

Appendix E
Geotechnical Investigation and Infiltration Feasibility Study



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Materials Testing
Environmental**

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GEOTECHNICAL INVESTIGATION

San Gabriel Valley Water Company
Plant F20 – Job No. 647F
15151 Long View Drive
Fontana, San Bernardino County, California

Prepared For:

San Gabriel Valley Water Company
11142 Garvey Avenue
El Monte, California 91733

Prepared By:

MTGL, Inc.
14467 Meridian Parkway, Building 2A
Riverside, California 92518

October 23, 2020

MTGL Project No. 2492A13
MTGL Log No. 20-2510



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October 23, 2020

San Gabriel Valley Water Company
11142 Garvey Avenue
San Bernardino, California 92411

MTGL Project No.: 2492A13
MTGL Log No.: 20-2510
MTGL Branch: Riverside

Attention: Mr. Kristofer J. Olsen

Subject: **GEOTECHNICAL INVESTIGATION**
San Gabriel Valley Water Company Plant F20 – Job No. 647F
15151 Long View Drive
Fontana, San Bernardino County, California

In accordance with your request and authorization, MTGL, Inc. has completed a Geotechnical Investigation for the subject site. MTGL, Inc. is pleased to present the following report which addresses geotechnical conditions of the subject site, including a description of the site conditions, results of MTGL, Inc.'s field exploration and laboratory testing, and MTGL, Inc.'s conclusions and recommendations for site grading and foundations design.

The project site is located on undeveloped land near an existing San Gabriel Valley Water Company Plant F20 water storage reservoir, which is closest in proximity to 15151 Long View Drive, in the City of Fontana, San Bernardino County, California. The project will consist of constructing a new approximate 1 million gallon water reservoir and associated infrastructure improvements.

Based on MTGL, Inc.'s investigation, the site will be suitable for construction, provided the recommendations presented herein are incorporated into the plans and specifications for the proposed construction. Details related to site seismicity, site preparation, foundation and pavement design, and construction considerations are also included in the subsequent sections of this report.

MTG_L, Inc. appreciates this opportunity to be of continued service and look forward to providing additional consulting services during the planning and construction of the project. Should you have any questions regarding this report, please do not hesitate to contact us at your convenience.

Respectfully submitted,

MTG_L, Inc.



Bruce A. Hick, P.E., G.E.
Vice President | Engineering Manager



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1.00 INTRODUCTION

In accordance with your request and authorization, MTGL, Inc. has completed a Geotechnical Investigation for a proposed construction project located on undeveloped land near an existing San Gabriel Valley Water Company Plant F20 water storage reservoir, which is closest in proximity to 15151 Long View Drive, in the City of Fontana, San Bernardino County, California. The following report presents a summary of MTGL, Inc.'s findings, conclusions and recommendations based on the field investigation, laboratory testing, and engineering analysis.

1.01 PLANNED CONSTRUCTION

MTGL understands that plans are to construct an approximate 1 million gallon water reservoir (tank) adjacent to an existing water reservoir (see Boring Location Map, Figure 2) on Plant F20. The new water reservoir is anticipated to be of welded steel construction, approximately 74 feet in diameter and approximately 40 feet in height. The proposed water reservoir foundation system will either be a slab as a mat foundation, or a structural slab supported by a group foundation system. Maximum foundation loads of up to 3,500 plf for continuous (ring wall) foundations and up to 80 kips for isolated pad foundations are anticipated.

Based upon information provided, a retaining system will be required to construct a level pad for the proposed reservoir. The retaining wall system will vary in height from 1-foot to a maximum of 26 feet. The retaining wall system may utilize any, or a combination of gravity retaining wall, pile supported retaining wall, and/or helical or grouted anchor tie-back retaining wall. Associated site improvements will consist of new pipelines, new site pavement improvements, block walls and/or wrought iron fencing.

1.02 SCOPE OF WORK

The scope of MTGL, Inc.'s geotechnical services included the following:

- Review of geologic, seismic, ground water and geotechnical literature.
- Logging, sampling, and backfilling of three (3) exploratory borings drilled with an 8" hollow stem auger drill rig to a maximum depth of 21.5 feet below existing grades. All borings were terminated due to encountering large gravels/boulders/granitic bedrock.
- Laboratory testing of representative samples (See Appendix C).
- Geotechnical engineering review of data and engineering recommendations.
- Preparation of this report summarizing MTGL, Inc.'s findings and presenting MTGL, Inc.'s conclusions and recommendations for the proposed construction.

1.03 SITE DESCRIPTION

The existing San Gabriel Valley Water Company Plant F20 is located in proximity to 15151 Long View Drive, in the City of Fontana, San Bernardino County, California (see Site Location Map, Figure 1). Existing structures at the Plant F20 site include an approximate 3.78-million gallon steel water storage reservoir (tank), asphalt pavement, underground water supply and distribution pipelines and associated equipment.

The proposed reservoir is to be located on an approximate 1-acre site situated north/northwest of the existing Plant F20 improvements. The proposed development area is located at approximately 34.0387° North Longitude and -117.4727° West Latitude. Access to this proposed development area is via an asphalt concrete paved access road to the existing reservoir along the southwest side of the proposed development area. An unpaved dirt road is located adjacent to the north and west sides of the proposed development area (see Boring Location Map, Figure 2). Numerous dirt trails trend thorough the proposed development site.

The proposed development area consists of a north/northwest trending large gravel/boulder-strewn ridge. Rock and boulder out-crops were observed throughout the proposed development area. Ground elevations at the proposed development area range from approximately 1,215 feet in the southern extreme of the development area to approximately 1,180 feet in the north/northwest extreme of the area. Drainage is by sheet flow to the north/northwest. The proposed development area was vegetated with a light covering of weeds, grasses, and small brush.

1.04 FIELD INVESTIGATION

Prior to the field investigation, a site reconnaissance was performed by an engineer from MTGL, Inc. to evaluate the locations with respect to obvious subsurface structures and access for the drilling rig. The subsurface investigation consisted of drilling and sampling three (3) test borings utilizing a truck-mounted drill rig equipped with an 8" diameter hollow stem auger. All borings were terminated due to encountering large gravels/boulders/granitic bedrock. See Appendix B for further discussion of the field exploration including Logs of Test Borings.

Borings were logged and sampled using Modified California Ring (Ring) and Standard Penetration Test (SPT) samplers at selected depth intervals. Samplers were driven into the bottom of the boring with successive drops of a 140-pound weight falling 30 inches. Blows required to drive the last 12 inches of the 18-inch Ring and SPT samplers are shown on the boring logs in the "blows/foot" column (Appendix B). SPT was performed in the borings in general accordance with the American

Standard Testing Method (ASTM) D1586 Standard Test Method. Representative bulk soil samples were also obtained from the borings.

Each soil sample collected was inspected and described in general conformance with the Unified Soil Classification System (USCS). The soil descriptions were entered on the boring logs (see Appendix B). All samples were sealed and packaged for transportation to MTGL, Inc.'s laboratory. After completion of drilling, borings were backfilled with the soil cuttings.

1.05 LABORATORY TESTING

Laboratory tests were performed on representative samples to verify the field classification of the recovered samples and to determine the geotechnical properties of the subsurface materials. All laboratory tests were performed in general conformance with ASTM or State of California Standard Methods. The results of our laboratory tests are presented in Appendix C of this report.

2.00 FINDINGS

2.01 REGIONAL GEOLOGIC CONDITIONS

As previously discussed, the proposed development area is situated on a north/northwest trending ridge of the northern slopes of the Jurupa Mountains. The Jurupa Mountains are regionally located along the northern edge of the Peninsular Ranges Geomorphic Province. The Jurupa Mountains are composed mainly of granitic and recrystallized metamorphic sedimentary rocks.

2.02 SITE SOIL CONDITIONS

The proposed development area is situated on a north/northwest trending ridge of the northern slopes of the Jurupa Mountains. Three (3), 8-inch diameter hollow stem auger soil borings were advanced to characterize near-surface geologic conditions and to obtain soil samples for analyses. All borings were terminated due to encountering large gravels/boulders/granitic bedrock. Boring locations and pertinent data for each boring are presented in the table below.

Boring No.	Depth (ft.)	Latitude	Longitude	Approx. Fill Thickness (ft)	Groundwater Depth (ft. bgs)
B1	26.5	34.0387°	-117.4727°	0	No GW
B2	21.0	34.0388°	-117.4727°	0	No GW
B-3	2.0	34.0390°	-117.4734°	0	No GW

The soils encountered in the borings consisted of interbedded silty sands, relatively clean sands, and slightly silty sands (SM, SP, SM/SP soil types based upon the Unified Soil Classification System) with variable amounts of gravel. All borings were terminated due to encountering large gravels/boulders/granitic bedrock.

2.03 FLOODING POTENTIAL

The site is not located within a 100 or 500-year flood hazard area as identified by FEMA flood hazard maps and the San Bernardino County Land Use Plan Geologic Hazard Overlay (2009).

2.04 SURFACE AND GROUNDWATER CONDITIONS

No areas of ponding or standing water were present at the time of the field exploration. Further, no springs or areas of natural seepage were observed at the time of the field exploration.

Ground water or perched water was not encountered to the maximum depth drilled of approximately 26.5 feet in Boring B1 at the time of drilling. Historical high groundwater is anticipated to be encountered at a depth of greater than 50-feet below existing grades.

2.05 FAULTING AND SEISMICITY

Faults are one of the most widespread geologic hazards to development in California. Faults of most concern are those designated as active (less than about 11,000 years since last movement) and potentially active (11,000 to about 750,000 years). The site is within 25 miles of a number of other active and potentially active faults in the seismically active southern California region, therefore, the potential for future strong ground shaking at the site is high. The site and site region will likely experience future earthquakes of moderate to large size. Some of the near-future earthquakes on nearby (less than about 50 miles) active faults may be greater than Richter magnitude 8.0. The site is not located within any mapped Alquist-Priolo Special Studies Zones (CDMG, 1997).

The closest fault to the site is the San Jacinto (San Bernardino Valley Section). This fault is expected to be capable of generating a magnitude 6.7 earthquake. This fault is the most seismically active fault in southern California and has generated ground-rupturing earthquakes greater than magnitude 5.5 as recently as 1968, and 1987 (Treiman and Lundberg, 1999). This extensive fault zone ranges up to 1.3 miles wide and extends southeastward approximately 120 miles into eastern San Diego County.

The Cucamonga fault zone (Sierra Madre, Cucamonga Section) is located north-northwest of the site and is capable of generating a magnitude 7.0 earthquake. Studies of the Cucamonga portion of this fault zone have demonstrated multiple Holocene events.

Other significant faults include the San Jose fault, northeast of the site and the San Andres fault, located to the northwest.

2.06 LIQUEFACTION POTENTIAL AND DYNAMIC SOIL SETTLEMENT

Liquefaction is a phenomenon where earthquake-induced ground vibrations increase the pore pressure in saturated, granular soils until it is equal to the confining, overburden pressure. When this occurs, the soil can completely lose its shear strength and enter a liquefied state. The possibility of liquefaction is dependent upon grain size, relative density, confining pressure, saturation of the soils, strength of the ground motion and duration of ground shaking. In order for liquefaction to occur three criteria must be met: underlying loose, coarse-grained (sandy) soils, a groundwater depth of less than about 50 feet and a nearby large magnitude earthquake.

The site is not within a Seismic Special Studies Zone as currently mapped by the California Division of Mines and Geology. Based on the high relative density/consistency of the subsurface soils and anticipated presence of relatively shallow bedrock, the potential for liquefaction is very low. Based upon review of the San Bernardino County Land Use Plan Geologic Hazard Overlay (2009), the project site is not indicated as having a liquefaction susceptibility. Due to the dense/high consistency nature of the subsurface soils, estimated dynamic settlement (“dry sand”) of the site soils are anticipated to be negligible.

2.07 LANDSLIDES

The site is located in a hillside area of the county where earthquake induced landslides could cause permanent ground displacements. However, no reported occurrences of landslides or mudflows are known to have recently affected the site. Therefore, the potential for landslides and mudflows is considered to be very low at the site.

2.08 TSUNAMI AND SEICHE HAZARD

Given the inland location of the site at an elevation of approximately 1,184 feet MSL, the inundation hazard posed by tsunami is considered to be very low. Seiches are not considered a hazard due to the absence of above-ground tanks or reservoirs located immediately up gradient from the site.

3.00 CONCLUSIONS

3.01 GENERAL CONCLUSIONS

Based on our geotechnical review of the planned construction, it is our opinion that the site is suitable for the proposed construction provided our conclusions are taken into consideration during design, and our recommendations are incorporated into the construction plans and specifications and implemented during grading and construction.

Given the findings of the investigation, it appears that the site geology is suitable for the proposed construction. Based on the investigation, it is our opinion that the proposed development is safe against landslides and settlement provided the recommendations presented in our report are incorporated into the design and construction of the project. Grading and construction of the proposed project will not adversely affect the geologic stability of adjacent properties. The nature and extent of the investigation conducted for the purposes of this declaration are, in our opinion, in conformance with generally accepted practice in this area. Therefore, the proposed project appears to be feasible from a geologic standpoint.

3.02 SEISMIC DESIGN PARAMETERS

The OSHPD Seismic Design Maps application, was used to calculate the CBC site specific design parameters as required by the 2019 California Building Code. Based upon the subsurface data, the site can be classified as Site Class C. The spectral acceleration values for 0.2 second and 1 second periods obtained from the computer program and in accordance with the 2013 California Building Code are tabulated below.

Ground Motion Parameter	Design Value
S _s	1.705 g
S ₁	0.60 g
Site Class	C
F _a	1.2
F _v	1.4
S _{DS}	1.364 g
S _{D1}	0.56 g
S _{MS}	2.046 g
S _{M1}	0.84 g
T _L	12 Seconds
Rick Category	IV

4.00 RECOMMENDATIONS

MTGL, Inc.'s recommendations are considered minimum and may be superseded by more conservative requirements of the architect, structural engineer, building code, or governing agencies. The foundation recommendations are based on the expansion index and shear strength of the on-site soils. Import soils, if necessary, should have a "very low" expansion index potential and should be approved by the Geotechnical Engineer prior to importing to the site. In addition to the recommendations in this section, additional general earthwork and grading specifications are included in Appendix D.

4.01 EXCAVATION CHARACTERISTICS/SHRINKAGE

All of the exploratory borings were terminated due to encountering large gravels/boulders/granitic bedrock. It is anticipated significant "oversize" materials (materials greater than six inches in maximum dimension) may be encountered within the anticipated depths of site grading/construction. Accordingly, it is expected that heavy duty grading equipment be needed to be used in the project site grading. Significant effort will be required to remove "oversize" material from the existing on-site native soils to be used for fill.

Shrinkage is the decrease in volume of soil upon removal and recompaction expressed as a percentage of the original in-place volume, which will account for changes in earth volumes that will occur during grading. MTGL, Inc.'s estimate for shrinkage of the on-site native soils are expected to range from 17 to 22 percent. Removal of significant "oversize" materials (materials greater than six inches in maximum dimension) from the site soils will significantly increase the estimate shrinkage values.

4.02 SETTLEMENT CONSIDERATIONS

Foundations should be designed to resist the anticipated settlements. Settlement of an individual foundation will vary depending on the plan dimensions of the foundation and the actual load supported. It is estimated maximum settlement of foundations designed and constructed in accordance with the recommendations presented in this report to be on the order of 1 inch. Differential settlement between similarly loaded and adjacent footings are expected to be a maximum of approximately ½ inch across 40 feet, provided footings are founded on compacted fill as recommended in this report. Settlement of all foundations is expected to occur rapidly and should be essentially complete shortly after initial application of the loads. Due to the dense/high consistency nature of the subsurface soils, estimated dynamic (seismic) settlement of the site soils are anticipated to be approximately ½ to ¾ inch.

