debris or other unsatisfactory materials at the time of backfill placement.
- Trench zone backfill should be compacted to at least 90 percent of the laboratory maximum dry density as per ASTM D1557 test method. At least the upper 1 foot of trench backfill underlying pavement should be compacted to at least 95 percent of the laboratory maximum dry density as per ASTM D1557 test method.
- Particles larger than 1 inch should not be placed within 12 inches of the pavement subgrade. No more than 30 percent of the backfill volume should be larger than ¾-inch in the largest dimension. Gravel should be well mixed with finer soil. Rocks larger than 3 inches in the largest dimension should not be placed as trench backfill.
- Trench backfill should be compacted by mechanical methods, such as sheepsfoot, vibrating or pneumatic rollers or mechanical tampers to achieve the density specified herein. The backfill materials should be brought to within ± 3 percent of optimum moisture content for coarse-grained soil, and between optimum and 2 percent above optimum for fine-grained soil, then placed in horizontal layers. The

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thickness of uncompacted layers should not exceed 8 inches. Each layer should be evenly spread, moistened or dried as necessary, and then tamped or rolled until the specified density has been achieved.

- The contractor should select the equipment and processes to be used to achieve the specified density without damage to adjacent ground, structures, utilities and completed work.
- The field density of the compacted soil should be measured by the ASTM D1556 (Sand Cone) or ASTM D6938 (Nuclear Gauge) or equivalent.
- Trench backfill should not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations should not resume until field tests by the project's geotechnical consultant indicate that the moisture content and density of the fill are in compliance with project specifications.

8.0 DESIGN RECOMMENDATIONS

General design recommendations, resistance to lateral loads, pipe design parameters, bearing pressures, and soil corrosivity are discussed in the following subsections.

8.1 General

Where pipes connect to rigid structures and are subjected to significant loads as the backfill is placed to finish grade, we recommend that provisions be incorporated in the design to provide support of these pipes where they exit the structures. Consideration can be given to flexible connections, concrete slurry support beneath the pipes where they exit the structures, overlaying the pipes with a few inches of compressible material, (i.e., Styrofoam, or other materials), or other techniques.

The various design recommendations provided in this section are based on the assumption that the above earthwork recommendations will be implemented.

8.2 Resistance to Lateral Loads

Resistance to lateral loads can be assumed to be provided by passive earth pressures and friction between construction materials and native soils. The resistance to lateral loads were estimated by using on-site native soils strength parameters obtained from laboratory testing. The resistance to lateral loads recommended for use in design of thrust blocks are presented in the following table.

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Table No. 2, Resistance to Lateral Loads

Soil Parameters	Value
Passive earth pressure (psf per foot of depth)	240
Maximum allowable bearing pressure against native soils (psf)	2,500
Coefficient of friction between formed concrete and native soils, fs	0.30

8.3 Soil Parameters for Pipe Design

Structural design requires proper evaluation of all possible loads acting on pipe. The stresses and strains induced on buried pipe depend on many factors, including the type of soil, density, bearing pressure, angle of internal friction, coefficient of passive earth pressure, and coefficient of friction at the interface between the backfill and native soils. The recommended values of the various soil parameters for design are provided in the following table.

Table No. 3, Soil Parameters for Pipe Design

Soil Parameters	Value
Average compacted fill total unit weight (assuming 92% relative compaction), γ (pcf)	130
Angle of internal friction of soils, ϕ	28
Soil cohesion, c (psf)	50
Coefficient of friction between concrete and native soils, fs	0.35
Coefficient of friction between PVC pipe and native soils, fs	0.25
Bearing pressure against native soils (psf)	2,500
Coefficient of passive earth pressure, Kp	2.77
Coefficient of active earth pressure, Ka	0.36
Modulus of Soil Reaction E' (psi)	1,500

8.4 Bearing Pressure for Anchor and Thrust Blocks

An allowable net bearing pressure presented in Table No. 3, *Soil Parameters for Pipe Design* may be used for anchor and thrust block design against alluvial soils. Such thrust blocks should be at least 18 inches wide.

If normal code requirements are applied for design, the above recommended bearing capacity and passive resistances may be increased by 33 percent for short duration loading such as seismic or wind loading.

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8.5 Soil Corrosivity

One representative soil sample was evaluated for corrosivity with respect to common construction materials such as concrete and steel. The test results are presented in Appendix B, *Laboratory Testing Program* and general discussion pertaining to soil corrosivity are presented below.

The sulfate contents of the sampled soils correspond to American Concrete Institute (ACI) exposure category S0 for these sulfate concentrations (ACI 318-19, Table 19.3.1.1). No concrete type restrictions are specified for exposure category S0 (ACI 318-19, Table 19.3.2.1). A minimum compressive strength of 2,500 psi is recommended.

We anticipate that concrete will be exposed to moisture from precipitation and irrigation. Based on the project location and the results of chloride testing of the soils, we do not anticipate that concrete structures will be exposed to external sources of chlorides, such as deicing chemicals, salt, brackish water, or seawater. ACI specifies exposure category C1 where concrete is exposed to moisture, but not to external sources of chlorides (ACI 318-19, Table 19.3.1.1). ACI provides concrete design recommendations in ACI 318-19, Table 19.3.2.1, including a compressive strength of at least 2,500 psi and a maximum chloride content of 0.3 percent.

Figure 3, *Soil Corrosivity Classification*, provides general guidelines of soil corrosion.

The measured value of the minimum electrical resistivity of the sample when saturated was 9,550 Ohm-cm. This indicates that the soils tested were moderately corrosive to ferrous metals in contact with the soils (Romanoff, 1957). Converse does not practice in the area of corrosion consulting. If needed, a qualified corrosion consultant should provide appropriate corrosion mitigation measures for any ferrous metals in contact with the site and site soils.

8.6 Asphalt Concrete Pavement

One representative soil sample was tested to determine the R-value of the subgrade soils. Based on laboratory testing, R-values was found 72. For pavement design, we have utilized an R-value of 50 and design Traffic Indices (TIs) ranging from 8 to 11.

Based on the above information, asphalt concrete and aggregate base thickness are determined using the *Caltrans Highway Design Manual (Caltrans, 2020)*, Chapter 630 with a safety factor of 0.2 for asphalt concrete/aggregate base Section and 0.1 for full depth asphalt concrete section. Preliminary asphalt concrete pavement sections for each street are presented in the following table.

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SOIL CORROSIVITY CLASSIFICATION

The tables provided in this document are intended to provide generalized guidelines for soil corrosivity classification. This information may be used to highlight conditions where soil corrosivity concerns should be elevated and mitigation should be employed. This information is not a substitute for professional engineering design.

Electrical Resistivity of Soil

Soil Resistivity (ohm-cm)	Corrosivity Category
Greater than 10,000	Mildly Corrosive
2,001 to 10,000	Moderately Corrosive
1,001 to 2,000	Corrosive
0 to 1,000	Severely Corrosive

Note: Variations in resistivity of an order of magnitude or more at the same site can increase corrosivity.

Sulfate in Soil per ACI 318

Sulfate Level (mg/kg)	Classification
Less than 1,000 (<0.1%)	Negligible
1,000 to 2,000 (0.1 to 0.2%)	Moderate
2,000 to 20,000 (0.2 to 2.0%)	Severe
Over 20,000 (>2.0%)	Very Severe

Chloride in Soil

Concentration (mg/kg)	Classification
ND to 100	Negligible
100 to 350	Little Added Concern
350 to 500	Potential Concern
Over 500	Definite Concern

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pH

pH Range	Description
<3.5	Ultra Acidic
3.5 to 4.4	Extremely Acidic
4.5 to 5.0	Very Strongly Acidic
5.1 to 5.5	Strongly Acidic*
5.6 to 6.0	Moderately Acidic
6.1 to 6.5	Slightly Acidic
6.6 to 7.3	Neutral
7.4 to 7.8	Slightly Alkaline
7.9 to 8.4	Moderately Alkaline
8.5 to 9.0	Strongly Alkaline
>9.0	Very Strongly Alkaline

*This range and below should have total acidity testing performed to evaluate corrosivity.
pH less than 5.5 and greater than 8.5 can be aggressive to aluminum.