4.03 SITE CLEARING RECOMMENDATIONS

All surface vegetation, trees, roots, existing landscaping, existing pavement and hardscaping, existing structures and foundations, trash, debris, asphalt concrete, Portland cement concrete, “oversize” materials, and underground utilities should be cleared and removed from the proposed construction sites. Underground facilities such as utilities, pipes or underground storage tanks may exist at the site. Removal of underground tanks is subject to state law as regulated by the County, City and/or Fire Department. If storage tanks containing hazardous or unknown substances are encountered, the proper authorities must be notified prior to any attempts at removing such objects.

Any water wells, if encountered during construction, should be exposed, and capped in accordance with the requirements of the regulating agencies. Depressions resulting from the removal of foundations of existing buildings, underground tanks, and pipes, buried obstructions and/or tree roots should be backfilled with properly compacted material.

4.04 SITE GRADING RECOMMENDATIONS

All fill materials should be compacted to at least 90 percent of maximum dry density as determined by ASTM Test Method D1557. Fill materials should be placed in loose lifts, no greater than 8 inches prior to applying compactive effort. All engineered fill materials should be moisture-conditioned and processed as necessary to achieve a uniform moisture content that is near optimum moisture content and within moisture limits required to achieve adequate bonding between lifts. Compaction should be verified by testing.

4.05 SITE OVEREXCAVATION

Building plans, grading plans, retaining wall plans, structural plans and foundation elevations were not available at the time of MTG_L, Inc.’s investigation. Therefore, once formal plans are prepared and available for review, this office should review these plans from a geotechnical viewpoint, comment on any changes, and revise the recommendations of this report, as necessary.

All artificial fills, organics, debris, trash, “oversize” materials, and topsoil should be removed from the grading area and hauled offsite. Recommendations for site grading to prepare the reservoir pad and retaining wall foundation areas for the support of structures are as follows.

It is recommended that soils within reservoir (tank pad) or retaining wall continuous foundation areas be excavated to a minimum depth of 2 feet below the bottom of the proposed footings or 4 feet below the existing grade, whichever is greater. The required horizontal limits of the over

excavated area shall be defined as the area extending from the edge of the reservoir (tank pad) perimeter/footing for a distance of 5 feet, where obtainable.

Hardscape areas, which include all paved areas, will require a minimum depth of 2 feet of removal and recompaction. The underlying subgrade soils beneath all remedial excavations should then be scarified (ripped) a minimum of 8 inches. Processing for hardscape areas should extend a minimum distance of 2 feet outside the hardscape limits, where obtainable.

4.06 FILL MATERIALS

Removed and/or overexcavated soils, as well as any scarified soils, should be moisture-conditioned to near optimum moisture content and recompacted as engineered fill, except for soils containing detrimental amounts of organic material. Our subsurface investigation indicates that the near surface materials are significantly below its optimum moisture content. The fill materials should be compacted to a minimum of 90% of the maximum dry density per ASTM D-1557. Compaction should be verified by testing. Significant effort will be required to remove “oversize” material from the existing on-site native soils to be used for fill.

A minimum thickness of six inches (6”) of aggregate base, gravel and/or oiled sand may be placed beneath the proposed tank bottom. Any such material should be compacted to a minimum of 95% of the maximum dry density per ASTM D-1557. Compaction should be verified by testing.

Imported materials shall be coarse grained, non-expansive, and non-plastic in nature. The materials should be free from vegetable matter and other deleterious substances, shall not contain rocks or lumps of a greater dimension than 3 inches, and shall be approved by the geotechnical consultant. Soils of poor gradation, expansion, or strength properties shall be placed in areas designated by the geotechnical consultant or shall be mixed with other soils providing satisfactory fill material.

4.07 SHALLOW FOUNDATIONS

Spread (column) and/or continuous (ring wall) footings on compacted fill materials may be used to support the proposed reservoir (tank) and site retaining walls. Such foundations may be designed using an allowable bearing pressure of 2,500 psf. This allowable bearing pressure may be increased by 20% for each additional foot of width and/or depth, to a maximum value of 5,000 psf. These bearing capacities can be considered to be “net” allowable bearing pressures (i.e. the weight of the concrete can be neglected). The allowable bearing capacity may also be increased by one-third for considerations of short term wind or seismic loads. The recommended minimum footing width and embedment depth below the lowest adjacent grade are as follows:

Foundation Type	Minimum Width	Minimum Depth*
Continuous (Perimeter/Ring Wall)	18 inches	18 inches
Spread (Column) Footings	24 inches	18 inches

*The minimum depth of foundations is relative to the lowest adjacent soil subgrade for perimeter foundations and finished grade (top of concrete) for interior foundations.

Soil resistance developed against lateral structural movement can be obtained from the passive pressure value of 350 pcf. The upper one foot of passive pressure should be neglected unless confined by pavement or slab. For sliding resistance, a friction coefficient of 0.40 may be used at the concrete and soil interface. The passive pressure and the friction resistance could be combined without reduction. However, the lateral passive resistance is to be considered only if it is ensured that the soil against embedded structures will remain intact with time. The recommended passive pressure provided above is an ultimate value. Therefore, a suitable factor of safety (minimum of 1.5) should be applied to this value for design purposes.

The near surface soils have an expansion index classification of “very low” (0-20). Therefore, nominal reinforcement consisting of two #5 bars placed within 3 inches of the top of footings and two #5 bars placed within 3 inches of the bottom of footings are recommended. However, the structural engineer may require heavier reinforcement. Spread foundations should be reinforced as required by the structural engineer.

4.08 MAT FOUNDATIONS

The proposed new reservoir may be supported on a mat foundation bearing on recompacted native soils. Mat foundations can be designed using a preliminary allowable bearing pressure of 3,000 psf, and designed with a preliminary modulus of subgrade reaction, K , equal to 250 pounds per cubic inch (pci).

The modulus of subgrade reaction should be adjusted based on the size of the mat using the following equation: $K' = K * [(B+1)/2B]^2$ where B = width of the mat, and K' = design subgrade modulus of the mat.

The allowable bearing capacity for mat foundations can be increased by 1/3 for temporary transient loading, such as earthquake or wind.

Mat settlements are anticipated to be less than 1 inch with differential settlements less than ½ inch over 40 feet. Approximately ½” or less of seismically-induced settlement is anticipated under dry dynamic loading conditions.

4.09 DRILLED PIER FOUNDATIONS

Proposed site improvements (reservoir structural slab, retaining walls, etc.) may be supported by cast-in-drilled-hole (CIDH) pier foundations. MTGL, Inc.'s recommendations are considered minimum and may be superseded by more conservative requirements of the architect, structural engineer, building code, or governing agencies. Any pile load tests should be as required by the structural engineer and/or governing agency.

The piers should be a minimum of 18 inches in diameter and be embedded a minimum of ten feet below the lowest adjacent soil grade. Allowable end bearing capacity for the pier foundation is 6,000 psf at a depth of ten feet below the lowest adjacent soil grade, which may be increased by 500 psf for each additional foot of embedment up to a maximum value of 10,000 psf. The upper two feet of the drilled pier foundation should be ignored for calculation of bearing capacity, unless confined by pavement or slab.

Alternatively, the piers may be designed utilizing an allowable frictional resistance along the sidewalls of the concrete pier of 350 psf. The upper two feet of the drilled pier foundation should be ignored for calculation of skin friction capacity, unless confined by pavement or slab. **End bearing capacity and frictional resistance cannot be combined.**

Lateral passive resistance may be considered 350 psf per foot of embedment up to a maximum value of 4,000 psf. The upper two feet of the drilled pier foundation should be ignored for calculation of passive resistance, unless confined by pavement or slab. The design coefficient of friction between concrete foundation and subsurface soils is 0.40.

Uplift capacity of the pier foundation may be considered equal to 60 percent of the allowable frictional capacity between the pier and the surrounding soils (limited to two feet below the lowest soil grade unless confined by pavement or slab), plus the weight of the pier foundation.

The allowable bearing capacity and the allowable resistance of the horizontal forces may be increased by 1/3 for wind, seismic, or other short-term loading.

Provided the piers are spaced a minimum of three diameters apart (measured from the butt), there is no reduction for pier group interaction. All piers shall be adequately reinforced and tied into foundations. The indicated pier capacities are based upon the strength of the soils. The structural capacity of the pier itself should be verified by the structural engineer. Pier foundation reinforcement should be in accordance with applicable sections of the governing building code and/or requirements of the structural engineer.

4.10 HELICAL ANCHOR FOUNDATIONS

The following table presents recommendations for both loading in compression and in tension for helical anchors. The recommended design values incorporate a design friction factor of 0.65 (tangent of design angle of internal friction) with a factor of safety of 2.0. Considering the generally non-plastic nature of the on-site soil deposits, a cohesion value of zero (0) was deemed appropriate.

Tip Depth (feet)	Allowable Base Bearing (KSF) in Compression	Allowable Skin Friction (KSF) Per Foot in Compression*	Allowable Skin Friction (KSF) Per Foot of Depth in Uplift (Tension)
10	9.5	0.09	0.025
15	14.5	0.11	0.030
20	19.5	0.16	0.045

*Neglect the upper one foot of anchor embedment unless confined by pavement or slab.

4.11 TIE-BACKED ANCHORED (BRACED) WALLS

The soil pressure distribution for excavation support for tie-backed anchored (braced) retaining walls is a function of the type of excavation support system and any bracing used. For design, the shoring system should be designed using a trapezoidal pressure distribution have a maximum pressure of 55H within the middle 0.6H and reducing to zero towards the top and bottom of the wall, where H is the height of the wall (see Figure 4).

The design earth pressure on the lagging can be 0.6 times the earth pressure or a maximum of 400 psf in accordance with California Department of Transportation (2011), "Trenching and Shoring Manual", Revision 1, August 2011.

Surcharge loading due to adjacent structures, traffic and construction loading within a distance of 30 feet from the top of the wall should be designed as a constant load equal to one-third the applied surcharge. Heavy concentrated construction surcharges (i.e. cranes, material storage, etc.) should be kept a minimum distance of 10 feet away from the wall.

Passive resistance against soldier beams below the excavated level should be based on an equivalent fluid pressure (EFP) of 350 psf/foot beginning three (3) feet below the lowest subgrade level in front of the soldier beams. This passive resistance includes a factor of safety of 1.5. A maximum of 3 times the width of the soldier beam can be considered as contributing to passive pressure. Care must be taken during construction so as not to excavate any soil providing lateral restraint to the shoring system's toe. To minimize vibration and avoid adversely impacting neighboring structures, it is recommended that the soldier piles are placed in pre-drilled and cleaned-out holes that are

subsequently backfilled with high-strength grout (minimum 5,000 psi compressive strength) or structural concrete (minimum of 4,000 psi compressive strength).

Tie-back anchors should have a minimum free-stressing length of 10 feet, a minimum bond length of 15 feet, and should develop a minimum allowable bond stress of 500 psf in the bond zone (see Figure 4). Post-grouting is expected to be necessary to attain this minimum allowable bond stress. High bond stresses may be feasible but should be confirmed by performance and proof load tests as documented below.

At least two (2) initial tie-backs along each excavation face should be performance tested to 200% of the design load to confirm the design bond stress. All tie-backs should be proof-tested to 150% of their design capacity prior to locking off the tie-back, with each anchor “lift-off” tested to verify proper lock-off load transfer.

Deflection at the top of the excavation support system will be a function of the design and sequence of installation of the tie-backs. The system should be designed to limit deflections adjacent to existing public streets and neighboring structures to less than ½ inch, but in no case should deformations be such that cause damage or loss of support to areas, structures, and utilities beyond the excavation.

4.12 CONCRETE SLABS ON GRADE AND MISCELLANEOUS FLATWORK

A minimum of five (5) inch thickness (actual) should be designed for structural concrete slab-on-grade within heavy use areas of buildings or structures. Concrete slabs on grade and miscellaneous flatwork that are not subjected to vehicular loads may be designed with a minimum thickness of four (4) inches for normal loading conditions. However, if heavier loads are anticipated, a modulus of subgrade reaction of 300 pounds per cubic inch may be used for design of mat or larger/combined braced footings, provided the foundations are supported on compacted fill placed as recommended in this report.

All slabs and flatwork should be reinforced with a minimum #4 bars, 18 inches on center, each direction, placed at the mid-height of the slab. The structural engineer may require heavier reinforcement. Special care should be taken so that reinforcement is placed at the slab mid-height.

Floor slabs should be separated from footings, structural walls, and utilities and provisions made to allow for settlement or swelling movements at these interfaces. If this is not possible from a structural or architectural design standpoint, it is recommended that the slab connection to footings be reinforced such that there will be resistance to potential differential movement.

Control joints should be constructed on all slabs on grade to create squares or rectangles with a maximum spacing of 12 feet on large slab areas. Where flatwork is adjacent to curbs, reinforcing bars should be placed between the flatwork and the curbs. Expansion joint material should be used between flatwork and curbs, and flatwork and buildings.

Vehicular concrete pavers should be designed with one (1) inch sand over eight (8) inches of Caltrans Class II aggregate base over a minimum of twenty-four (24) inches of subgrade compacted to at least 90 percent of maximum dry density. Any aggregate base material should be compacted to at least 95 percent of maximum dry density. Compaction should be verified by testing.

Subsurface moisture and moisture vapor naturally migrate upward through the soil and where the soil is covered by a building or pavement. To reduce the impact of the subsurface moisture and potential impact of future introduced moisture (such as landscape irrigation or precipitation) damp proofing should be provided under all slabs on grade with moisture sensitive floor coverings. The damp proofing should consist of a minimum 15 mil polyethylene liner placed with 2 inches of sand below and 2 inches of sand above the polyethylene liner. The liner should be carefully fitted around service openings with joints lapped not less than 6 inches.

Damp proofing typically will not necessarily assure that floor slab moisture transmission rates will meet floor-covering manufacturer standards. Other factors such as surface grades, adjacent planters, the quality of slab concrete and the permeability of the on-site soils will affect slab moisture. In many cases, floor moisture problems are the result of either improper curing of floors slabs or improper application of flooring adhesives. It is recommended contacting a flooring consultant experienced in the area of concrete slab-on-grade floors for specific recommendations regarding the proposed flooring applications. We make no guarantee nor provide any assurance that use of a vapor retarder system will reduce concrete slab-on-grade floor moisture penetration to any specific rate or level, particularly those required by floor covering manufacturers. The builder and designers should consider all available measures for floor slab moisture protection.

Special precautions must be taken during the placement and curing of all concrete slabs. Excessive slump (high water-cement ratio) of the concrete and/or improper curing procedures used during either hot or cold weather conditions could lead to excessive shrinkage, cracking, or curling of the slabs. High water-cement ratio and/or improper curing also greatly increase the water vapor permeability of concrete. It is recommended that all concrete placement and curing operations be performed in accordance with the American Concrete Institute (ACI) manual.

The subgrade soils beneath all concrete flatwork should be compacted to a minimum of 90% relative compaction for a minimum depth of 24 inches. The geotechnical engineer should monitor

the compaction of the subgrade soils and perform testing to verify that proper compaction has been obtained.

4.13 PREWETTING RECOMMENDATION

Prior to placing concrete slabs and flatwork, the underlying soils should be brought to near optimum moisture content for a depth of six inches prior to the placement of concrete. The geotechnical consultant should perform in-situ moisture tests to verify that the appropriate moisture content has been achieved a maximum of 24 hours prior to the placement of concrete or moisture barriers.

Once the slab subgrade soil has been pre-wetted and compacted, the soil should not be allowed to dry prior to concrete placement. If the subgrade soil is dry, the moisture content of the soil should be restored prior to placement of concrete and re-tested.

Proper moisture conditioning and compaction of subgrade soils prior to placement is very important prior to concrete placement. Even with proper site preparation, some soil moisture changes of the subgrade soils supporting the concrete flatwork due to edge effects (shrink/swell) may occur. Drying and/or wetting of subgrade soils adjacent to landscaped areas or open fields may increase the potential of shrink/swell effects beneath concrete flatwork areas. To help reduce edge effects, lateral cutoffs, such as inverted curbs are recommended. Control joints should be used to reduce the potential for flatwork panel cracks as a result of minor soil shrink/swell.

4.14 SOIL CORROSION POTENTIAL

Soluble sulfate tests indicate that concrete at the subject site will have a “negligible” (Class S0) exposure to water soluble sulfate in the soil. Recommendations for concrete exposed to sulfate-containing soils are presented below.

RECOMMENDATIONS FOR CONCRETE EXPOSED TO SULFATE CONTAINING SOILS

Sulfate Exposure Severity	Class	Water soluble sulfate (SO ₄) in soil (% by wgt)	Sulfate (SO ₄) in water (ppm)	Max Water to Cement Ratio by Weight	Minimum Compressive Strength (psi)	Cement Type	Calcium Chloride Admixture
Negligible	S0	0.00 - 0.10	0-150	---	2,500	---	No Restriction
Moderate	S1	0.10 - 0.20	150-1,500	0.50	4,000	II/V	No Restriction
Severe	S2	0.20 - 2.00	1,500-10,000	0.45	4,500	V	Not Permitted
Very Severe	S3	Over 2.00	Over 10,000	0.45	4,500	V Plus Pozzolan	Not Permitted

Corrositivity testing consisting of soils reactivity (pH) and resistivity (ohms-cm) were also tested on representative soils. The test results indicate that the soils have a soil reactivity (pH) of 7.8, and a resistivity of 23,000 ohms-cm. A neutral or non-corrosive soil has a reactivity value ranging from 5.5 to 8.4. Generally, soils that could be considered corrosive to metal have resistivities less than 3,000 ohms. Those soils with resistivity values of less than 1,000 ohms-cm can be considered extremely corrosive.

Based on our test results, near surfaces are anticipated to have a moderate corrosion potential. Protection of buried metal with sand bedding and protective coatings may be used to further reduce corrosion potential. A qualified corrosion engineer should be consulted to further assess the corrosion potential, as necessary.

4.15 RETAINING WALLS

Embedded structural walls should be designed for lateral earth pressures exerted on the walls (see Figure 5). The magnitude of these earth pressures will depend on the amount of deformation that the wall can yield under the load. If the wall can yield sufficiently to mobilize the full shear strength of the soils, it may be designed for the “active” condition. If the wall cannot yield under the applied load, then the shear strength of the soil cannot be mobilized, and the earth pressures will be higher. These walls such as basement walls and swimming pools should be designed for the “at-rest” condition. If a structure moves towards the retained soils, the resulting resistance developed by the soil will be the “passive” resistance. Both passive and active earth pressures are considered to act as “triangular” distributions (see Figure 5).

For design purposes, the recommended equivalent fluid pressure for each case for walls constructed above the static groundwater table and backfilled with non-expansive soils is provided below.

Retaining wall backfill should be compacted to at least 90% relative compaction based on the maximum density defined by ASTM D1557. Retaining structures may be designed to resist the following lateral earth pressures:

- Allowable Bearing Pressure – 2,500 psf
- Coefficient of Friction (Soil to Footing) – 0.40
- Passive Earth Pressure – equivalent fluid weight of 350 pcf (Maximum of 2,500 psf)
- At-rest lateral earth pressure – 55 pcf
- Active Earth Pressures – equivalent fluid weights:

Slope of Retained Material	Equivalent Fluid Weight (pcf)
Level	35
2:1 (H:V)	60

It is recommended that all retaining wall footings be embedded at least 18 inches below the lowest adjacent finish grade, or a minimum of 12 inches below lowest adjacent soil grade. In addition, the wall footings should be designed and reinforced as required for structural considerations. The wall areas should be over-excavated to a minimum depth of 2 feet below the bottom of the proposed footings. The required horizontal limits of the over excavated area shall be defined as the area extending from the edge of the footing for a minimum distance of 2 feet.

The passive pressure value provided above is an ultimate value. Therefore, a suitable factor of safety (minimum of 1.5) should be applied to these values for design purposes. The appropriate factor of safety will depend on the design condition and should be determined by the project Structural Engineer. If any super-imposed loads are anticipated, this office should be notified so that appropriate recommendations for earth pressures may be provided.

Surcharge loading due to adjacent structures, traffic and construction loading within a distance of 30 feet from the top of the wall should be designed as a constant load equal to one-third the applied surcharge. Heavy concentrated construction surcharges (i.e. cranes, material storage, etc.) should be kept a minimum distance of 10 feet away from the wall.

Retaining structures should be drained to prevent the accumulation of subsurface water behind the walls. Back drains should be installed behind all retaining walls exceeding 3.0 feet in height. A typical detail for retaining wall back drains is presented as Figure 3. Alternatively, a pre-manufactured drainage product (i.e. Mira-Drain™ or equivalent) may be utilized instead of an aggregate drain. All back drains should be outlet to suitable drainage devices. Walls and portions thereof that retain soil and enclose interior spaces and floors below grade should be waterproofed and damp-proofed accordingly. Any pre-manufactured product should be installed in strict conformance with the manufacturer's requirements.

4.16 SEISMICALLY INDUCED LATERAL EARTH PRESSURES

A seismic lateral increment of 30 pcf (equivalent fluid weight) may be applied as an incremental force which should be applied to the back of the wall in the upper 1/3 of the wall and also applied as a reduction of force to the front of the wall in the upper 1/3 of the footing.

4.17 PAVEMENT RECOMMENDATIONS

Recommended pavement structural sections are based on the procedures outlined in "Design Procedures for Flexible Pavements" of the Highway Design Manual, California Transportation Department. This procedure uses the principal that the pavement structural section must be of adequate thickness to distribute the load from the design traffic (TI) to the subgrade soils in such a manner that the stresses from the applied loads do not exceed the strength of the soil (R value).

All asphalt concrete pavement sections should be supported by a minimum twenty-four (24) inch thickness of subgrade compacted to at least 90 percent relative compaction. Compaction should be verified by testing.

Pavement sections were designed based on an R-Value of 60 and assumed Traffic Index of 4.0 for light auto parking and drive lanes, 5.0 for commercial vehicles/access lanes, and 7.0 for truck access/fire lanes. The recommend structural sections are as follows:

ASPHALT PAVEMENT STRUCTURAL SECTION

Pavement Area	Traffic Index	Asphalt Thickness	Aggregate Base Thickness
Light Auto Parking / Drive Lanes	4.0	3.5"	4.0"
Commercial Vehicles / Access Lanes	5.0	4.0"	4.0"
Truck Access/Fire Lanes (Heavy Truck Traffic/ 80,000 Pound Fire Vehicle)	7.0	5.0"	6.0"

Portland cement concrete (PCC) pavements for areas which are subject to traffic loads may be designed with a minimum thickness of 5.0 inches of Portland cement concrete on 4.0 inches of compacted aggregate base. As recommended in Section 4.10 of this report, project Portland cement concrete should have a minimum compressive strength of 4,000 psi.

Prior to paving, the exposed subgrade soils should be scarified, adjusted to within 2% of optimum moisture and compacted to a minimum of 90% relative compaction for a minimum depth of 12 inches. All aggregate base courses should be compacted to a minimum of 95% relative compaction. Compaction should be confirmed by testing.

4.18 CONSTRUCTION CONSIDERATIONS

4.18.1 MOISTURE SENSITIVE SOILS/WEATHER RELATED CONCERNS

The upper soils encountered at this site may be sensitive to disturbances caused by construction traffic and to changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and its support capabilities. In addition, soils that become excessively wet may be slow to dry and thus significantly delay the progress of the grading operations. Therefore, it will be advantageous to perform earthwork and foundation construction activities during the dry season. Much of the on-site soils may be susceptible to erosion during periods of inclement weather. As a result, the project Civil Engineer/Architect and Grading Contractor should take appropriate precautions to reduce the potential for erosion during and after construction.

4.18.2 DRAINAGE AND GROUNDWATER CONSIDERATIONS

Historic high groundwater levels in the immediate site vicinity are approximately 100 feet below grade. Since this is below the anticipated depths of grading, the installation of subdrains is not expected to be necessary. However, variations in the ground water table may result from fluctuation in the ground surface topography, subsurface stratification, precipitation, irrigation, and other factors such as impermeable and/or cemented formational materials overlain by fill soils. In addition, during retaining wall excavations, seepage may be encountered. Therefore, it is recommended that a representative of MTG_L, Inc. be present during grading operations to evaluate areas of seepage. Drainage devices for reduction of water accumulation can be recommended should these conditions occur.

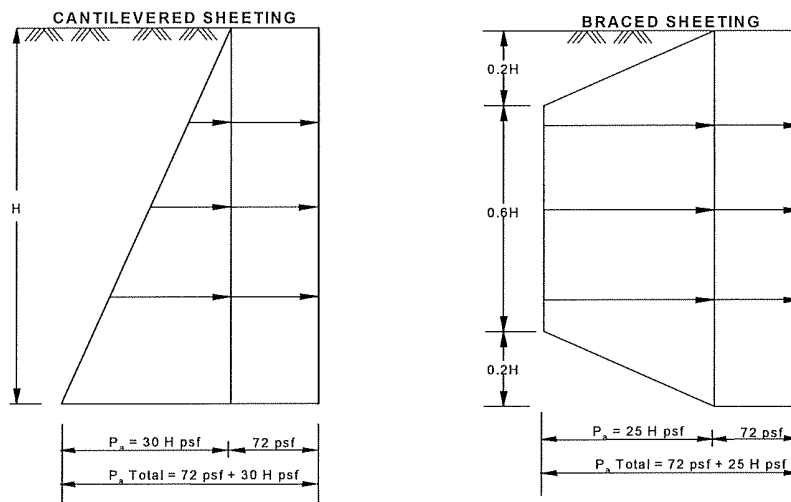
Water should not be allowed to collect in the foundation excavation, on floor slab areas, or on prepared subgrades of the construction area either during or after construction. Undercut or excavated areas should be sloped to facilitate removal of any collected rainwater, groundwater, or surface runoff. Positive site drainage should be provided to reduce infiltration of surface water around the perimeter of the building and beneath the floor slabs. The grades should be sloped away from the building and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill and floor slab areas of the building.

4.18.3 TEMPORARY EXCAVATIONS AND SHORING

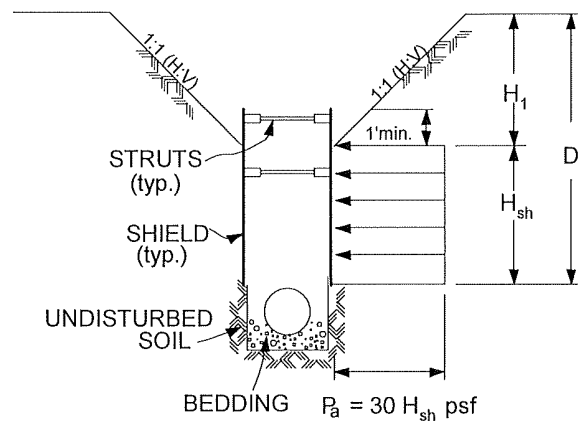
Short term temporary excavations in existing soils may be safely made at an inclination of 1:1 (horizontal to vertical) or flatter. If vertical sidewalls are required in excavations greater than 5

feet in depth, the use of cantilevered or braced shoring is recommended. Excavations less than 5 feet in depth may be constructed with vertical sidewalls without shoring or shielding. Our recommendations for lateral earth pressures to be used in the design of cantilevered and/or braced shoring are presented below. These values incorporate a uniform lateral pressure of 72 psf to provide for the normal construction loads imposed by vehicles, equipment, materials, and workmen on the surface adjacent to the trench excavation. However, if vehicles, equipment, materials, etc. are kept a minimum distance equal to the height of the excavation away from the edge of the excavation, this surcharge load need not be applied.

Design of the shield struts should be based on a value of 0.65 times the indicated pressure, P_a , for the approximate trench depth. The wales and sheeting can be design for a value of $2/3$ the design strut value.



SHORING DESIGN: LATERAL SHORING PRESSURES



HEIGHT OF SHIELD, H_{sh} = DEPTH OF TRENCH, D_t , MINUS DEPTH OF SLOPE, H_1

TYPICAL SHORING DETAIL

Placement of the shield may be made after the excavation is completed or driven down as the material is excavated from inside of the shield. If placed after the excavation, some overexcavation may be required to allow for the shield width and advancement of the shield. The shield may be placed at either the top or the bottom of the pipe zone. Due to the anticipated thinness of the shield walls, removal of the shield after construction should have negligible effects on the load factor of pipes. Shields may be successively placed with conventional trenching equipment.

Vehicles, equipment, materials, etc. should be set back away from the edge of temporary excavations a minimum distance of 15 feet from the top edge of the excavation. Surface waters should be diverted away from temporary excavations and prevented from draining over the top of the excavation and down the slope face. During periods of heavy rain, the slope face should be protected with sandbags to prevent drainage over the edge of the slope, and a visqueen liner placed on the slope face to prevent erosion of the slope face.

Periodic observations of the excavations should be made by the geotechnical consultant to verify that the soil conditions have not varied from those anticipated and to monitor the overall condition of the temporary excavations over time. If at any time during construction conditions are encountered which differ from those anticipated, the geotechnical consultant should be contacted and allowed to analyze the field conditions prior to commencing work within the excavation. All Cal/OSHA construction safety orders should be observed during all underground work.

4.18.4 UTILITY TRENCHES

All Cal/OSHA construction safety orders should be observed during all underground work. All utility trench backfills within street right of way, utility easements, under or adjacent to sidewalks, driveways, or building pads should be observed and tested by the geotechnical consultant to verify proper compaction. Trenches excavated adjacent to foundations should not extend within the footing influence zone defined as the area within a line projected at a 1:1 (horizontal to vertical) drawn from the bottom edge of the footing. Trenches crossing perpendicular to foundations should be excavated and backfilled prior to the construction of the foundations. The excavations should be backfilled in the presence of the geotechnical engineer and tested to verify adequate compaction beneath the proposed footing.

Utilities should be bedded and backfilled with clean sand or approved granular soil to a depth of at least 1-foot over the pipe. The bedding materials shall consist of sand, gravel, crushed aggregates, or native soils that are free draining with a sand equivalence of not less than 30. The bedding should be uniformly watered and compacted to a firm condition for pipe support.

The remainder of the backfill shall be typical on-site soil or imported soil which should be placed in lifts not exceeding 8 inches in thickness, watered or aerated to near optimum moisture content, and mechanically compacted to at least 90% of maximum dry density (ASTM D1557).

The bedding and backfill materials and placement shall conform to the requirements of the latest Standard Specifications for Public Works Construction (Greenbook).

4.18.5 SITE DRAINAGE

The site should be drained to provide for positive drainage away from structures in accordance with the building code and applicable local requirements. Unpaved areas should slope no less than 2% away from structure. Paved areas should slope no less than 1% away from structures. Concentrated roof and surface drainage from the site should be collected in engineered, non-erosive drainage devices and conducted to a safe point of discharge. The site drainage should be designed by a civil engineer.