Nitrate and Ammonium

Range	Classification
Nitrate Greater than 50 mg/kg	Aggressive to copper
Ammonium Greater than 20 mg/kg	Aggressive to copper

Qualitative Sulfide (Iodine-Azide Test)

Result	Classification
Positive	Severely corrosive to all metals used in construction.
Negative	Negligible

Oxidation-Reduction Potential (Redox)

Range	Classification
Greater than 100 millivolts (mV)	Negligible
Between 0 and 100 mV	Moderate
Negative	Severe

Moisture Content

Range	Classification
Dry	Negligible
Moist	Moderate
Wet	Severe

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Keegan Lab, LLC 465 W. Alvarado St., Pomona, CA 91768 (951) 203-6581
james@keeganlab.com

Figure 3b

Table No. 5, Recommended Preliminary Pavement Sections

R-value	Traffic Index (TI)	Pavement Section		
		Asphalt Concrete (inches)	Aggregate Base (inches)	Full AC Section (inches)
50	8	4.0	7.0	7.5
	9	5.0	7.5	8.5
	10	6.0	8.0	9.5
	11	7.0	8.0	10.5

Pavement sections should follow the City of Hesperia Standard Plans or Table No. 5, *Recommended Preliminary Pavement Sections*, whichever is applicable. At or near the completion of grading, the subgrade should be tested to evaluate the actual subgrade R-value for final pavement design.

Prior to placement of aggregate base or asphalt concrete, at least the upper 12 inches of subgrade soils should be scarified, moisture-conditioned if necessary, and recompacted to at least 95 percent of the laboratory maximum dry density as defined by ASTM Standard D1557 test method.

Base materials should conform to Section 200-2.2,"*Crushed Aggregate Base*," of the current Standard Specifications for Public Works Construction (SSPWC; Public Works Standards, 2021) or the City of Hesperia Standard, whichever is applicable and should be placed in accordance with Section 301-2 of the SSPWC.

Asphaltic concrete materials should conform to Section 203 of the SSPWC or the City of Hesperia Standard, whichever is applicable and should be placed in accordance with Section 302-5 of the SSPWC.

9.0 CONSTRUCTION CONSIDERATIONS

Construction recommendations are presented below.

9.1 General

Prior to the start of construction, all existing underground utilities should be located along the pipeline alignment. Such utilities should either be protected in-place or removed and replaced during construction as required by the project specifications.

Vertical braced excavations are feasible along the pipeline alignment. Sloped excavations may not be feasible in locations adjacent to existing utilities (if any).

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Where the side of the excavation is a vertical cut, it should be adequately supported by temporary shoring to protect workers and any adjacent structures.

All applicable requirements of the California Construction and General Industry Safety Orders, the Occupational Safety and Health Act, current amendments, and the Construction Safety Act should be met. The soils exposed in cuts should be observed during excavation by the owner's representative and the competent person employed by the contractor in accordance with regulations. If potentially unstable soil conditions are encountered, modifications of slope ratios for temporary cuts may be required.

9.2 Temporary Sloped Excavations

Temporary open-cut trenches may be constructed in areas not adjacent to existing underground utilities improvements with side slopes as recommended in the table below. Temporary cuts encountering soft and wet fine-grained soils, dry loose, cohesionless soils, or loose fill from trench backfill may have to be constructed at a flatter gradient than presented below.

Table No. 6, Slope Ratios for Temporary Excavations

Soil Type	OSHA Soil Type	Depth of Cut (feet)	Recommended Maximum Slope (Horizontal:Vertical)[1]
Silty Sand (SM), Sand (SP) and Clayey Sand (SC)	C	0-10	1.5:1
		10-20	2:1

[1] Slope ratio is assumed to be constant from top to toe of slope, with level adjacent ground.

For shallow excavations up to 4 feet bgs, wall slope can be vertical. For steeper temporary construction slopes or deeper excavations, or unstable soil encountered during the excavation, shoring or trench shields should be provided by the contractor as necessary to protect the workers in the excavation.

Surfaces exposed in sloped excavations should be kept moist but not saturated to retard raveling and sloughing during construction. Adequate provisions should be made to protect the slopes from erosion during periods of rainfall. Surcharge loads, including construction materials, should not be placed within 5 feet of the unsupported slope edge. Stockpiled soils with a height higher than 6 feet will require greater distance from trench edges.

9.3 Shoring Design

Temporary shoring will be required where open sloped excavations will not be feasible due to unstable soils or due to nearby existing structures or facilities. Temporary shoring may consist of conventional soldier piles and lagging or sheet piles or any piles selected by contractor. The shoring for the pipe excavations may be laterally supported by walers and cross bracing or may be cantilevered. Drilled excavations for soldier piles will require

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the use of drilling fluids to prevent caving and to maintain an opened hole for pile installation.

The active earth pressure behind any shoring depends primarily on the allowable movement, type of backfill materials, backfill slopes, wall inclination, surcharges, and any hydrostatic pressures.

The lateral earth pressures to be used in the design of shoring is presented in the following table.

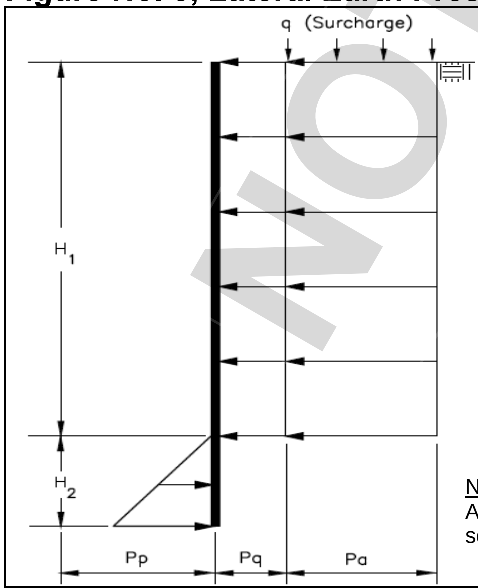
Table No. 7, Lateral Earth Pressures for Temporary Shoring

Lateral Resistance Soil Parameters*	Value
Active Earth Pressure (Braced Shoring) (psf) (A)	33
Active Earth Pressure (Cantilever Shoring) (psf) (B)	50
At-Rest Earth Pressure (Cantilever Shoring) (psf) (C)	70
Passive earth pressure (psf per foot of depth) (D)	240
Maximum allowable bearing pressure against native soils (psf) (E)	2,500
Coefficient of friction between sheet pile and native soils, fs (F)	0.25

* Parameters A through F are used in Figures No. 7 and 8 on the next page.

Restrained (braced) shoring systems should be designed based on Figure No. 3, *Lateral Earth Pressures for Temporary Braced Excavation* to support a uniform rectangular lateral earth pressure.

Figure No. 3, Lateral Earth Pressures for Temporary Braced Excavation



Total Earth Pressure, P

P = Pq + Pa

Pq = 0.5q - incremental surcharge pressure

Pa = (A)H$_1$ - active earth pressure (Braced walls)

Lateral Pressure Resistance

Pp = (D) H$_2$ ≤ (E) psf - passive earth pressure (on native soils)

μ = (F) - ultimate friction coefficient between steel sheet piles and soil

Note:
All values of height (H) in feet, pressure (P) and surcharge (q) in pounds per square foot (psf).

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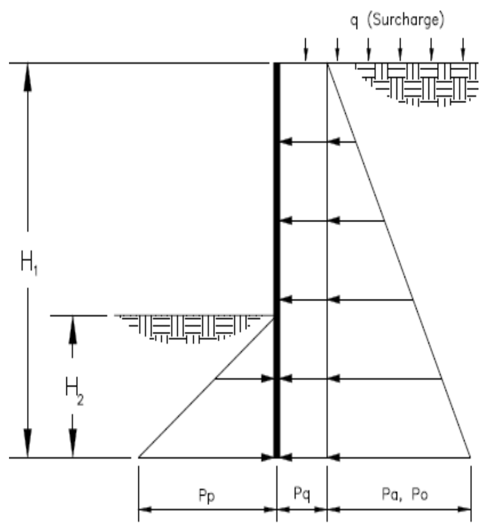
Unrestrained (cantilever) design of cantilever shoring consisting of soldier piles spaced at least two diameters on-center or sheet piles, can be based on Figure No. 4, *Lateral Earth Pressures on Temporary Cantilever Wall*.

Figure No. 4, Lateral Earth Pressures on Temporary Cantilever Wall



Total Earth Pressure, P

P = Pq + Pa, Po

Pq = 0.5q - incremental surcharge pressure

$Pa = (B)H_1$ - active earth pressure (Un-restrained)

$Po = (C)H_1$ - at rest earth pressure (Restrained)

Lateral Pressure Resistance

$Pp = (D)\ H_2 \le (E)$ psf - passive earth pressure (on native soils)

μ = (F) - ultimate friction coefficient between steel sheet piles and soil

Note:
All values of height (H) in feet, pressure (P) and surcharge (q) in pounds per square foot (psf).

The provided pressures assume no hydrostatic pressures. If hydrostatic pressures are allowed to build up, the incremental earth pressures below the ground-water level should be reduced by 50 percent and added to hydrostatic pressure for total lateral pressure.

Passive resistance includes a safety factor of 1.5. The upper 1 foot for passive resistance should be ignored unless the surface is confined by a pavement or slab.