4.19 GEOTECHNICAL OBSERVATION/TESTING OF EARTHWORK OPERATIONS

The recommendations provided in this report are based on preliminary design information and subsurface conditions as interpreted from the investigation. Our preliminary conclusion and recommendations should be reviewed and verified during site grading and revised accordingly if

exposed Geotechnical conditions vary from our preliminary findings and interpretations. The Geotechnical consultant should perform Geotechnical observation and testing during the following phases of grading and construction:

- During site grading and overexcavation.
- During foundation excavations and placement.
- Upon completion of retaining wall footing excavation prior to placing concrete.
- During excavation and backfilling of all utility trenches
- During processing and compaction of the subgrade for the access and parking areas and prior to construction of pavement sections.
- When any unusual or unexpected Geotechnical conditions are encountered during any phase of construction.

5.00 LIMITATIONS

The findings, conclusions, and recommendations contained in this report are based on the site conditions as they existed at the time of MTG_L, Inc.'s investigation, and further assume that the subsurface conditions encountered during MTG_L, Inc.'s investigation are representative of conditions throughout the site. Should subsurface conditions be encountered during construction that are different from those described in this report, this office should be notified immediately so that our recommendations may be re-evaluated.

This report was prepared for the exclusive use and benefit of the owner, architect, and engineer for evaluating the design of the facilities as it relates to geotechnical aspects. It should be made available to prospective contractors for information on factual data only, and not as a warranty of subsurface conditions included in this report.

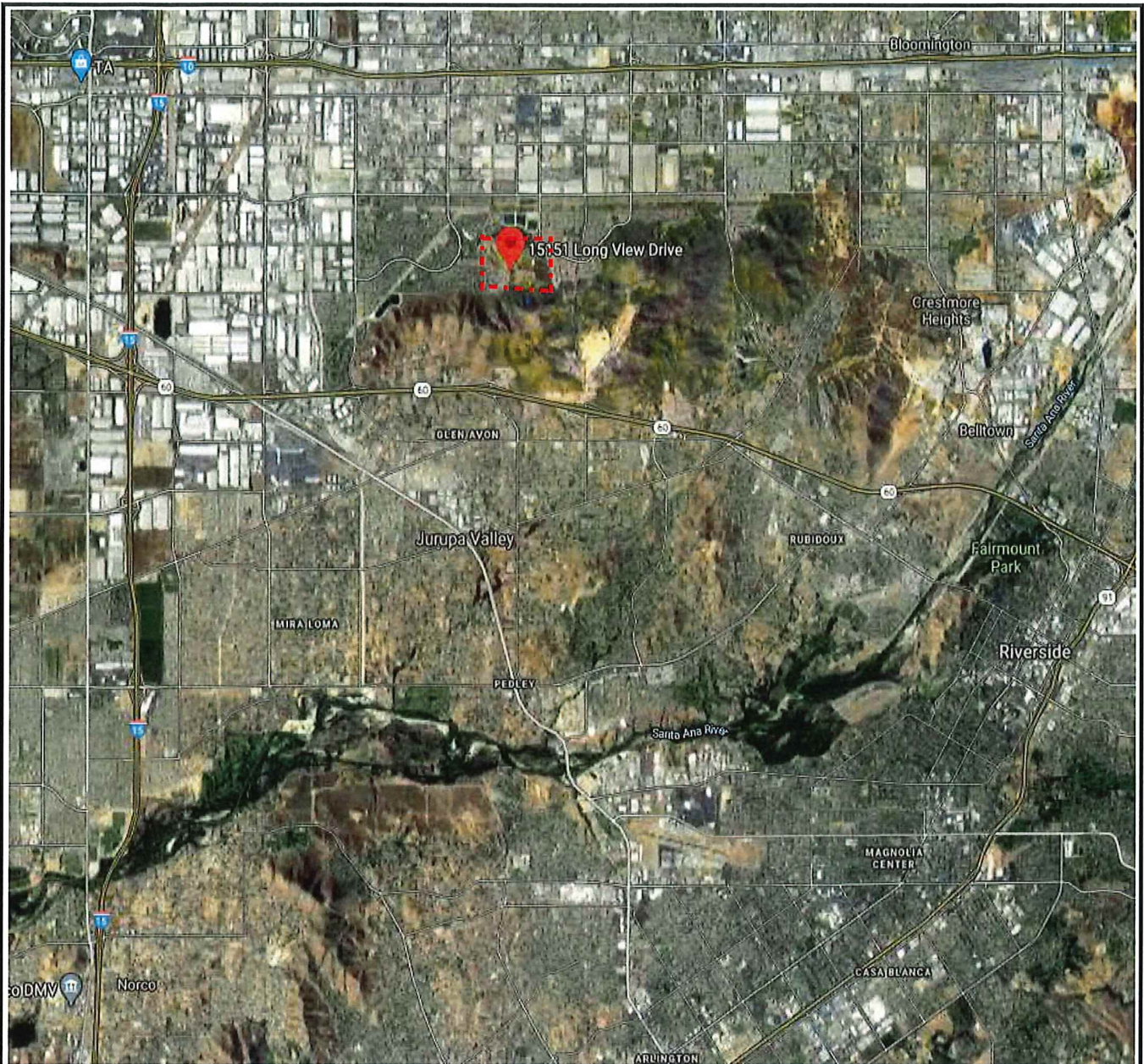
MTG_L, Inc.'s investigation was performed using the standard of care and level of skill ordinarily exercised under similar circumstances by reputable soil engineers and geologists currently practicing in this or similar localities. No other warranty, express or implied, is made as to the conclusions and professional advice included in this report.

This firm does not practice or consult in the field of safety engineering. MTG_L, Inc.'s does not direct the Contractor's operations, and are not responsible for their actions. The contractor will be solely and completely responsible for working conditions on the job site, including the safety of all persons and property during performance of the work. This responsibility will apply continuously and will not be limited to MTG_L, Inc.'s normal hours of operation.

The findings of this report are considered valid as of the present date. However, changes in the conditions of a site can occur with the passage of time, whether they are due to natural events or to human activities on this or adjacent sites. In addition, changes in applicable or appropriate codes and standards may occur, whether they result from legislation or the broadening of knowledge.

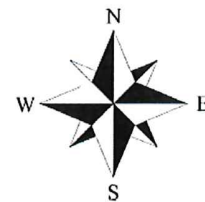
Accordingly, this report may become invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and revision as changed conditions are identified.

FIGURES



Source: Google Maps

SITE LOCATION MAP



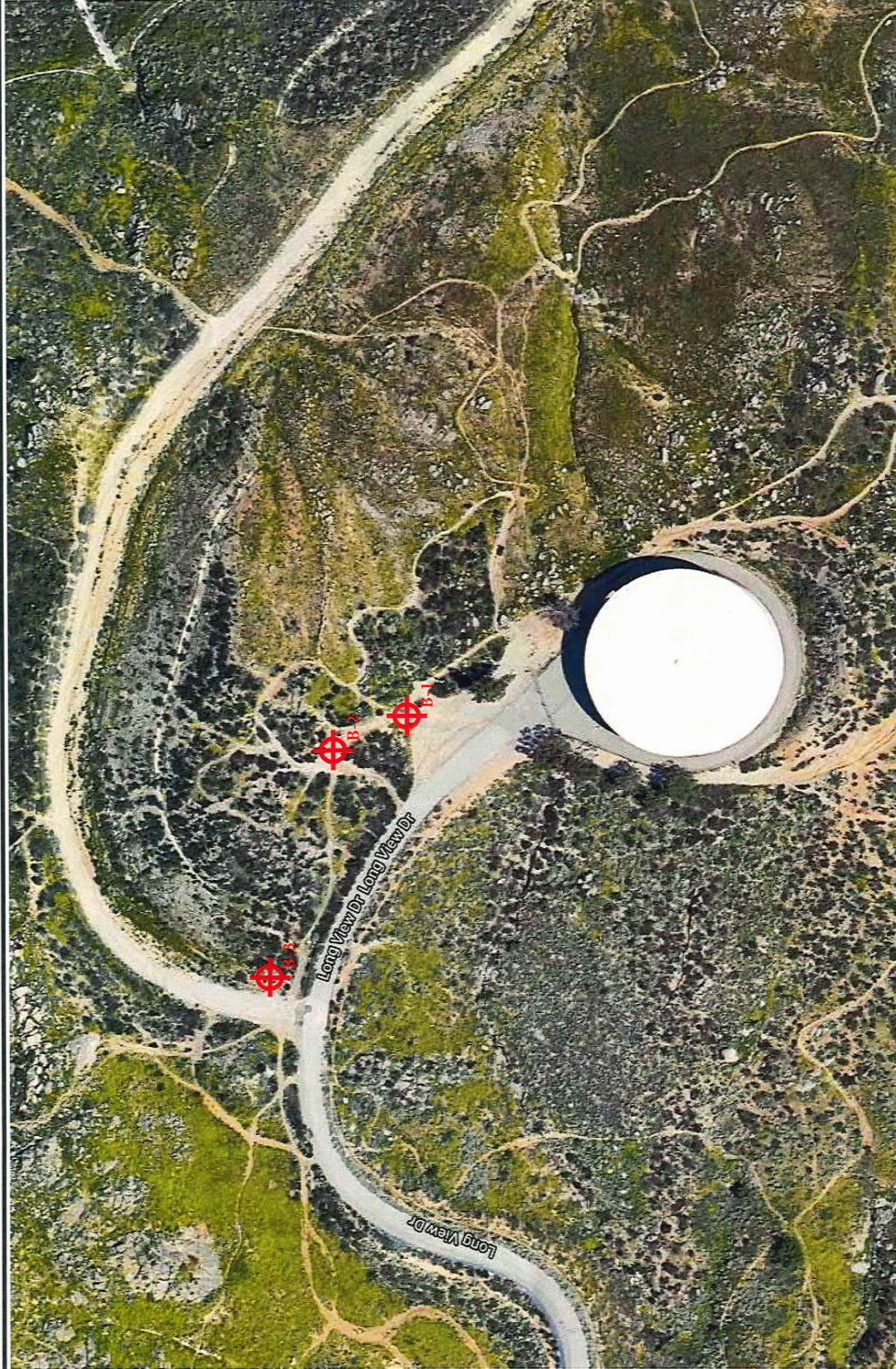
SGV Plant F20
15151 Long View Drive
Fontana, CA 92337

Project Number:
2492A13

Scale: Not to Scale

Date: 9/25/20

Figure No. 1



LEGEND:



Boring Location

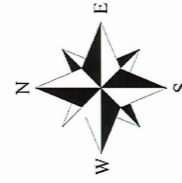
BORING LOCATION MAP

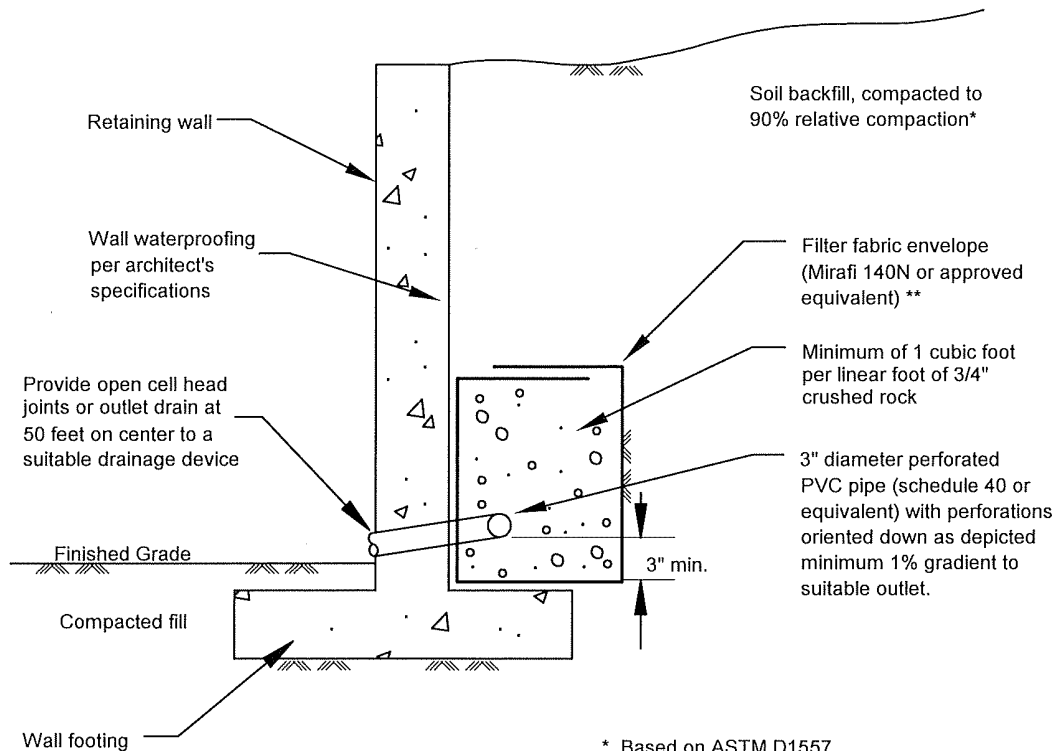
SGV Plant F20
15151 Long View Drive
Fontana, California 92337

Project No.: 2492A13

Figure No.: 2

Project Date: 9/25/2020





* Based on ASTM D1557

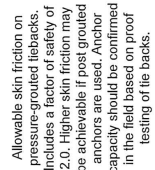
** If class 2 permeable material (See gradation to left) is used in place of 3/4" - 1 1/2" gravel. Filter fabric may be deleted. Class 2 permeable material compacted to 90% relative compaction. *

**SPECIFICATIONS FOR CLASS 2
 PERMEABLE MATERIAL
 (CAL TRANS SPECIFICATIONS)**

Sieve Size	% Passing
1"	100
3/4"	90-100
3/8"	40-100
No.4	25-40
No.8	18-33
No.30	5-15
No.50	0-7
No.200	0-3

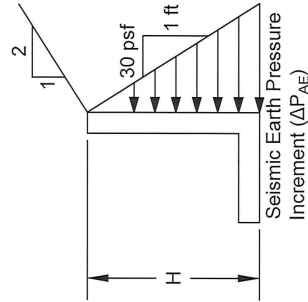
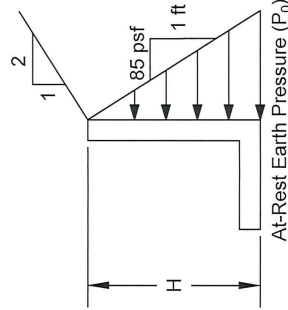
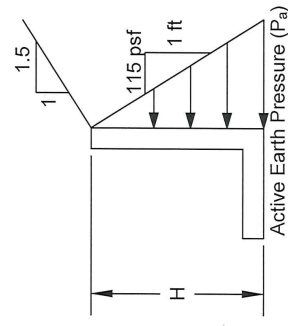
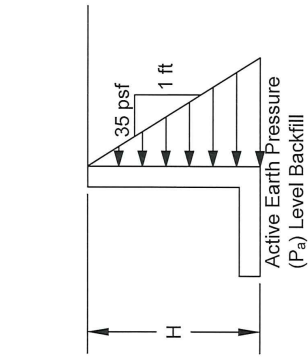
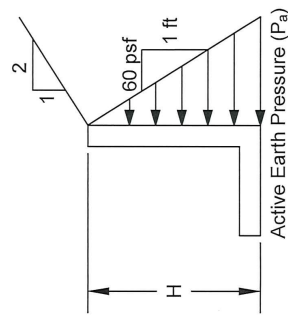
RETAINING WALL DRAINAGE DETAIL

Figure 3



- Notes:**
1. Passive pressure should be assumed to act over the soldier pile spacing of three pile diameters.
 2. Active pressure below the excavation should be assumed to act over one pile diameter.
 3. The recommended pressures do not include surcharges from adjacent structures. Surcharges from adjacent structures should be added to the above shoring pressures, as appropriate.
 4. psf denotes pounds per cubic foot; pscf denotes pounds per square foot.