In addition to the lateral earth pressure, surcharge pressures due to miscellaneous loads, such as soil stockpiles, vehicular traffic or construction equipment located adjacent to the shoring, should be included in the design of the shoring. A uniform lateral pressure of 100 psf should be included in the upper 10 feet of the shoring to account for normal vehicular and construction traffic within 10 feet of the trench excavation. As previously mentioned, all shoring should be designed and installed in accordance with state and federal safety regulations.

The contractor should have provisions for soldier pile and sheet pile removal. All voids resulting from removal of shoring should be filled. The method for filling voids should be selected by the contractor, depending on construction conditions, void dimensions and available materials. The acceptable materials, in general, should be non-deleterious, and able to flow into the voids created by shoring removal (e.g., concrete slurry, “pea” gravel, etc.).

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Excavations for the proposed pipeline should not extend below a 1:1 horizontal: vertical (H:V) plane extending from the bottom of any existing structures, utility lines or streets. Any proposed excavation should not cause loss of bearing and/or lateral supports of the existing utilities or streets.

If the excavation extends below a 1:1 (H:V) plane extending from the bottom of the existing structures, utility lines or streets, a maximum of 10 feet of slope face parallel to the existing improvement should be exposed at a time to reduce the potential for instability. Backfill should be accomplished in the shortest period of time and in alternating sections.

10.0 CLOSURE

This report is prepared for the project described herein and is intended for use solely by San Bernardino County Public Works- Special District and their authorized agents, to assist in the design and construction of the proposed project. Our findings and recommendations were obtained in accordance with generally accepted professional principles practiced in geotechnical engineering. We make no other warranty, either expressed or implied.

Converse Consultants is not responsible or liable for any claims or damages associated with interpretation of available information provided to others. Field exploration identifies actual soil conditions only at those points where samples are taken, when they are taken. Data derived through sampling and laboratory testing is extrapolated by Converse employees who render an opinion about the overall soil conditions. Actual conditions in areas not sampled may differ. In the event that changes to the project occur, or additional, relevant information about the project is brought to our attention, the recommendations contained in this report may not be valid unless these changes and additional relevant information are reviewed, and the recommendations of this report are modified or verified in writing. In addition, the recommendations can only be finalized by observing actual subsurface conditions revealed during construction. Converse Consultants cannot be held responsible for misinterpretation or changes to our recommendations made by others during construction.

As the project evolves, continued consultation and construction monitoring by a qualified geotechnical consultant should be considered an extension of geotechnical investigation services performed to date. The geotechnical consultant should review plans and specifications to verify that the recommendations presented herein have been appropriately interpreted, and that the design assumptions used in this report are valid. Where significant design changes occur, Converse may be required to augment or modify the recommendations presented herein. Subsurface conditions may differ in some locations from those encountered in the explorations, and may require additional analyses and, possibly, modified recommendations.

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Design recommendations given in this report are based on the assumption that the recommendations contained in this report are implemented. Additional consultation may be prudent to interpret Converse's findings for contractors, or to possibly refine these recommendations based upon the review of the actual site conditions encountered during construction. If the scope of the project changes, if project completion is to be delayed, or if the report is to be used for another purpose, this office should be consulted.

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11.0 REFERENCES

AMERICAN CONCRETE INSTITUTE (ACI), 2019, Building Code Requirements for Structural Concrete (ACI 318-19) and Commentary, June 2019.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE), 2016, Minimum Design Loads for Buildings and Other Structures, SEI/ASCE Standard No. 7-16, dated, 2017.

CALIFORNIA BUILDING STANDARDS COMMISSION (CBSC), 2022, California Building Code (CBC).

CALIFORNIA DEPARTMENT OF TRANSPORTATION (Caltrans), 2020, Highway Design Manual, dated January 2020.

CALIFORNIA DEPARTMENT OF WATER RESOURCES (DWR), 2024, Water Data Library (http://wdl.water.ca.gov/waterdatalibrary/), accessed March 2024.

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD (SWRCB), 2024, GeoTracker database (http://geotracker.waterboards.ca.gov/), accessed March 2024.

CALIFORNIA GEOLOGICAL SURVEY (CGS), 2007, Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Faulting Zoning Act with Index to Earthquake Fault Zone Maps, Special Publication 42, revised 2007.

DAS, B.M., 2011, Principles of Foundation Engineering, Seventh Edition, published by Global Engineering, 2011.

Morton, D.M., and Miller, F.K., 2006, Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California: U.S. Geological Survey, Open-File Report OF-2006-1217, scale 1:100,000

MOSER A. P. Buried Pipe Design, Second Edition, published by McGraw-Hill, 2001.

PUBLIC WORKS STANDARDS, INC., 2021, Standard Specifications for Public Works Construction (“Greenbook”), 2021.

ROMANOFF, MELVIN, 1957, Underground Corrosion, National Bureau of Standards Circular 579, dated April 1957.

U.S. GEOLOGICAL SURVEY (USGS), 2024, National Water Information System: Web Interface (https://maps.waterdata.usgs.gov/mapper/index.html), accessed March 2024.

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APPENDIX A

FIELD EXPLORATION

Our field investigation involved an alignment reconnaissance, securing a permit from the City of Hesperia, and executing a subsurface exploration program, which included drilling soil borings. During the field reconnaissance, we observed and documented surface conditions along the pipeline alignments, and the boring locations were marked following a review and approval by Ms. Deanna Lestina of San Bernardino County Public Works – Special Districts. It is important to note that the accuracy of these locations is limited by the methods used.

On April 5, 2024, Converse Consultants was scheduled to drill five exploratory borings (BH-01 through BH-05). The drillers encountered and penetrated an unmarked 12-inch-high pressure water line belonging to the County of San Bernardino. Drilling was canceled and rescheduled for April 9, 2024.

On April 9, 2024, five exploratory borings (BH-01 through BH-05) were drilled along the pipeline alignment to investigate the subsurface conditions. The borings were drilled to depths ranging from approximately 15.5 feet to 16.5 feet below ground surface (bgs).

The borings were advanced using a truck-mounted drill rig equipped with 8-inch diameter hollow-stem augers for soils sampling. Encountered materials were continuously logged by a Converse geologist and classified in the field by visual classification in accordance with the Unified Soil Classification System. Where appropriate, the field descriptions and classifications have been modified to reflect laboratory test results. The exploratory boring details are presented in the following table.

Table No. A-1, Summary of Borings

Boring No.	Street Name	Coordinates	Proposed Depth (ft)	Drilled Depth (ft)
BH-01	Rodeo Road	34.3868 °N, 117.3548°W	15.0	15.5
BH-02	Rodeo Road	34.3868°N, 117.3529°W	15.0	16.0
BH-03	Rodeo Road	34.3868°N, 117.3514°W	15.0	16.5
BH-04	Rodeo Road	34.3868°N, 117.3496°W	15.0	16.5
BH-05	Pitzner Avenue	34.3859°N, 117.3487°W	15.0	16.5

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Relatively undisturbed samples were obtained using California Modified Samplers (2.4 inches inside diameter and 3.0 inches outside diameter) lined with thin sample rings. The steel ring sampler was driven into the bottom of the borehole with successive drops of a 140-pound driving weight falling 30 inches. Blow counts at each sample interval are presented on the boring logs. Samples were retained in brass rings (2.4 inches inside diameter and 1.0 inch in height) and carefully sealed in waterproof plastic containers for shipment to the Converse laboratory. Representative bulk samples were collected from selected depths and placed in large plastic bags for delivery to our laboratory.

The exact depths at which material changes occur cannot always be established accurately. Unless a more precise depth can be established by other means, changes in material conditions that occur between driven samples are indicated in the log at the top of the next drive sample.

Following completion of logging and sampling, borings were backfilled with excavated soil cuttings and compacted by pushing down with the auger using the weight of the drill rig.

If construction is delayed the ground surface at the boring locations may settle over time. We recommend the owner monitor the boring locations and backfill any depressions that occur or provide protection around the boring locations to prevent trip and fall injuries from occurring.

For a key to soil symbols and terminology used in the boring logs, refer to Drawing No. A-1a and A-1b, *Unified Soil Classification and Key to Boring Log Symbols*. For logs of borings, see Drawing Nos. A-2 through A-6, *Logs of Borings*.