[illegible]



Symbols:

H = Height of Wall (feet)

psf = pounds per square foot

P_0 = At-Rest Earth Pressure (Restrained Walls)

P_a = Active Earth Pressure (Unrestrained Walls)

 ΔP_{AE} = Seismic Earth Pressure Increment

Notes:

1. Seismic Earth Pressure Increment should be added to the Active Earth Pressure and any applicable surcharge.
2. Retained soil material assumed to be compromised of native material.

2. Retained soil material assumed to be comprised of native material.

NO.	REVISION DESCRIPTION	AUTHOR	DATE
REVISIONS			

DRAWN ON: October 20, 2020

CHECKED BY:

CLIENT: **SAN GABRIEL VALLEY
WATER COMPANY**

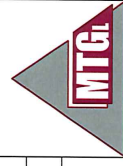
PROJECT:	SGVWC - PLANT F20	NO.	2492A13
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DRAWING:	DESIGN EARTH PRESSURES FOR RETAINING WALL
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FIGURE:	5	15151 LONG VIEW DRIVE,
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SCALE:	NTS	FONTANA, CA 92337
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SCALE:	NT:
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APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

California Department of Conservation, Division of Mines and Geology, 2001, Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117.

Carson, S.E. and Matti, J.C., 1985, Contour Map Showing Minimum Depth to Ground Water, Upper Santa Ana River Valley, California, 1973-1979: U.S. Geological Survey Map MF - 1802.

Hart, E.W., 1997, Fault-rupture Hazard Zones in California: California Department of Conservation, Division of Mines and Geology Special Publication 42.

Jennings, C.W., 1994, Fault Activity Map of California and Adjacent Areas: California Department of Conservation, Division of Mines and Geology, Geologic Data Map No. 6.

San Bernardino County Land Use Plan, 2009, Geologic Hazard Overlays, Sheet FH22C

Treiman, J. A., and Lundberg, M. Matthew, compilers, 1999, Fault number 125a, San Jacinto fault, San Bernardino Valley section, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, <http://earthquakes.usgs.gov/regional/qfaults>.

Treiman, J. Jerome, compiler, 2000, Fault number 105h, Sierra Madre fault zone, Cucamonga section, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, <http://earthquakes.usgs.gov/regional/qfaults>.

U.S. Geological Survey, Seismic Design Maps Application, ASCE 7 Standard, <http://earthquake.usgs.gov/designmaps/us/application.php>

U.S. Geological Survey, Earthquakes Hazard Program/Quaternary Fault and Fold Database, <http://gldims.cr.usgs.gov/qfault/viewer.htm>

US Army Corps of Engineers, 2003, Engineering and Design - Stability Analysis of Concrete Structures, Publication CECW-E, Circular No. 1110-2-6058, Appendix G,

Ziony, J.I., 1985, Evaluating Earthquake Hazards in the Los Angeles Region: U.S. Geological Survey Professional Paper 1360.

APPENDIX B
FIELD EXPLORATION PROGRAM

APPENDIX B

FIELD EXPLORATION PROGRAM

The subsurface conditions for this Geotechnical Investigation were explored by drilling exploratory borings with an 8-inch hollow-stem-auger to a maximum depth of 26.5 feet below existing grade. All borings were terminated due to encountering large gravels/boulders/bedrock. All drive samples were obtained by California Tube or SPT Samplers. The approximate locations of the borings are shown on the Boring Location Map (Figure 2). The field exploration was performed under the supervision of an Engineer/Geologist who maintained a continuous log of the subsurface soils encountered and obtained samples for laboratory testing.

Subsurface conditions are summarized on the accompanying Logs of Borings. The logs contain factual information and interpretation of subsurface conditions between samples. The stratum indicated on these logs represents the approximate boundary between earth units and the transition may be gradual. The logs show subsurface conditions at the dates and locations indicated and may not be representative of subsurface conditions at other locations and times.

Identification of the soils encountered during the subsurface exploration was made using the field identification procedure of the Unified Soils Classification System (ASTM D2488). A legend indicating the symbols and definitions used in this classification system and a legend defining the terms used in describing the relative compaction, consistency or firmness of the soil are attached in this appendix. Bag samples of the major earth units were obtained for laboratory inspection and testing, and the in-place density of the various strata encountered in the exploration was determined.

The exploratory borings were located in the field by using cultural features depicted on a preliminary site plan provided by the client. Each location should be considered accurate only to the scale and detail of the plan utilized.

The exploratory borings were backfilled with native soil cuttings, compacted, and patched with asphalt concrete where appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM					
No. 200 U.S. Standard Sieve is the smallest particle visible	Coarse-grained soils >1/2 of materials is larger than #200 sieve	GRAVELS are more than half of coarse fraction larger than #4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
			Gravels with fines	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
		SANDS are more than half of coarse fraction larger than #4 sieve	Clean Sands (less than 5% fines)	GM	Silty Gravels, poorly-graded gravel- sand-silt mixtures
			Sands with fines	GC	Clayey Gravels, poorly-graded gravel- sand-clay mixtures
	Fine-grained Soils >1/2 of materials is smaller than #200 sieve	SILTS AND CLAYS Liquid Limit Less than 50		SW	Well-graded sands, gravelly sands, little or no fines
				SP	Poorly-graded sands, gravelly sands, little or no fines
				SM	Silty Sands, poorly-graded sands- gravel-clay mixtures
				SC	Clayey Sands, poorly-graded sand- gravel-silt mixtures
				ML	Inorganic clays of low to med plasticity, gravelly, sandy, silty, or lean clays
		SILTS AND CLAYS Liquid Limit Greater than 50		CL	Inorganic clays of low to med plasticity, gravelly, sandy, silty, or lean clays
				OL	Organic silts and clays of low plasticity
				MH	Inorganic silts, micaceous or diatomaceous fine sands or silts
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic silts and clays of medium to high plasticity
Highly Organic Soils			PT	Peat, humus swamp soils with high organic content	

GRAIN SIZE				SIZE PROPORTION
Description	Sieve Size	Grain Size	Approximate Size	
Boulders	>12"	>12"	Larger than basketball-sized	Trace – Less than 5%
Cobbles	3" - 12"	3" - 12"	Fist-sized to basketball-sized	Few – 5% to 10%
Gravel	Coarse ¾" - 3"	¾" - 3"	Thumb-sized	Little – 15% to 20%
	Fine #4 - ¾"	0.19" - 0.75"	Peat-sized to thumb-sized	Some – 30% to 45%
Sand	Coarse #10 - #4	0.075" - 0.19"	Rock salt-sized to pea-sized	Mostly – 50% to 100%
	Medium #40 - #10	0.017" - 0.075"	Sugar-sized to rock salt-sized	MOISTURE CONTENT
	Fine #200 - #40	0.0029" - 0.017"	Flour-sized to sugar-sized	Dry – Absence of moisture
Fines	Passing #200	<0.0029"	Flour-sized or smaller	Moist – Damp but not visible
				Wet – Visible free water

CONSISTENCY FINE GRAINED SOILS			RELATIVE DENSITY COARSE GRAINED SOILS		
Apparent Density	SPT (Blows/Foot)	Mod CA Sampler (Blows/Foot)	Apparent Density	SPT (Blows/Foot)	Mod CA Sampler (Blows/Foot)
Very Soft	<2	<3	Very Loose	<4	<5
Soft	2-4	3-6	Loose	4-10	5-12
Firm	5-8	7-12	Medium Dense	11-30	13-35
Stiff	9-15	13-25	Dense	31-50	36-60
Very Stiff	16-30	26-50	Very Dense	>50	>60
Hard	>30	>50			

Project: **SGV Plant F20**

Project Location: **15151 Long View Drive, Fontana**

Project Number: **2492A13**

Key to Log of Boring

Sheet 1 of 1

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8	9	10	11
COLUMN DESCRIPTIONS										
1	Elevation (feet): Elevation (MSL, feet).						7	Graphic Log: Graphic depiction of the subsurface material encountered.		
2	Depth (feet): Depth in feet below the ground surface.						8	MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.		
3	Sample Type: Type of soil sample collected at the depth interval shown.						9	Water Content, %: Water content of the soil sample, expressed as percentage of dry weight of sample.		
4	Sample Number: Sample identification number.						10	Dry Unit Weight, pcf: Dry weight per unit volume of soil sample measured in laboratory, in pounds per cubic foot.		
5	Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.						11	REMARKS AND OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field personnel.		
6	Material Type: Type of material encountered.									
FIELD AND LABORATORY TEST ABBREVIATIONS										
CHEM: Chemical tests to assess corrosivity						PI: Plasticity Index, percent				
COMP: Compaction test						SA: Sieve analysis (percent passing No. 200 Sieve)				
CONS: One-dimensional consolidation test						UC: Unconfined compressive strength test, Qu, in ksf				
LL: Liquid Limit, percent						WA: Wash sieve (percent passing No. 200 Sieve)				
MATERIAL GRAPHIC SYMBOLS										
 Gravel						 Poorly graded SAND (SP)				
 Silty SAND (SM)						 Poorly graded SAND with Silt (SP-SM)				
TYPICAL SAMPLER GRAPHIC SYMBOLS										
 Auger sampler						 CME Sampler				
 Bulk Sample						 Grab Sample				
 3-inch-OD California w/ brass rings						 2.5-inch-OD Modified California w/ brass liners				
 Pitcher Sample						 2-inch-OD unlined split spoon (SPT)				
 Shelby Tube (Thin-walled, fixed head)										
OTHER GRAPHIC SYMBOLS										
 Water level (at time of drilling, ATD)						 Water level (after waiting)				
 Minor change in material properties within a stratum						 Inferred/gradational contact between strata				
 Queried contact between strata										
GENERAL NOTES										
1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.										
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.										

Project: **SGV Plant F20**Project Location: **15151 Long View Drive, Fontana**Project Number: **2492A13**

Log of Boring B-1

Sheet 1 of 1

Date(s) Drilled	9/25/20	Logged By	J. Rowerdink	Checked By	B. Hick
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	8" HSA	Total Depth of Borehole	26.5 ft
Drill Rig Type	CME-75	Drilling Contractor	Baja Explorations	Approximate Surface Elevation	1213 ft
Groundwater Level and Date Measured	Not Encountered	Sampling Method(s)	Bulk, Cal, SPT	Hammer Data	140 lb/ 30" Drop
Borehole Backfill	Soil Cuttings	Location	34.0387, -117.4727		

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
1213	0				SM		Surface: Sand and Gravel Silty Sand, Light Brown			R-Value = 77 Max Density = 134.0 pcf Opt. Moisture = 6.8%
1208	5			75	SM		Silty Sand, Light Brown, Multicolored, Some and Gravel, Dry, Very Dense	0.9	125.7	
1203	10			66	SM		Silty Sand, Light Brown, Some Gravel, Dry, Very Dense			
1198	15			50/6"	SM		Silty Sand, Light Brown, Trace Gravel, Dry, Very Dense	1.0	124.9	
1193	20			50/3"	SM		Silty Sand, Light Brown, Dry, Very Dense	0.8		
1188	25			50/4"	SM		Silty Sand, Brown, Trace Gravel, Moist, Very Dense	3.9	124.4	Added water to try to break through granite, higher moisture can be attributed to this
1183	30						Auger Refusal at 26.5' No Free Groundwater Encountered No Caving Boring Backfilled with Soil Cuttings on 9/25/20			

Project: **SGV Plant F20**Project Location: **15151 Long View Drive, Fontana**Project Number: **2492A13**

Log of Boring B-2

Sheet 1 of 1

Date(s) Drilled 9/25/20	Logged By J. Rowerdink	Checked By B. Hick
Drilling Method Hollow Stem Auger	Drill Bit Size/Type 8" HSA	Total Depth of Borehole 17.5 ft
Drill Rig Type CME-75	Drilling Contractor Baja Explorations	Approximate Surface Elevation 1214 ft
Groundwater Level and Date Measured Not Encountered	Sampling Method(s) Cal, SPT	Hammer Data 140 lb/ 30" Drop
Borehole Backfill Soil Cuttings	Location 34.0388, -117.4727	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
1214	0				SP		Surface: Sand and Gravel			
					SP		Sand, Light Brown			
				80	SP		Sand, Light Brown, Multicolored, Some Silt and Gravel, Dry, Very Dense			
1209	5			88	SP		Sand, Light Brown, Multicolored, Some Silt, Trace Gravel, Dry, Very Dense			Fines = 30.1%
				72	SM		Silty Sand, Light Brown, Multicolored, Some Gravel, Dry, Very Dense	1.3	119.6	
1204	10			50/3"	SM		Silty Fine Sand, Light Brown, Trace Gravel, Dry, Very Dense			
1199	15			82	SM		Silty Fine Sand, Light Brown, Trace Gravel, Dry, Very Dense			
1194	20						Auger Refusal at 17.5' No Free Groundwater Encountered No Caving Boring Backfilled with Soil Cuttings on 9/25/20			
1189	25									
1184	30									

Project: SGV Plant F20	Log of Boring B-3 Sheet 1 of 1
Project Location: 15151 Long View Drive, Fontana	
Project Number: 2492A13	

Date(s) Drilled 9/25/20	Logged By J. Rowerdink	Checked By B. Hick
Drilling Method Hollow Stem Auger	Drill Bit Size/Type 8" HSA	Total Depth of Borehole 2.0 ft
Drill Rig Type CME-75	Drilling Contractor Baja Explorations	Approximate Surface Elevation 1184 ft
Groundwater Level and Date Measured Not Encountered	Sampling Method(s)	Hammer Data 140 lb/ 30" Drop
Borehole Backfill Soil Cuttings	Location 34.0390, -117.4734	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	REMARKS AND OTHER TESTS
1184	0				SP-SM		Surface: Sand and Gravel Sand/Silty Sand, Trace Gravel, Dry			
							Auger Refusal at 2.0'. Large Granite Boulders cover most of area No Free Groundwater Encountered No Caving			
1179	5									
1174	10									
1169	15									
1164	20									
1159	25									
1154	30									

APPENDIX C

LABORATORY TESTING PROCEDURES

APPENDIX C

LABORATORY TESTING PROCEDURES

1. Classification

Soils were classified visually, generally according to the Unified Soil Classification System. Classification tests were also completed on representative samples in accordance with ASTM D422 for Grain Size. The test results are included in this Appendix.

2. Moisture Content and Dry Density Tests

The moisture content and density tests were performed on selected soil samples obtained from the borings. The moisture content and dry density tests were performed in accordance with ASTM Test Methods D2216 and D2937, respectively. The results of these tests are presented on the Log of Borings.

3. Maximum Density

Maximum density tests were performed on a representative bag sample of the near surface soils in accordance with ASTM D1557. Test results are presented in this Appendix.

4. Direct Shear

Direct Shear Tests were performed on in-place and remolded samples of site soils in accordance with ASTM D3080. Graphical plots of the tests are included in this Appendix.

5. Consolidation

Consolidation tests were performed on representative, relatively undisturbed samples of the underlying soils to determine compressibility characteristics in accordance with ASTM D2435. Test results are presented in this Appendix.

6. “R”-Value Testing

R-Value testing was completed in substantial compliance with Caltrans Test Method 301. Graphical plots of the tests are included in this Appendix.

7. Expansion Index

Expansion Index testing was completed in accordance with the standard test method ASTM D4829. Test results are presented below.