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SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

FIELD AND LABORATORY TESTS

C	Consolidation (ASTM D 2435)
CL	Collapse Potential (ASTM D 4546)
CP	Compaction Curve (ASTM D 1557)
CR	Corrosion, Sulfates, Chlorides (CTM 643-99; 417; 422)
CU	Consolidated Undrained Triaxial (ASTM D 4767)
DS	Direct Shear (ASTM D 3080)
EI	Expansion Index (ASTM D 4829)
M	Moisture Content (ASTM D 2216)
OC	Organic Content (ASTM D 2974)
P	Permeablility (ASTM D 2434)
PA	Particle Size Analysis (ASTM D 6913 [2002])
PI	Liquid Limit, Plastic Limit, Plasticity Index (ASTM D 4318)
PL	Point Load Index (ASTM D 5731)
PM	Pressure Meter
PP	Pocket Penetrometer
R	R-Value (CTM 301)
SE	Sand Equivalent (ASTM D 2419)
SG	Specific Gravity (ASTM D 854)
SW	Swell Potential (ASTM D 4546)
TV	Pocket Torvane
UC	Unconfined Compression - Soil (ASTM D 2166)
	Unconfined Compression - Rock (ASTM D 7012)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850)
UW	Unit Weight (ASTM D 2937)
WA	Passing No. 200 Sieve

BORING LOG SYMBOLS

DRILLING METHOD SYMBOLS

Auger Drilling

Mud Rotary Drilling

Dynamic Cone or Hand Driven

Diamond Core

SAMPLE TYPE

STANDARD PENETRATION TEST
Split barrel sampler in accordance with ASTM D-1586-84 Standard Test Method

DRIVE SAMPLE 2.42" I.D. sampler (CMS).

DRIVE SAMPLE No recovery

BULK SAMPLE

GROUNDWATER WHILE DRILLING

GROUNDWATER AFTER DRILLING

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UNIFIED SOIL CLASSIFICATION AND KEY TO BORING LOG SYMBOLS

Converse Consultants

Hesperia Waterline Replacement Project.
Approximately 2,800 Linear feet of 12 Inch Diameter Pipeline.
City Of Hesperia, San Bernardino County, California.

For: San Bernardino County Department of Public Works, Special District.

Project No. 23-81-343-01

Drawing A-1a

CONSISTENCY OF COHESIVE SOILS

Descriptor	Unconfined Compressive Strength (tsf)	SPT Blow Counts	Pocket Penetrometer (tsf)	CA Sampler	Torvane (tsf)	Field Approximation
Very Soft	<0.25	< 2	<0.25	<3	<0.12	Easily penetrated several inches by fist
Soft	0.25 - 0.50	2 - 4	0.25 - 0.50	3 - 6	0.12 - 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 - 1.0	5 - 8	0.50 - 1.0	7 - 12	0.25 - 0.50	Can be penetrated several inches by thumb with moderate effort
Stiff	1.0 - 2.0	9 - 15	1.0 - 2.0	13 - 25	0.50 - 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2.0 - 4.0	16 - 30	2.0 - 4.0	26 - 50	1.0 - 2.0	Readily indented by thumbnail
Hard	>4.0	>30	>4.0	>50	>2.0	Indented by thumbnail with difficulty

APPARENT DENSITY OF COHESIONLESS SOILS

Descriptor	SPT N_{60}- Value (blows / foot)	CA Sampler
Very Loose	<4	<5
Loose	4- 10	5 - 12
Medium Dense	11 - 30	13 - 35
Dense	31 - 50	36 - 60
Very Dense	>50	>60

MOISTURE

Descriptor	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OF PROPORTION OF SOILS

Descriptor	Criteria
Trace (fine)/ Scattered (coarse)	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

SOIL PARTICLE SIZE

Descriptor		Size
Boulder		> 12 inches
Cobble		3 to 12 inches
Gravel	Coarse	3/4 inch to 3 inches
	Fine	No. 4 Sieve to 3/4 inch
Sand	Coarse	No. 10 Sieve to No. 4 Sieve
	Medium	No. 40 Sieve to No. 10 Sieve
	Fine	No. 200 Sieve to No. No. 40 Sieve
Silt and Clay		Passing No. 200 Sieve

PLASTICITY OF FINE-GRAINED SOILS

Descriptor	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to reach the plastic limit; it cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

CEMENTATION/ Induration

Descriptor	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

NOTE: This legend sheet provides descriptions and associated criteria for required soil description components only. Refer to Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010), Section 2, for tables of additional soil description components and discussion of soil description and identification.

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UNIFIED SOIL CLASSIFICATION AND KEY TO BORING LOG SYMBOLS

Converse Consultants

Hesperia Waterline Replacement Project.
Approximately 2,800 Linear feet of 12 Inch Diameter Pipeline.
City Of Hesperia, San Bernardino County, California.

Project No. **23-81-343-01**

Drawing **A-1b**

For: San Bernardino County Department of Public Works, Special District.

Log of Boring No. BH-01 (Rodeo Rd.)

Date Drilled: 4/9/2024 Logged by: Stephen McPherson Checked By: Hashmi Quazi

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 3584 Depth to Water (ft, bgs): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		ALLUVIUM **SILTY SAND (SM):** fine to coarse-grained, scattered gravel up to 1 inch maximum dimension, trace clay, pinhole porosity, medium dense, moist, reddish brown.		X				PA, R
			X	X	7/11/14	8	124	
5		-@5.0': scattered gravel up to 2 inches maximum dimension, caliche, dense.	X		10/15/23	8	122	DS
		-@7.5': reddish brown.	X		12/19/23	3	114	
10			X		20/27/33	2	121	
15		-@15.0': very dense.	X		50-6"	4	113	
		End of boring 15.5 feet bgs. No groundwater encountered. Borehole backfilled with soil cuttings, and compacted with an auger using the drill rig weight on 4/9/2024.						

NOT FOR BID

Log of Boring No. BH-02 (Rodeo Rd.)

Date Drilled: 4/9/2024 Logged by: Stephen McPherson Checked By: Hashmi Quazi

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 3557 Depth to Water (ft, bgs): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		ALLUVIUM **SILTY SAND (SM):** fine to coarse-grained, scattered gravel up to 1 inch maximum dimension, trace clay, caliche, very dense, moist, reddish brown.	■		27/31/45	6	129	
5		-@5.0': dense.	■		24/26/33	6	120	
		-@7.5': very dense.	■		15/27/36	6	125	
10		-@10.0': dense	■	▨	18/19/24	5	112	SE
15		-@15.0': very dense.	■		24/50-6"	4	125	
		End of boring 16.0 feet bgs. No groundwater encountered. Borehole backfilled with soil cuttings, and compacted with an auger using the drill rig weight on 4/9/2024.						

NOT FOR BID

Log of Boring No. BH-03 (Rodeo Rd.)

Date Drilled: 4/9/2024 Logged by: Stephen McPherson Checked By: Hashmi Quazi

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 3564 Depth to Water (ft, bgs): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		ALLUVIUM **SILTY SAND (SM):** fine to coarse-grained, trace clay, caliche, yellow oxidation, medium dense, moist, reddish brown.			8/11/19	6	120	
5		-@5.0': scattered gravel up to 1 inch maximum dimension, dense.			14/19/25	8	118	EI, PA
		-@7.5': orange oxidation, very dense.			20/27/45	10	119	
10		**CLAYEY SAND (SC):** fine to coarse-grained, scattered gravel up to 1 inch maximum dimension, very dense, moist, reddish-brown.			17/50-6"	6	126	
15		-@15.0': dense.			24/27/32	7	123	
		End of boring 16.5 feet bgs. No groundwater encountered. Borehole backfilled with soil cuttings, and compacted with an auger using the drill rig weight on 4/9/2024.						

NOT FOR BID

Converse Consultants

Hesperia Waterline Replacement Project.
Approximately 2,800 Linear feet of 12 Inch Diameter Pipeline.
City Of Hesperia, San Bernardino County, California.
For: San Bernardino County Department of Public Works, Special District.

Project No. **23-81-343-01** Drawing No. **A-4**

Log of Boring No. BH-04 (Rodeo Rd.)

Date Drilled: 4/9/2024 Logged by: Stephen McPherson Checked By: Hashmi Quazi

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 3557 Depth to Water (ft, bgs): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
0		**ALLUVIUM** **SILTY SAND (SM):** fine to coarse-grained, scattered gravel up to 0.8 inches maximum dimension, medium dense, moist, reddish brown.		X				EI, CR, PA, SE
2.5			X	X	6/11/16	8	130	
5		-@5.0': scattered cobble up to 3,5 inches maximum dimension, very dense.	X		10/36/38	8	96	
7.5		-@7.5': scattered to few gravel up to 0.8 inch maximum dimension, dense.	X		13/22/30	6	133	
10			X		21/26/32	8	128	
15			X		16/24/33	9	124	
16.5		End of boring 16.5 feet bgs. No groundwater encountered. Borehole backfilled with soil cuttings, and compacted with an auger using the drill rig weight on 4/9/2024.						

NOT FOR BID

Log of Boring No. BH-05 (Pitzer Ave.)