Sample Location	Expansion Index	Expansion Classification
B-1 @ 0-5 ft	0	Very Low

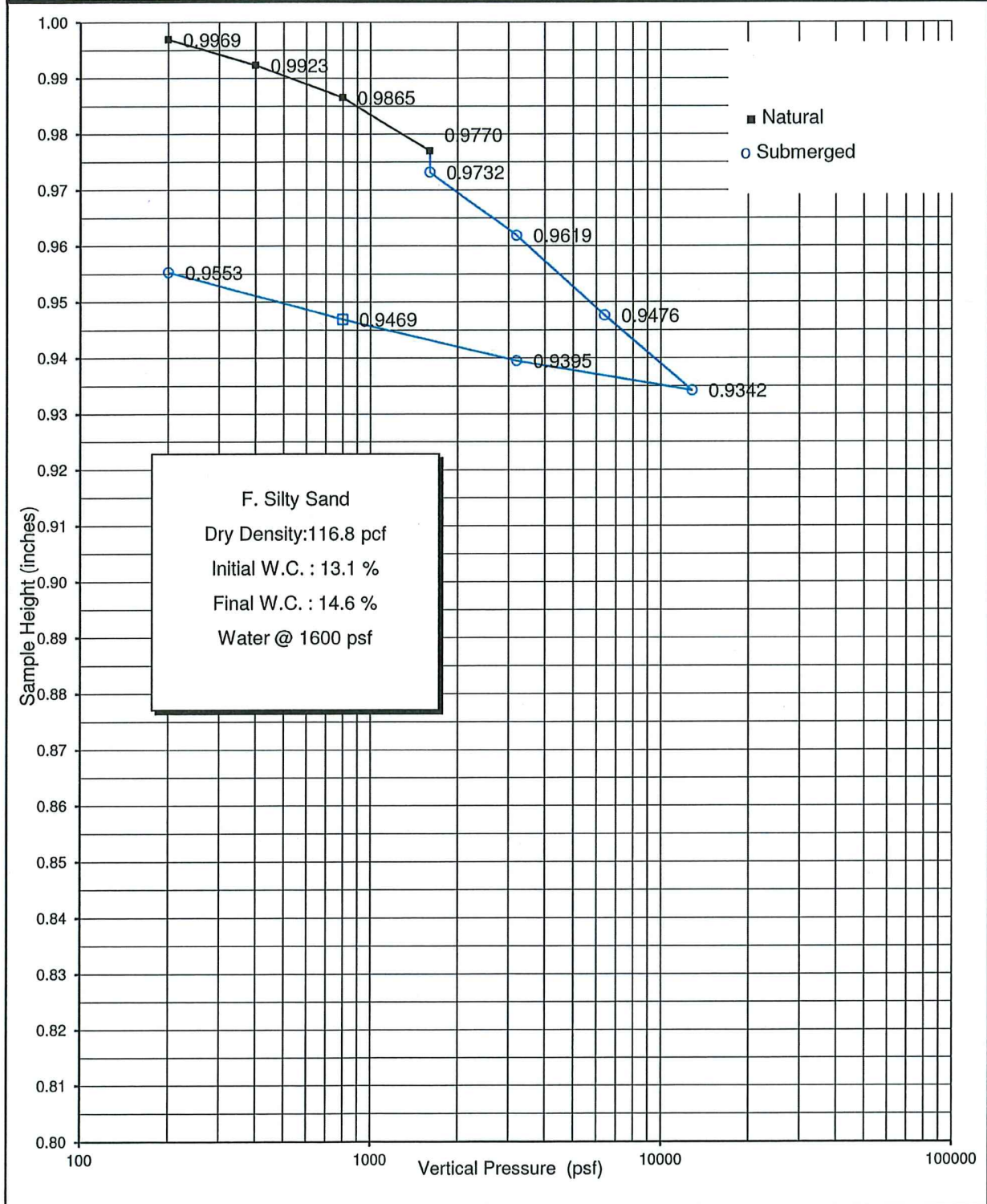
8. Corrosion

Chemical testing was performed on representative samples to determine the corrosion potential of the onsite soils. Testing consisted of pH, chlorides (CTM 422), soluble sulfates (CTM 417), and resistivity (CTM 643). Test results are as follows:

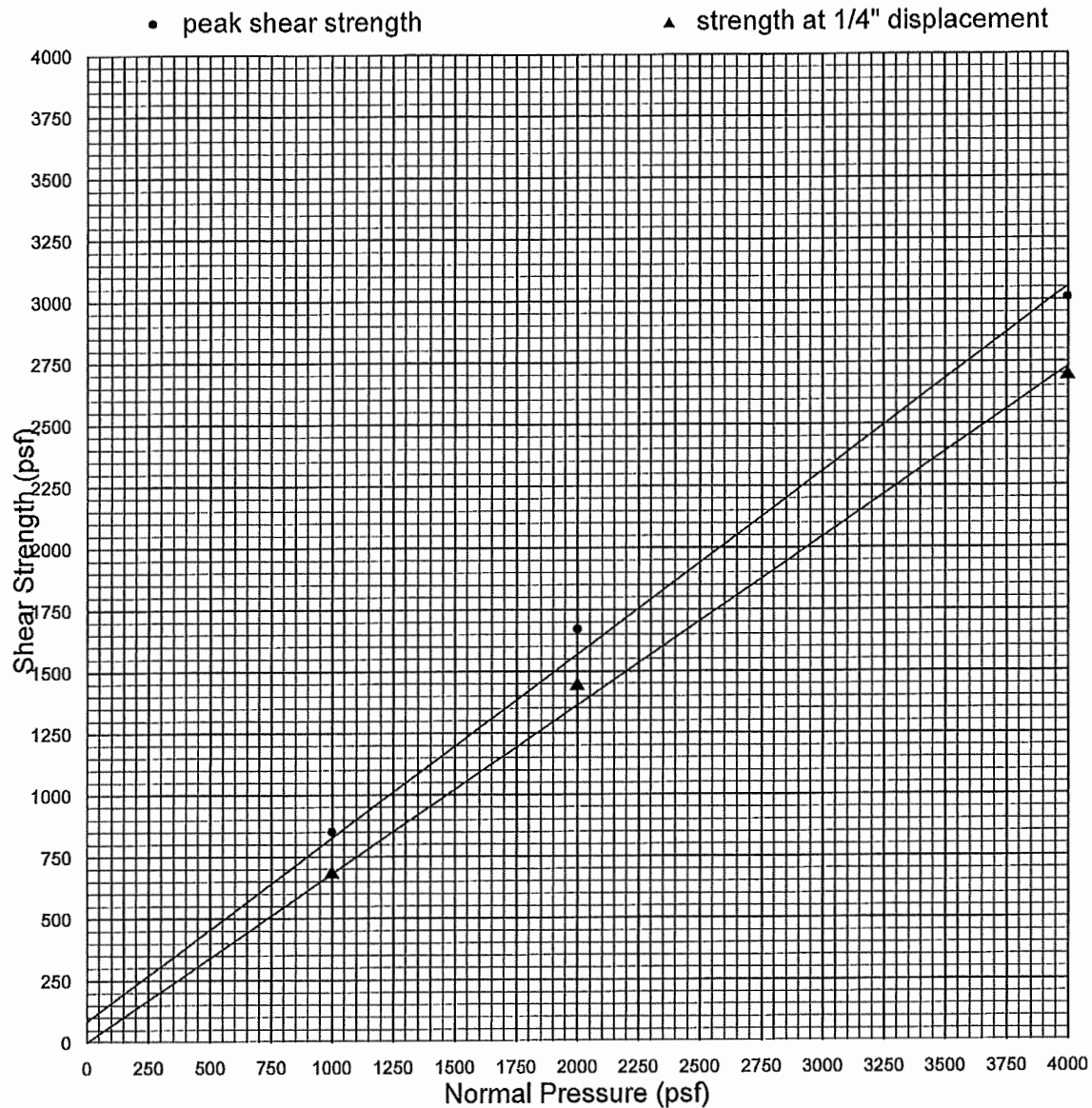
Sample Location	pH	Chlorides (ppm)	Sulfates (ppm)	Resistivity (ohm-cm)
B-2 @ 10 ft	7.8	39	65	23,000

CONSOLIDATION TEST - ASTM D2435

Boring / Sample No.	B-2	Depth:	15'	Date	10-06-20
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DIRECT SHEAR TEST - ASTM D-3080



Strain Rate: 0.0084 in. / min.

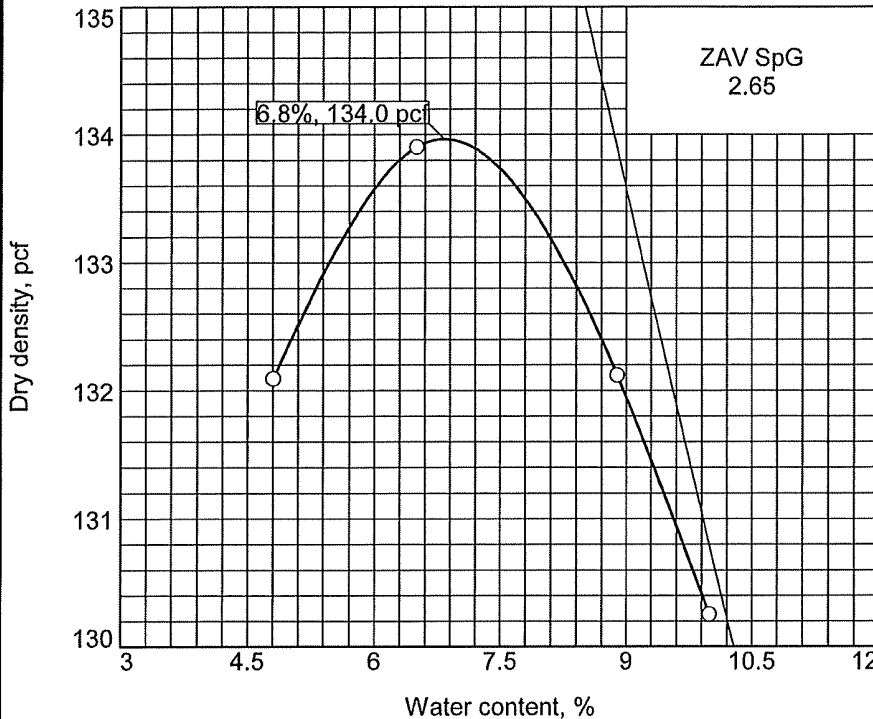
<u>Sample</u>	<u>Type</u>	<u>Description</u>	<u>Dry Density (pcf)</u>	<u>Initial W.C. (%)</u>	<u>Final W.C. (%)</u>
B2 @ 2'	Undisturbed & Saturated	Silty Sand	108.0	3.8	17.7

<u>Normal Pressure (psf)</u>	<u>Peak Shear Strength (psf)</u>	<u>Ultimate Shear Strength (psf)</u>
1000	850 @ 0.0700"	680
2000	1670 @ 0.1350"	1440
4000	3010 @ 0.1155"	2690
	C = 100 psf	C = 0 psf
	φ = 36 deg.	φ = 34 deg.

COMPACTION TEST REPORT

Curve No.

B-1 @ 0-5 ft



Test Specification:

ASTM D 1557-12 Method A Modified

Preparation Method Moist

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) 2.65

%>#4 %<No.200

USCS SP AASHTO

Date Sampled 9/25/20

Date Tested 9/30/20

Tested By RJS

TESTING DATA

	1	2	3	4	5	6
WM + WS	6210.0	6273.0	6292.0	6283.0		
WM	4117.0	4117.0	4117.0	4117.0		
WW + T #1	305.4	312.9	300.1	321.4		
WD + T #1	291.4	293.8	275.6	292.2		
TARE #1	0.0	0.0	0.0	0.0		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	4.8	6.5	8.9	10.0		
DRY DENSITY	132.1	133.9	132.1	130.3		

TEST RESULTS

Maximum dry density = 134.0 pcf

Optimum moisture = 6.8 %

Project No. 2492A13 Client: San Gabriel Valley Water Company

Project: Plant F20 Water Tank #6476F

Location: B-1 Depth: 0-5 ft Sample Number: 10199

MTGL, Inc.

Anaheim, CA

Material Description

Light Brown SAND with some Silt

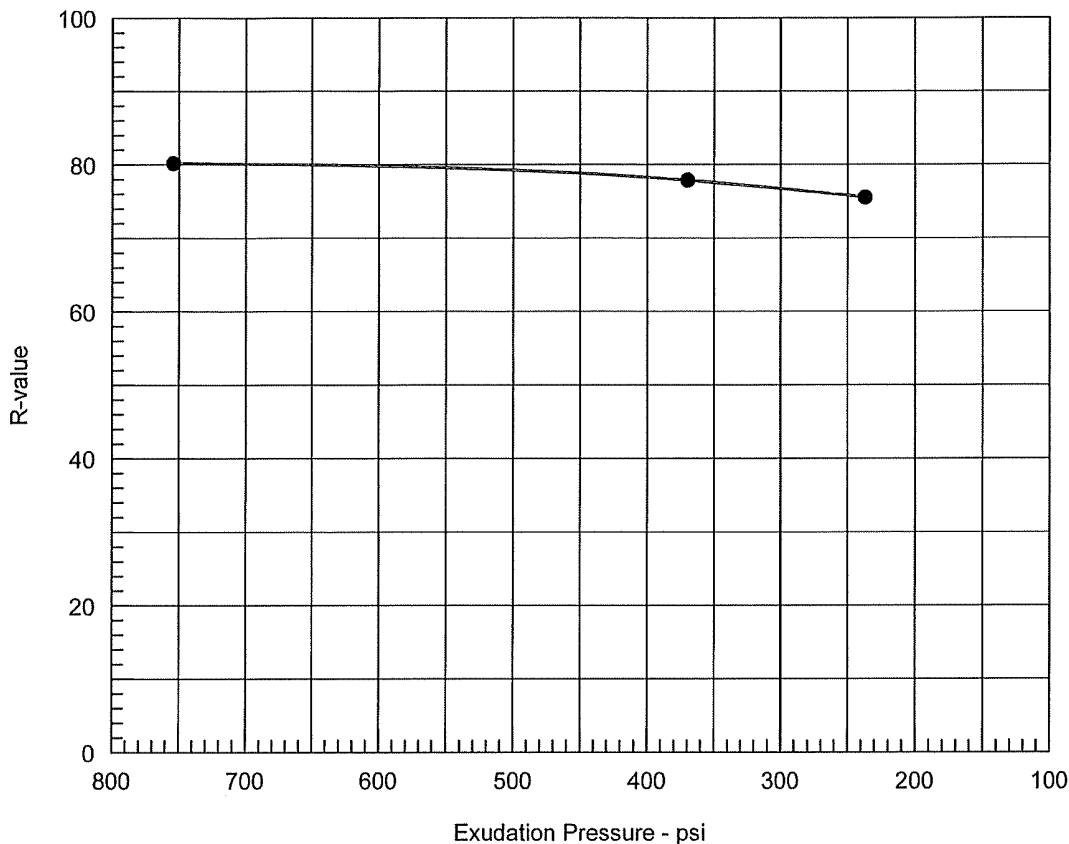
Remarks:

Sampled by JR

Checked by: IC

Title: EM

R-VALUE TEST REPORT

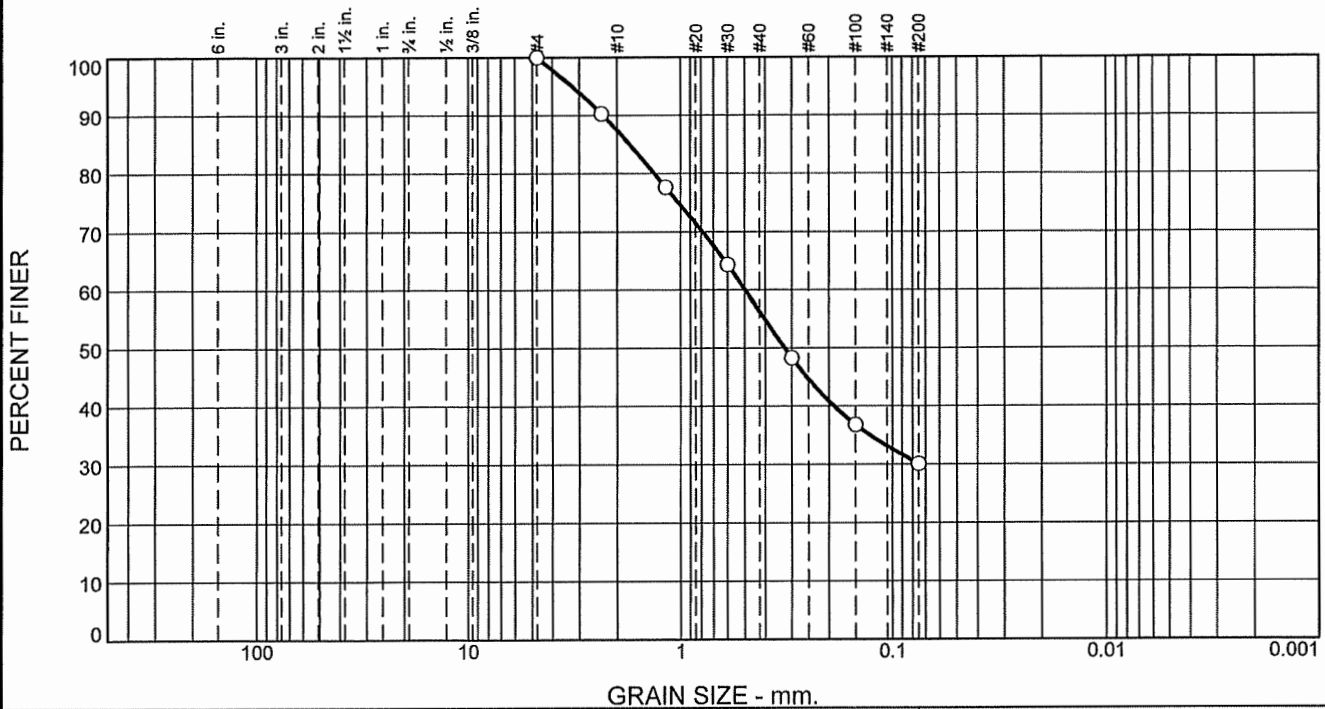


Resistance R-Value and Expansion Pressure - Cal Test 301

[illegible]

Test Results	Material Description
R-value at 300 psi exudation pressure = 77	Light Brown SAND with some Silt (SP)
Project No.: 2492A13 Project: Plant F20 Water Tank #6476F Location: B-1 Sample Number: 10199 Depth: 0-5 ft Date: 10/8/2020	Tested by: RJS Checked by: IC Remarks:
R-VALUE TEST REPORT MTGL, Inc.	

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	12.5	31.2	26.2	30.1	

Test Results (ASTM D 422 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#8	90.3		
#16	77.7		
#30	64.3		
#50	48.3		
#100	36.8		
#200	30.1		

* (no specification provided)

Material Description		
Brown SILTY SAND		
Atterberg Limits (ASTM D 4318)		
PL=	LL=	PI=
Classification		
USCS (D 2487)= SM	AASHTO (M 145)=	
Coefficients		
D ₉₀ = 2.3151	D ₈₅ = 1.7404	D ₆₀ = 0.4975
D ₅₀ = 0.3245	D ₃₀ =	D ₁₅ =
D ₁₀ =	C _u =	C _c =
Remarks		
Sampled by JR		
Date Received: 9/25/20 Date Tested: 9/30/20		
Tested By: RJS		
Checked By: IC		
Title: EM		

Location: B-2
Sample Number: 10199 Depth: 5 ft

Date Sampled: 9/25/20

MTGL, Inc.

Anaheim, CA

Client: San Gabriel Valley Water Company
Project: Plant F20 Water Tank #6476F

Project No: 2492A13

ANAHEIM TEST LAB, INC

196 Technology Drive, Unit D
Irvine, CA 92618
Phone (949)336-6544

MTGL, INC.
2992 LA PALMA AVE. #A
ANAHEIM, CA 92806

DATE: 10/02/2020

P.O. NO: Transmittal

LAB NO: C-4143

SPECIFICATION: CTM-643/417/422

MATERIAL: Soil

Project No.: 2492A13
Lab No: 10199
Sample ID: B-2 @ 10'

ANALYTICAL REPORT

CORROSION SERIES SUMMARY OF DATA

pH	MIN. RESISTIVITY per CT. 643 ohm-cm	SOLUBLE SULFATES per CT. 417 ppm	SOLUBLE CHLORIDES per CT. 422 ppm
7.8	23,000	65	39

RESPECTFULLY SUBMITTED



WES BRIDGER LAB MANAGER

APPENDIX D
STANDARD GRADING SPECIFICATIONS

APPENDIX D

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

GENERAL

These specifications present general procedures and requirements for grading and earthwork as shown on the approved grading plans, including preparation of areas to be filled, placement of fill, installation of subdrains, and excavations. The recommendations contained in the attached geotechnical report are a part of the earthwork and grading specifications and shall supersede the provisions contained herein in the case of conflict. Evaluations performed by the Consultant during the course of grading may result in new recommendations, which could supersede these specifications, or the recommendations of the geotechnical report.

EARTHWORK OBSERVATION AND TESTING

Prior to the start of grading, a qualified Geotechnical Consultant (Geotechnical Engineer and Engineering Geologist) shall be employed for the purpose of observing earthwork procedures and testing the fills for conformance with the recommendations of the geotechnical report and these specifications. It will be necessary that the Consultant provide adequate testing and observation so that he may determine that the work was accomplished as specified. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that he may schedule his personnel accordingly.

It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications, and the approved grading plans.

Maximum dry density tests used to determine the degree of compaction will be performed in accordance with the American Society for Testing and Materials Test Method (ASTM) D1557.

PREPARATION OF AREAS TO BE FILLED

Clearing and Grubbing: All brush, vegetation and debris shall be removed or piled and otherwise disposed of.

Processing: The existing ground which is determined to be satisfactory for support of fill shall be scarified to a minimum depth of 6 inches. Existing ground, which is not satisfactory, shall be overexcavated as specified in the following section.

Overexcavation: Soft, dry, spongy, highly fractured, or otherwise unsuitable ground, extending to such a depth that surface processing cannot adequately improve the condition, shall be overexcavated down to firm ground, approved by the Consultant.

Moisture conditioning: Overexcavated and processed soils shall be watered, dried-back, blended, and mixed as required to have a relatively uniform moisture content near the optimum moisture content as determined by ASTM D1557.

Recompaction: Overexcavated and processed soils, which have been mixed, and moisture conditioned uniformly shall be recompacted to a minimum relative compaction of 90 percent of ASTM D1557.

Benching: Where soils are placed on ground with slopes steeper than 5:1 (horizontal to vertical), the ground shall be stepped or benched. Benches shall be excavated in firm material for a minimum width of 4 feet.

FILL MATERIAL

General: Material to be placed as fill shall be free of organic matter and other deleterious substances and shall be approved by the Consultant.

Oversize: Oversized material defined as rock, or other irreducible material with a maximum dimension greater than 12 inches, shall not be buried or placed in fill, unless the location, material, and disposal methods are specifically approved by the Consultant. Oversize disposal operations shall be such that nesting of oversized material does not occur, and such that the oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 feet vertically of finish grade or within the range of future utilities or underground construction, unless specifically approved by the Consultant.

Import: If importing of fill material is required for grading, the import material shall meet the general requirements.

FILL PLACEMENT AND COMPACTION

Fill Lifts: Approved fill material shall be placed in areas prepared to receive fill in near-horizontal layers not exceeding 6 inches in compacted thickness. The Consultant may approve thicker lifts if testing indicates the grading procedures are such that adequate compaction is being achieved with lifts of greater thickness. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to attain uniformity of material and moisture in each layer.

Fill Moisture: Fill layers at a moisture content less than optimum shall be watered and mixed, and wet fill layers shall be aerated by scarification or shall be blended with drier material. Moisture conditioning and mixing of fill layers shall continue until the fill material is at uniform moisture content at or near optimum.

Compaction of Fill: After each layer has been evenly spread, moisture conditioned, and mixed, it shall be uniformly compacted to not less than 90 percent of maximum dry density in accordance with ASTM D1557. Compaction equipment shall be adequately sized and shall be either specifically designed for soil compaction or of proven reliability, to efficiently achieve the specified degree of compaction.

Fill Slopes: Compacting on slopes shall be accomplished, in addition to normal compacting procedures, by backrolling of slopes with sheepsfoot rollers at frequent increments of 2 to 3 feet as the fill is placed, or by other methods producing satisfactory results. At the completion of grading, the relative compaction of the slope out to the slope face shall be at least 90 percent in accordance with ASTM D1557.

Compaction Testing: Field tests to check the fill moisture and degree of compaction will be performed by the consultant. The location and frequency of tests shall be at the consultant's discretion. In general, these tests will be taken at an interval not exceeding 2 feet in vertical rise, and/or 1,000 cubic yards of fill placed. In addition, on slope faces, at least one test shall be taken for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope.

SUBDRAIN INSTALLATION

Subdrain systems, if required, shall be installed in approved ground to conform to the approximate alignment and details shown on the plans or herein. The subdrain location or materials shall not be changed or modified without the approval of the Consultant. The Consultant, however, may recommend and, upon approval, direct changes in subdrain line, grade, or materials. All subdrains should be surveyed for line and grade after installation and sufficient time shall be allowed for the surveys, prior to commencement of fill over the subdrain.

EXCAVATION

Excavations and cut slopes will be examined during grading. If directed by the Consultant, further excavation or overexcavation and refilling of cut areas, and/or remedial grading of cut slopes shall be performed. Where fill over cut slopes are to be graded, unless otherwise approved, the cut portion of the slope shall be made and approved by the Consultant prior to placement of materials for construction of the fill portion of the slope.

APPENDIX E
SITE SEISMICITY



SGV Plant F20

Latitude, Longitude: 34.0387, -117.4727



Date	10/15/2020, 8:41:01 AM
Design Code Reference Document	ASCE7-16
Risk Category	IV
Site Class	C - Very Dense Soil and Soft Rock

Type	Value	Description
S _s	1.705	MCE _R ground motion. (for 0.2 second period)
S ₁	0.6	MCE _R ground motion. (for 1.0s period)
S _{MS}	2.046	Site-modified spectral acceleration value
S _{M1}	0.84	Site-modified spectral acceleration value
S _{DS}	1.364	Numeric seismic design value at 0.2 second SA
S _{D1}	0.56	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F _a	1.2	Site amplification factor at 0.2 second
F _v	1.4	Site amplification factor at 1.0 second
PGA	0.722	MCE _G peak ground acceleration
F _{PGA}	1.2	Site amplification factor at PGA
PGA _M	0.866	Site modified peak ground acceleration
T _L	12	Long-period transition period in seconds
SsRT	1.705	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.816	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.782	Factored deterministic acceleration value. (0.2 second)
S1RT	0.631	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.691	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.727	Factored deterministic acceleration value. (Peak Ground Acceleration)
C _{RS}	0.939	Mapped value of the risk coefficient at short periods

Type	Value	Description
C _{R1}	0.914	Mapped value of the risk coefficient at a period of 1 s

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June 22, 2022

Mr. Kristofer J. Olsen
San Gabriel Valley Water Company
11142 Garvey Avenue
El Monte, California 91733

MTGL Project No.: 2492A13

MTGL Log No.: 22-507

MTGL Branch: Anaheim

Subject: Geotechnical Addendum #1
San Gabriel Valley Water Company F20 Plant
Fontana, California

Reference: MTGL, Inc. (2020). *Geotechnical Investigation, San Gabriel Valley Water Company F20 Plant, Job No. 647F*, MTLG Project No.2492A13, dated October 23.

Dear Mr. Olsen,

In accordance with your request, MTGL is providing this geotechnical addendum letter to supplement the referenced geotechnical investigation report. Figure 1 presents a Lateral Earth Pressures Diagram to be used for the project's retaining wall design for the currently proposed condition. If the wall type or conditions change, please notify us so we may check the applicability of these recommendations and provide revised recommendations, if needed.

We appreciate this opportunity to be of continued service to you on this project. Should you have any questions regarding this geotechnical addendum, please do not hesitate to contact us at your convenience.

Respectfully Submitted,
MTGL, Inc.

Daniel Richardson, P.E.
Senior Engineer



Attachment: Figure 1- Lateral Earth Pressures Diagram

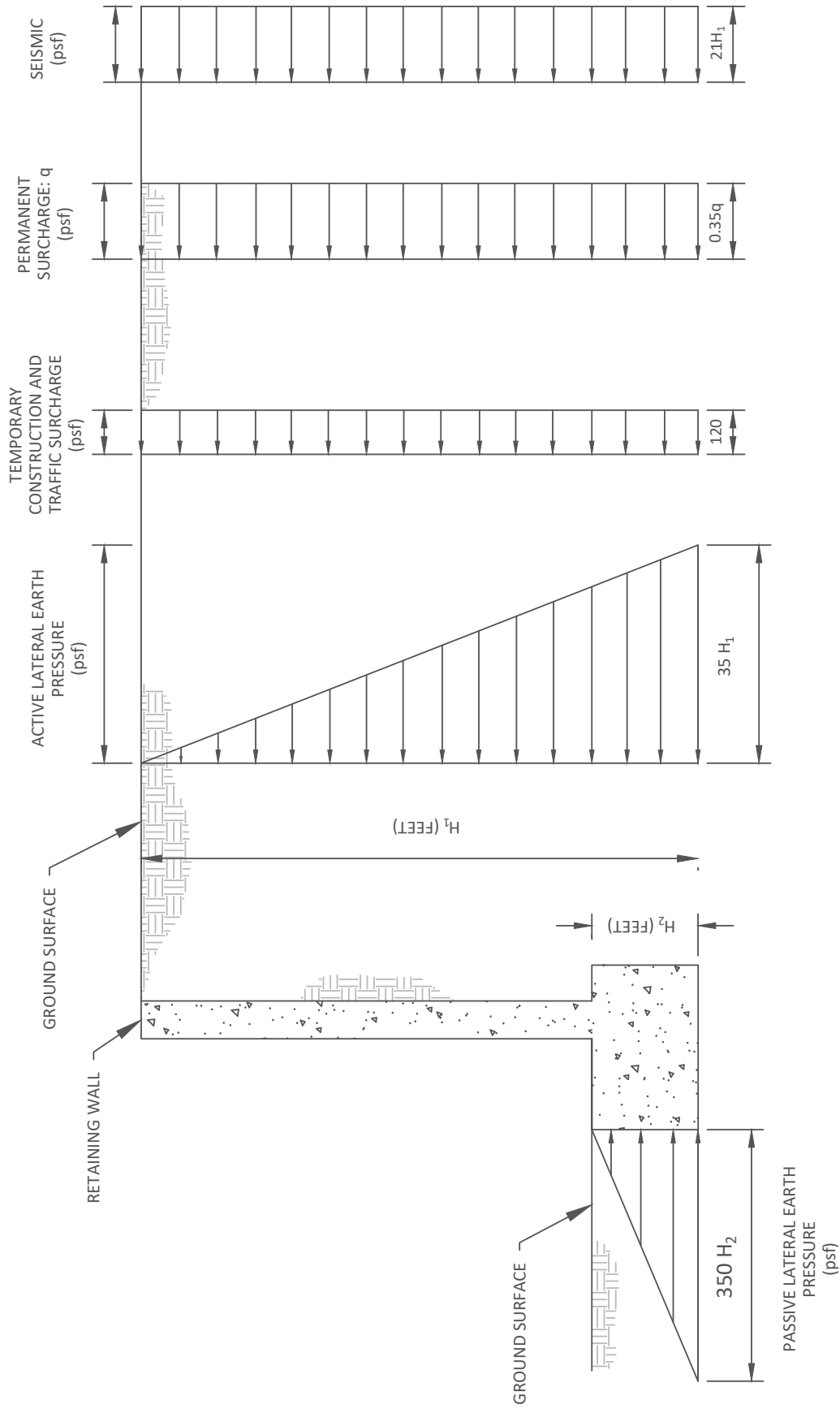


Figure No. **1**

Geotechnical Engineering
Construction Inspection
Materials Testing
Environmental



LATERAL EARTH PRESSURES DIAGRAM
SAN GABRIEL PLANT F-20 WATER TANK
FONTANA, CALIFORNIA

MTGL Project No.: 2492A13	Date: June, 2022	Author: TC
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NOT TO SCALE