Date Drilled: 4/9/2024 | Logged by: Stephen McPherson | Checked By: Hashmi Quazi

Equipment: 8" HOLLOW STEM AUGER | Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 3554 | Depth to Water (ft, bgs): NOT ENCOUNTERED

SUMMARY OF SUBSURFACE CONDITIONS

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Depth (ft)	Summary of Subsurface Conditions	Samples: Drive	Samples: Bulk	Blows	Moisture (%)	Dry Unit Wt. (pcf)	Other
0	**ALLUVIUM** **SILTY SAND (SM):** fine to coarse-grained, scattered gravel up to 1 inch maximum dimension, trace clay, caliche, medium dense, moist, reddish brown.						
2.5		X		8/12/15	8	113	
5	-@5.0': dense.	X	X	6/16/21	7	115	CP
7.5		X	X	8/12/16	8	128	
10	-@10.0': medium dense.	X		8/13/18	7	113	DS
15	-@15.0': very dense.	X		23/30/43	8	127	

End of boring 16.5 feet bgs.
No groundwater encountered.
Borehole backfilled with soil cuttings, and compacted with an auger using the drill rig weight on 4/9/2024.

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APPENDIX B

LABORATORY TESTING PROGRAM

Tests were conducted in our laboratory on representative soil samples for the purpose of classification and evaluation of their physical properties and engineering characteristics. The amount and selection of tests were based on the geotechnical parameters required for this project. Test results are presented herein and on the Logs of Borings, in Appendix A, *Field Exploration*. The following is a summary of the various laboratory tests conducted for this project.

***In-Situ* Moisture Content and Dry Density**

In-situ dry density and moisture content tests were performed on relatively undisturbed ring samples, in accordance with ASTM Standard D2216-19 and 2937-17e2D to aid soils classification and to provide qualitative information on strength and compressibility characteristics of the soil along the pipeline alignments. For test results, see the Logs of Boring in Appendix A, Field Exploration.

Expansion Index (EI)

Two representative bulk samples were tested to evaluate the expansion potential in accordance with ASTM Standard D4829-21. The test results are presented in table No. B-1, *Expansion Index Test Results* below.

Table No. B-1, Expansion Index Test Results

Boring No./ Street	Depth (feet)	Soil Description	Expansion Index	Expansion Potential
BH-03 (Rodeo Road)	5-10	Silty Sand (SM), Trace Clay	13	Very Low
BH-04 (Rodeo Road)	0-5	Silty Sand (SM)	4	Very Low

Sand Equivalent (SE)

Two representative soil samples were tested in accordance with the ASTM Standard 2419-22 test method to determine the sand equivalent. The test results are presented in table No. B-2, *Sand Equivalent Test Results* below.

Table No. B-2, Sand Equivalent Test Results

Boring No./ Street	Depth (feet)	Soil Description	Sand Equivalent
BH-02 (Rodeo Road)	10-15	Silty Sand (SM)	24
BH-04 (Rodeo Road)	0-5	Silty Sand (SM)	16

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R-value (R)

One representative bulk soil sample was tested in accordance with California Test Method CT301 for resistance value (R-value). The tests provide a relative measure of soil strength for use in pavement design. The test result are presented in table No. B-3, *R-Value Test Result* below.

Table No. B-3, R-Value Test Result

Boring No./ Street	Depth (feet)	Soil Classification	Measured R-value
BH-01 (Rodeo Road)	0-5	Silty Sand (SM)	72

Soil Corrosivity (CR)

One representative soil sample was tested to determine minimum electrical resistivity, pH, and chemical contents, including soluble sulfate and chloride concentrations. The purpose of these tests is to determine the corrosion potential of soils when placed in contact with common construction materials. The tests were performed by Keegan Labs (Pomona, CA) in accordance with Caltrans Test Methods 643, 422 and 417. Test results are presented in table No. B-4, *Summary of Soil Corrosivity Test Results* below.

Table No. B-4, Summary of Soil Corrosivity Test Results

Boring No./Street	Depth (feet)	pH	Soluble Sulfates (CA 417) (ppm)	Soluble Chlorides (CA 422) (ppm)	Min. Resistivity (CA 643) (Ohm-cm)
BH-04 (Rodeo Road)	0-5	7.4	25	28	9,550

Grain-Size Analyses (PA)

To assist in classification of soils, mechanical grain-size analyses were performed on three select samples in accordance with the ASTM Standard D6913/D6913M-17 test method. The grain-size curve is shown in Drawing No. B-1, *Grain Size Distribution Result* and the test results are presented in table No. B-5, *Grain Size Distribution Test Result* below.

Table No. B-5, Grain Size Distribution Test Result

Boring No.	Depth (ft)	Soil Classification	% Gravel	% Sand	%Silt	%Clay
BH-01 (Rodeo Road)	0-5	Silty Sand (SM)	3.0	80.4	16.6	
BH-03 (Rodeo Road)	5-10	Silty Sand (SM)	8.0	61.2	30.8	
BH-04 (Rodeo Road)	0-5	Silty Sand (SM)	4.0	67.8	28.2	

Maximum Density and Optimum Moisture Content (CP)

Laboratory maximum dry density-optimum moisture content relationship test was performed on one representative bulk sample. The test was conducted in accordance

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with the ASTM Standard D1557-12(2021) test method. The test results are presented in Drawing No. B-2, *Moisture-Density Relationship Results,* and are summarized in the table No B-6, *Summary of Moisture-Density Relationship Results* below.

Table No B-6, Summary of Moisture-Density Relationship Results

Boring No./ Street	Depth (feet)	Soil Description	Optimum Moisture (%)	Maximum Density (lb/cft)
BH-05 (Pitzer Avenue)	5-10	Silty Sand (SM), Reddish brown	6.5 (* 6,0)	133.0 (*135.0)

*Rock correction of 6.19%

Direct Shear (DS)

Two direct shear tests were performed on relatively undisturbed samples under soaked conditions in accordance with ASTM Standard D3080/D3080M-23. For each test, 3 samples contained in a brass sampler ring were placed, one at a time, directly into the test apparatus and subjected to a range of normal loads appropriate for the anticipated conditions. The samples were then sheared at a constant strain rate of 0.02 inch/minute. Shear deformation was recorded until a maximum of about 0.25-inch shear displacement was achieved. Ultimate strength was selected from the shear-stress deformation data and plotted to determine the shear strength parameters. For test results, including sample density and moisture content, see Drawing Nos. B-3 and B-4, *Direct Shear Test Results,* and in table No. B-7, *Summary of Direct Shear Test Results below*

Table No. B-7, Summary of Direct Shear Test Results

Boring No.	Depth (feet)	Soil Description	Peak Strength Parameters	
			Friction Angle (degrees)	Cohesion (psf)
BH-01 (Rodeo Road)	5.0-6.5	Silty Sand (SM), Trace Clay	28	260
BH-05 (Pitzer Avenue)	10.0-11.5	Silty Sand (SM)	34	100

Sample Storage

Soil samples presently stored in our laboratory will be discarded 30 days after the date of this report, unless this office receives a specific request to retain the samples for a longer period.

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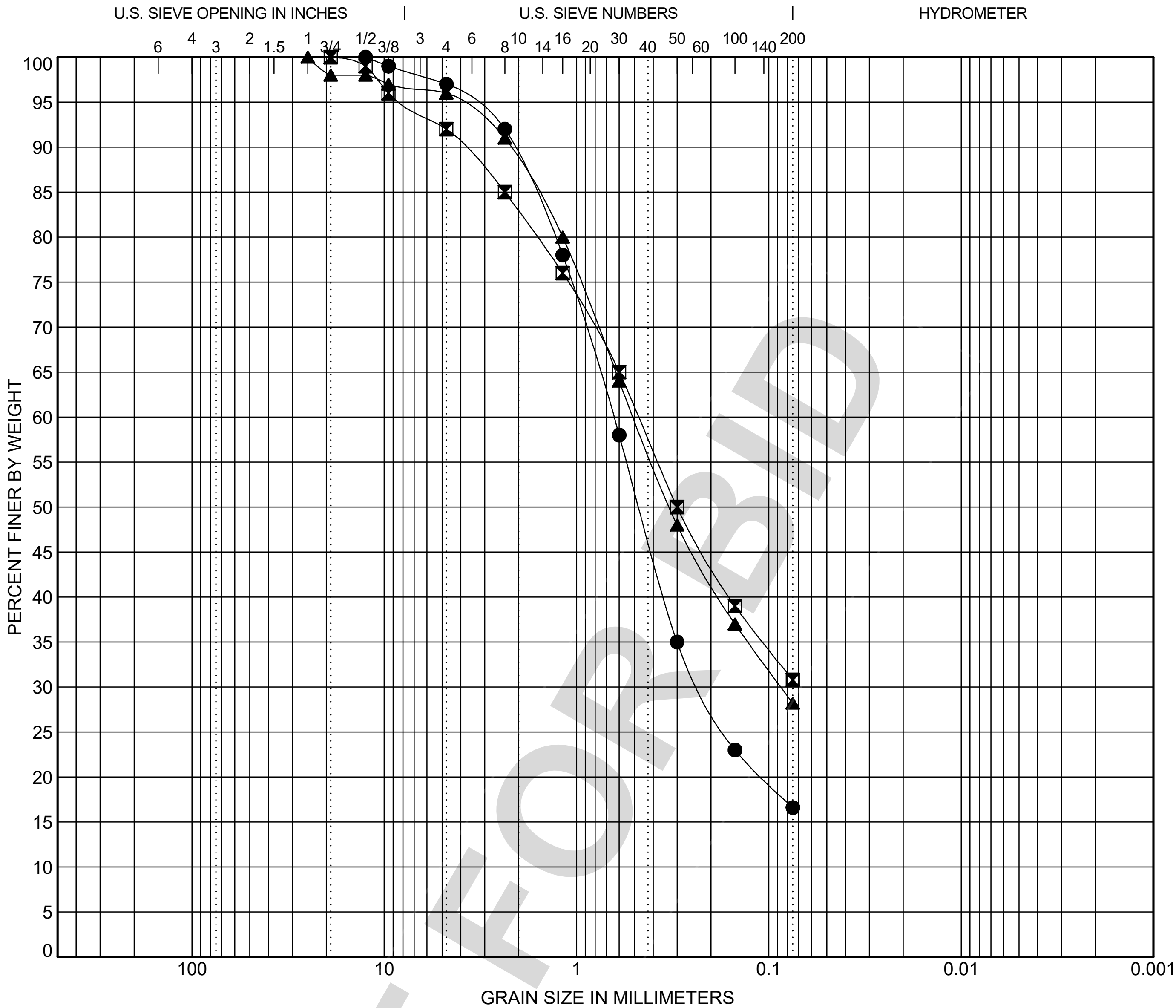


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Description	LL	PL	PI	Cc	Cu
●	BH-01 (Rodeo Rd.)	0-5	SILTY SAND (SM)					
⊠	BH-03 (Rodeo Rd.)	5-10	SILTY SAND (SM)					
▲	BH-04 (Rodeo Rd.)	0-5	SILTY SAND (SM)					

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BH-01 (Rodeo Rd.)	0-5	12.5	0.642	0.225		3.0	80.4	16.6	
⊠	BH-03 (Rodeo Rd.)	5-10	19	0.476			8.0	61.2	30.8	
▲	BH-04 (Rodeo Rd.)	0-5	25	0.505	0.086		4.0	67.8	28.2	

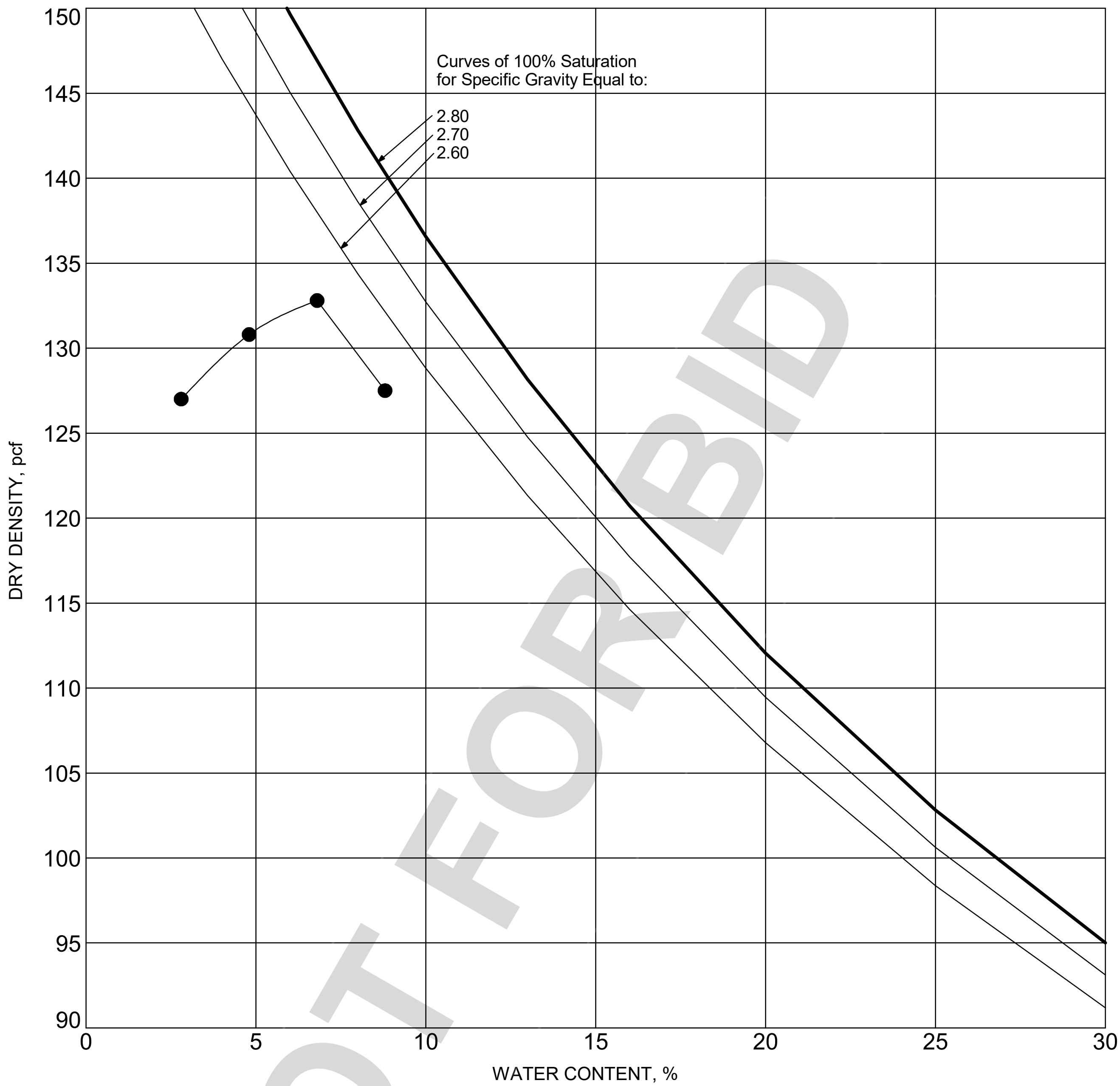
GRAIN SIZE DISTRIBUTION RESULTS

Converse Consultants

Hesperia Waterline Replacement Project.
Approximately 2,800 Linear feet of 12 Inch Diameter Pipeline.
City Of Hesperia, San Bernardino County, California.
For: San Bernardino County Department of Public Works, Special District.

Project No. **23-81-343-01**

Drawing No. **B-1**



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SYMBOL	BORING NO.	DEPTH (ft)	DESCRIPTION	ASTM TEST METHOD	OPTIMUM WATER, %	MAXIMUM DRY DENSITY, pcf
●	**BH-05 (Pitzer Ave.)**	**5-10**	**SILTY SAND (SM), REDDISH BROWN**	**D1557 A**	**6.4 (*6.0)**	**133 (*135)**

*Rock correction of 6.19%

MOISTURE-DENSITY RELATIONSHIP RESULTS

Converse Consultants

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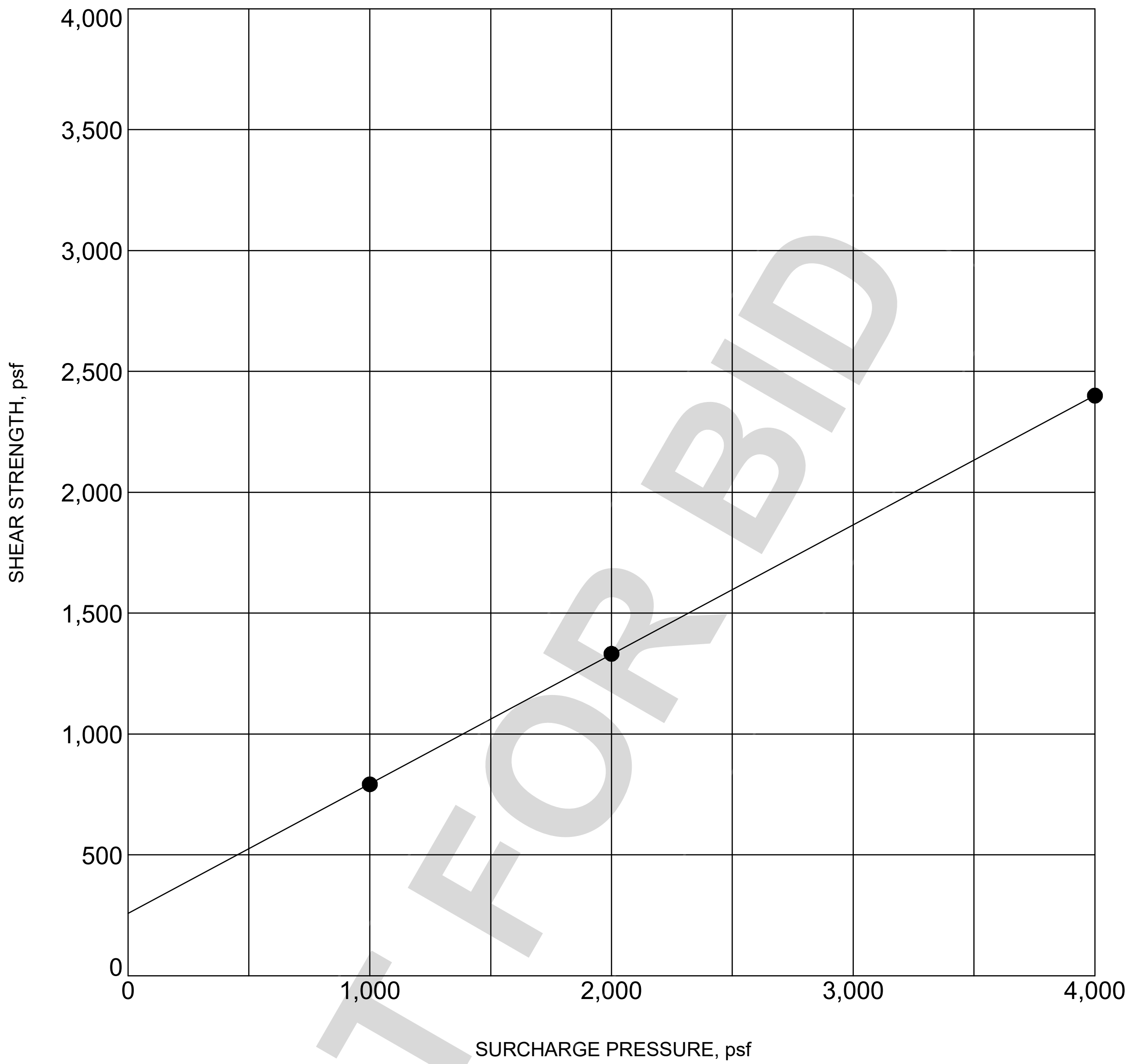
For: San Bernardino County Department of Public Works, Special District.

Project No. **23-81-343-01**

Drawing No. **B-2**



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BORING NO. :	**BH-01 (Rodeo Rd.)**	DEPTH (ft) :	**5.0-7.5**
DESCRIPTION :	**SILTY SAND (SM)**		
COHESION (psf) :	**260**	FRICTION ANGLE (degrees):	**28**
MOISTURE CONTENT (%) :	**8.0**	DRY DENSITY (pcf) :	**122.0**

NOTE: Ultimate Strength.

DIRECT SHEAR TEST RESULTS

Converse Consultants

Hesperia Waterline Replacement Project.
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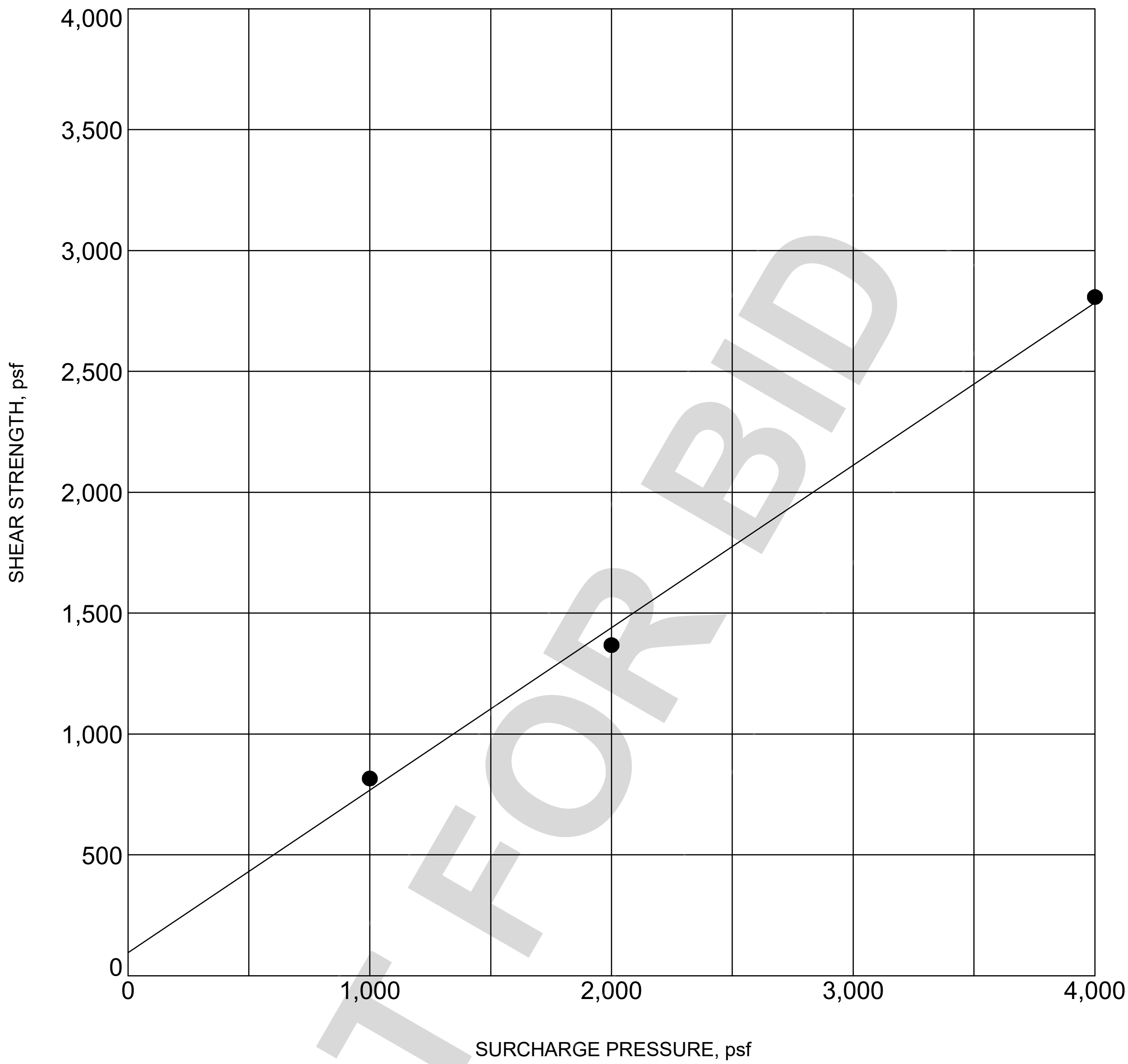
City Of Hesperia, San Bernardino County, California.
For: San Bernardino County Department of Public Works, Special District.

Project No. **23-81-343-01**

Drawing No. **B-3**



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BORING NO. :	**BH-05 (Pitzer Ave.)**	DEPTH (ft) :	**10.0-11.5**
DESCRIPTION :	**SILTY SAND (SM)**		
COHESION (psf) :	**100**	FRICTION ANGLE (degrees):	**34**
MOISTURE CONTENT (%) :	**6.5**	DRY DENSITY (pcf) :	**113.0**

NOTE: Ultimate Strength.

DIRECT SHEAR TEST RESULTS

Converse Consultants

Hesperia Waterline Replacement Project.
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City Of Hesperia, San Bernardino County, California.
For: San Bernardino County Department of Public Works, Special District.

Project No. **23-81-343-01**

Drawing No. **B-4**

APPENDIX C

CITY OF HESPERIA TRENCH ZONE AND PIPE BEDDING STANDARDS

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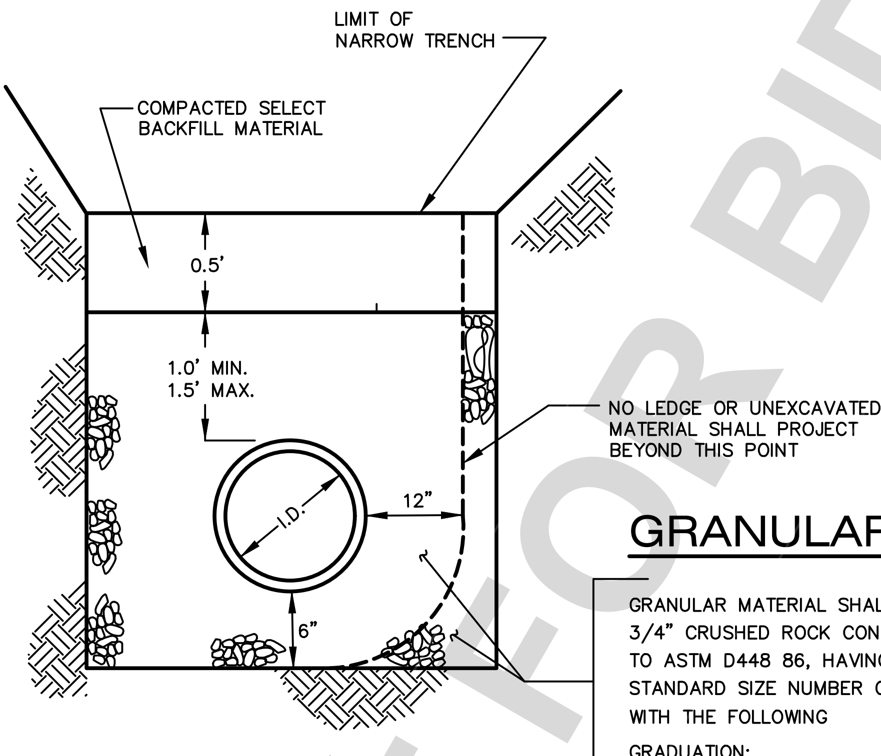

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GRANULAR MATERIAL:

GRANULAR MATERIAL SHALL BE 3/4" CRUSHED ROCK CONFORMING TO ASTM D448 86, HAVING A STANDARD SIZE NUMBER OF 67 WITH THE FOLLOWING

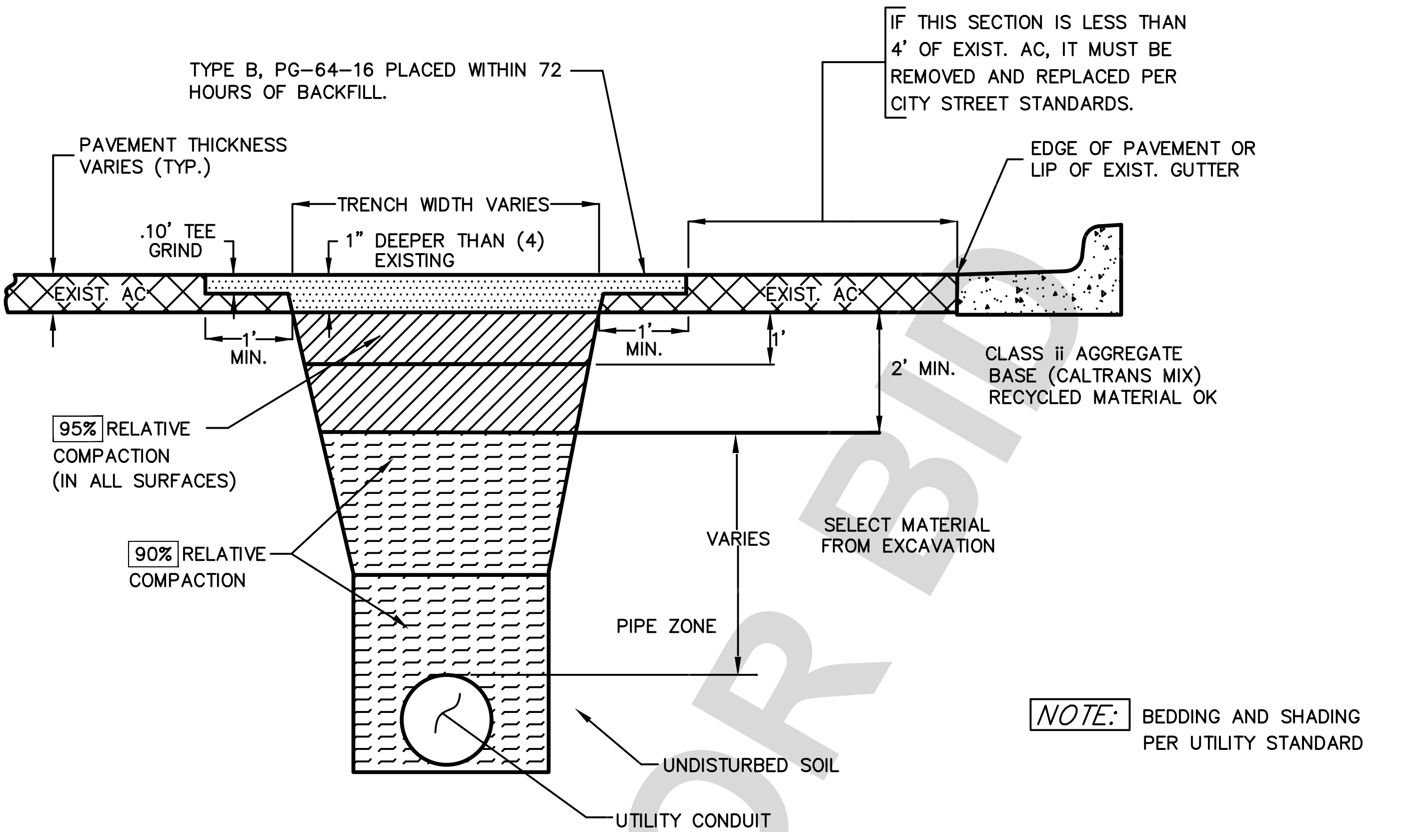
GRADUATION:

100	PERCENT PASSING 1 IN. SIEVE;
90–100	PERCENT PASSING 3/4 IN. SIEVE;
20–55	PERCENT PASSING 3/8 IN. SIEVE;
0–10	PERCENT PASSING #4 SIEVE;
0–5	PERCENT PASSING #8 SIEVE;

SLAG, PEA GRAVEL OR OTHER ALTERNATIVE MATERIALS WILL NOT BE ACCEPTABLE IN LIEU OF CRUSHED STONE.

(NOTE: CLASS A BASE WILL NOT BE ACCEPTED AS A SUBSTITUTE FOR THE ABOVE MENTIONED GRANULAR MATERIAL)

DRAWN BY: M.W.M.	CITY OF HESPERIA		REV. DATE	STD. DRW'G. NO.
APPROVED BY:	P.V.C. PIPE BEDDING DETAIL			S-2
DATE: 03/15/23				



NOTE: CONTINUOUS TRENCHES OF UP TO 500 LINEAR FEET IN LENGTH AND/OR MORE THAN SIX (6) LATERALS, AND/OR POTHOLES IN A 500 FOOT SECTION OF ASPHALT CONCRETE, THE ENTIRE WIDTH (12 FOOT MINIMUM) OF THE LANE SHALL BE OVERLAID WITH ASPHALT CONCRETE. THE AREA OF OVERLAY SHALL BE UNIFORMLY TACK COATED. ASPHALT CONCRETE OVERLAY MUST EXTEND AT LEAST ONE (1) FOOT LATERALLY AND FIVE (5) FEET LONGITUDINALLY BEYOND EDGES OF EXCAVATED AND/OR DAMAGED PAVEMENT. ANY ASPHALT OVERLAY SHALL HAVE A MINIMUM PRACTICAL THICKNESS OF ONE TENTH (.10').

NOTES:

1. *ALL TRENCHES SHALL BE BACKFILLED AND CONSOLIDATED IN ACCORDANCE WITH THE ABOVE DETAIL UNLESS OTHERWISE SPECIFIED BY THE CITY ENGINEER.*
2. *ALL TRENCHES OR BELL HOLES WILL REQUIRE A .10 FT GRIND A MINIMUM OF 1 FT OUTSIDE REPAIR. CITY ARTERIAL ROADS WILL REQUIRE A .10 FT GRIND A MINIMUM OF 8 FT OUTSIDE REPAIR. NO T-CUTS WILL BE ALLOWED FOR TRENCH REPAIRS UNLESS APPROVED BY CITY INSPECTOR.*
3. *UNLESS OTHERWISE INSTRUCTED BY THE CITY ENGINEER, TRENCH PATH SHALL BE STRAIGHT GRADE ACROSS WIDTH, AND SHALL NOT BE CURVED AT CENTER.*
4. *ASPHALT IN AREA OF TRENCH 1" THICKER THAN EXISTING.*
5. *1-SACK SAND/CEMENT SLURRY MAY BE SUBSTITUTED FOR AGGREGATE BASE.*
6. *FREQUENCY OF COMPACTION TESTING SHALL BE NO LESS THAN ONE TEST PER 300 LINEAL FEET OF MAIN LINE, ONE TEST MINIMUM FOR EVERY THREE (3') FEET OF VERTICAL FILL. ADDITIONAL TESTING MAY BE REQUIRED AT THE DISCRETION OF THE CITY ENGINEER.*
7. *PAVING MACHINES USED FOR OVERLAY OF TRENCHES SHALL CONFORM TO S.P.P.W.C. STANDARDS.*

NOT FOR BID

DRAWN BY: M.W.M.	CITY OF HESPERIA		REV. DATE	STD. DRW'G. NO.
APPROVED BY: M Thaton	STANDARD TRENCH REPAIR #201			ST-6
DATE: 03/21/23				