Note: No Groundwater Condition Shown.
Hydrostatic pressures not included



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**GEOTECHNICAL ADDENDUM #2: SUPPLEMENTAL INVESTIGATION
DEEP FOUNDATION PILE DESIGN DEVELOPMENT**

San Gabriel Valley Water Company Plant F20 – Job No. 647F
15151 Long View Drive
Fontana, San Bernardino County, California

Prepared For:

San Gabriel Valley Water Company
11142 Garvey Avenue
El Monte, California 91733

Prepared By:

MTGL, Inc.
2992 La Palma, Suite A
Anaheim, California 92806

September 27, 2022

MTGL Project No. 2492A13
MTGL Log No. 22-0727



**GEOTECHNICAL ENGINEERING
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September 27, 2022

Karolina Guzman, Design Manager
San Gabriel Valley Water Company
11142 Garvey Avenue
El Monte, California 91733

MTGL Project No.: 2492A13

MTGL Log No.: 22-0727

MTGL Branch: Anaheim

**Subject: GEOTECHNICAL ADDENDUM #2: SUPPLEMENTAL INVESTIGATION
DEEP FOUNDATION PILE DESIGN DEVELOPMENT**

San Gabriel Valley Water Company Plant F20 – Job No. 647F
15151 Long View Drive, Fontana, California 92337

Dear Ms. Guzman,

MTGL Inc. is pleased to present this report describing the results of our supplemental geotechnical investigation for the subject project. With your authorization, we have performed this work in general accordance with our Change Order #2 dated June 27, 2022. Based on the results of our investigation, we consider the planned developments feasible from a geotechnical perspective, provided the recommendations of this report are followed.

We appreciate this opportunity to be of continued service and look forward to providing additional consulting services during the planning and construction of the project. Should you have any questions regarding this report, please do not hesitate to contact us.

Respectfully submitted,
MTGI, Inc.

Jay Rowerdink, E.I.T.
Staff Engineer

Isaac Chun, P.E., G.E.
Vice President



Daniel Richardson, P.E.
Senior Engineer



EXECUTIVE SUMMARY

In accordance with your request and authorization, we have completed our geotechnical investigation for the subject site located at San Gabriel Valley Water Company Plant F20 in Fontana, California. We understand this project currently consists of the proposed design and construction of two new 1.13-Million Gallon (MG) reservoir tanks. The main focus of this report will be to address the design of the piles underlying the retaining wall which has been proposed to be built on the north and west side of the rock formation upon which the tanks are to be built.

Our subsurface investigation was performed on August 4th, 2022, and consisted of drilling eight exploratory soil borings within areas of proposed improvements. The borings were drilled to depths ranging from 7- to 33-feet below existing ground surface (BGS) using hand tools and a truck-mounted drilling rig equipped with an 8-inch hollow stem auger. An MTGL engineer logged the borings and collected samples of the encountered materials for geotechnical laboratory testing. Selected samples were tested in our laboratory to evaluate their engineering properties.

As seen on the surface and encountered in each of the borings, the site consists of older alluvial-fan deposits. The older alluvial fan deposits consisted of coarse-grained sandy materials, mixed and interbedded with layers of gravels, cobbles, and boulders.

The main geotechnical considerations affecting the project are the presence of large natural slopes and drainages at the site, and the proximity of the property line that is anticipated to constrain construction and improvements. The natural slopes and drainages result in a complicated topography, and while currently stable, the stability of existing slopes may be compromised by the improvement's surcharge. Therefore, due to the site's complicated topography, Cast-in drilled-hole (CIDH) concrete piles are recommended to support the proposed tanks and retaining walls. CIDH pile foundations can significantly reduce the earthwork that would otherwise be required for shallow foundations, while transferring surcharge loads to a depth below that which would influence slope instability.

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ATTACHMENTS:

Figure 1 – Site Location Map

Figure 2 – Subsurface Exploration Map

Appendix A – References

Appendix B – Field Investigation

Appendix C – Laboratory Testing

Appendix D – Axial Capacities Graphs

Appendix E – Lateral Capacities Graphs

1.00 INTRODUCTION

In accordance with your request and authorization, MTGL, Inc. has completed a supplemental geotechnical investigation at the San Gabriel Valley Water Company's Plant F20 site and performed additional engineering analyses for deep foundation design development.

1.01 PLANNED CONSTRUCTION

Based on our review of the provided current plans in development and conversations with the project development team, we understand the project consists of the design and construction of two new 1.13-Million Gallon (MG) reservoir tanks, their associated foundational elements, and retaining walls around them to support the tanks on an elevated pad. The locations of the new tanks are on top of a currently undeveloped hill adjacent to an existing Plant F20 tank. The retaining walls will be about 1- to 20-feet high and retain up to about 18 feet of soil.

Due to varying hillside topography at the site location, we understand the current design consists of supporting both the retaining walls and tanks on deep foundations.

1.02 SCOPE OF WORK

We conducted this investigation in general conformance with the scope of work presented in our Change Order Request No. 2 – Supplemental Geotechnical Investigation for Pile Analysis. The scope of our geotechnical services included the following:

- Reviewing readily available literature and maps to obtain background information of regional geology, site development, seismicity, and ground water.
- Marking out boring locations on the site and contacting Underground Service Alert (USA) to locate onsite utility lines.
- Utilizing a private utility locator service to clear borings of underground utility conflicts.
- Drilling, logging, and sampling of eight exploratory borings using hand tools and an 8-inch hollow stem auger drill rig to a maximum depth of 50-feet Below Ground Surface (BGS), or refusal.
- Performing laboratory testing of select samples.
- Performing geotechnical engineering review of compiled data and performing geotechnical engineering analyses, included pile design development.
- Preparation of this geotechnical addendum report summarizing our findings and presenting our conclusions and recommendations for the proposed construction.

1.03 FIELD INVESTIGATION

Prior to performing our field investigation, a site reconnaissance was performed by an MTGL staff engineer to observe the existing surface conditions, mark out proposed boring locations, evaluate each location with respect to obvious subsurface structures and determine access for the drilling rig. Underground Service Alert (USA) was then notified of the marked locations for utility clearance as required by law. In addition, a private utility locator, GPRS, Inc., was subcontracted to mark-out potential utility conflicts.

Our subsurface investigation was performed August 4th, 2022 and consisted of drilling eight exploratory borings within areas of proposed improvements. Eight borings (B-1 through B-5A) were drilled to depths ranging from about 7 to 33 feet (BGS) using hand tools and a truck-mounted drilling rig equipped with an 8-inch hollow stem auger. Hollow-stem auger refusal was encountered on cobbles/boulders in all borings. See Appendix B for further discussion of the field exploration and logs of test borings. Figure 2 attached presents a Subsurface Exploration Map.

An MTGL engineer logged the borings and collected samples of the encountered materials for geotechnical laboratory testing. Representative disturbed bulk soil samples were obtained from the borings in the upper five feet. Relatively undisturbed samples were taken using Modified California (CAL) and Standard Penetration Test (SPT) samplers at selected depth intervals. Samplers were driven into the bottom of the boring with successive drops of a 140-pound weight falling 30-inches. The energy corrected number of blows per foot required to drive the CAL and SPT samplers are shown on the boring logs in the N_{60} column (Appendix B). A conversion factor of 0.65 was used to normalize N_{60} values obtained by Modified California samplers. SPTs were performed in general accordance with the American Society for Testing and Materials (ASTM) D1586 standard test method.

Soil samples were evaluated in the field and described in general conformance with the Unified Soil Classification System (USCS). Samples were transported to MTGL's geotechnical laboratory for testing.

1.04 LABORATORY TESTING

Laboratory testing was performed on select samples to verify the field classification of the recovered samples and evaluate the geotechnical properties of the subsurface materials. Laboratory tests were performed in general conformance with ASTM or State of California Department of Transportation (Caltrans) standard methods. The results of our laboratory tests are presented in Appendix C.

2.00 FINDINGS

2.01 REVIEW OF PREVIOUS GEOTECHNICAL STUDIES

A preliminary geotechnical investigation was performed at this site to evaluate the project's feasibility (MTGL, 2020). Data from this investigation was also used for preliminary design of the new tank, retaining walls, and their associated foundations. However, the report was preliminary, and the project's design required further investigation and analyses to develop deep foundation recommendations for the retaining walls and tanks.

2.02 SUBSURFACE CONDITIONS

As encountered in our borings, the site is underlain by older alluvial-fan deposits. Materials encountered in our borings were generally consistent with the mapped geologic units presented by Morton and Miller, 2003. Descriptions of the materials encountered in the borings are presented below.

Old alluvial-fan deposits, unit 1 (Qof₁) – Middle Pleistocene-age old alluvial fan deposits were observed on the surface and encountered in Borings B-1, B-2, B-2A, B-3, B-4, B-4A, B-5, and B-5A. These materials were observed to extend approximately 33-feet below the existing ground surface. As encountered, the materials generally consisted of light brown to brown, dense to very dense silty to well-graded sands. Cobbles and boulders were encountered in each of the borings resulting in refusal.

A summary of boring locations and pertinent data for each boring are presented in the table below.

SUMMARY OF SUBSURFACE SOIL CONDITIONS

Boring No.	Drilled Depth* (ft)	Latitude (Deg)	Longitude (Deg)	Surface Conditions	Existing Ground Elevation** (ft)	Approximate Thickness of Fill (ft)	Groundwater Depth Below Ground Surface (ft)
B-1	31	34.0389	-117.4728	Gravelly Sand	1,217	0	Not Encountered
B-2	7	34.0389	-117.4732	Gravelly Sand	1,205	0	Not Encountered
B-2A	7	34.0389	-117.4731	Gravelly Sand	1,206	0	Not Encountered
B-3	26	34.0393	-117.4733	Gravelly Sand	1,182	0	Not Encountered
B-4	22	34.0395	-117.4729	Gravelly Sand	1,170	0	Not Encountered
B-4A	17	34.0395	-117.4729	Gravelly Sand	1,169	0	Not Encountered
B-5	11	34.0394	-117.4725	Gravelly Sand	1,156	0	Not Encountered
B-5A	9	34.0394	-117.4724	Gravelly Sand	1,154	0	Not Encountered

* Refusal encountered at indicated drilled depths

**Elevation approximated using Google Earth

2.03 SURFACE AND GROUNDWATER CONDITIONS

Groundwater was not encountered in the borings. No areas of ponding or standing water were present at the time of our study. Further, no springs or areas of natural seepage were found. No visible seepage was observed within the boreholes approximately one hour after drilling.

Based on our review of readily available data, groundwater in the immediate site vicinity is estimated to be at depths of greater than 100-feet below existing grade (DWR, 2008). Groundwater is not anticipated to be encountered during the proposed construction. However, changes in rainfall, irrigation and local drainage may produce seepage or perched groundwater conditions below the site. These conditions are generally difficult to predict and typically mitigated if and when they occur.

2.04 GEOLOGIC HAZARDS

Geologic hazards have been summarized and discussed with respect to the site and proposed development in the previous preliminary geotechnical report (MTGL, 2020). However, due to the presence of relatively large natural slopes at and surrounding the project site, a slope stability analysis should be performed once final plans are developed.

2.05 SEISMIC DESIGN PARAMETERS

A geologic hazard likely to affect the project is ground shaking as a result of movement along an active fault zone in the vicinity of the subject site (USGS, 2022). Based on the subsurface conditions encountered during our investigation, the site may be classified as Site Class C. The mapped site coefficients and maximum considered earthquake (MCER) spectral response acceleration parameters in accordance with the 2019 CBC are presented below:

2019 CALIFORNIA BUILDING CODE – MAPPED SITE COEFFICIENTS	
Site Coordinates	
Latitude	Longitude
32.0390°	-117.4728°
Site Coefficients and Spectral Response Acceleration Parameters	
	Values
Site Class	C
Site Coefficients, F_a	1.2
Site Coefficients, F_v	1.5
Mapped Spectral Response Acceleration at Short Period, S_s	1.442 g
Mapped Spectral Response Acceleration at 1-Second Period, S_1	0.491 g
Mapped Design Spectral Acceleration at Short Period, S_{DS}	1.154 g
Design Spectral Acceleration at 1-Second Period, S_{D1}	0.491 g
Nearest Zoned Active Fault	Rialto-Colton
Fault Distance from Site	~6.5 mi
Peak Ground Acceleration, PGA_m	0.811 g

3.00 CONCLUSIONS

3.01 GENERAL CONCLUSIONS

Based on our geotechnical review of the planned construction, it is our opinion that the site is suitable for the proposed improvements provided the following conclusions and recommendations are incorporated into the construction plans and specifications and implemented during grading and construction. The recommendations presented herein may need to be updated once final plans are developed.

The main geotechnical considerations affecting the project are the presence of large natural slopes and drainages at the site, and the proximity of the property line that is anticipated to constrain construction and improvements. The natural slopes and drainages result in a complicated topography, and while currently stable, the stability of existing slopes may be compromised by the improvement's surcharge. Therefore, due to the site's complicated topography, Cast-in drilled-hole (CIDH) concrete piles are recommended to support the proposed tanks and retaining walls. CIDH pile foundations can significantly reduce the earthwork that would otherwise be required for shallow foundations, while transferring surcharge loads to a depth below that which would influence slope instability.

4.00 RECOMMENDATIONS

The following recommendations are provided to address the geotechnical aspects of this project and are considered minimum. They may be superseded by more conservative requirements of the architect, structural engineer, building code, or governing agencies.

4.01 CAST IN DRILLED HOLE (CIDH) DEEP FOUNDATIONS

CIDH deep foundations (piles) may be used to support the proposed tanks and retaining walls. Where setbacks for shallow foundations cannot be established, CIDH piles can provide a feasible alternative to transfer surcharge loads below the influence zones of existing slopes and below-ground improvements. The remainder of this section provides CIDH pile design development recommendations.

4.01.1 REMOVALS AND OVEREXCAVATION

It is recommended that the existing soils below the proposed tanks and retaining walls be over excavated to a minimum depth of 2-feet below the bottom of the slab, pile caps, or grade beams and replaced with compacted fill. The required horizontal limits of the over excavated area shall be defined as the area extending from the edge of the perimeter of the structure for a distance of 5-feet or up to existing improvements.

Shoring and/or underpinning of any existing buildings or improvements within close proximity to the grading area may be required prior to performing any over-excavations or removals.

4.01.2 MINIMUM DEPTH OF EMBEDMENT

The CIDH piles should extend a minimum depth of 10-feet into competent native alluvial materials. It is recommended that the horizontal distance between the top near edge of each pile to the slope face be a minimum 10-feet.

4.01.3 AXIAL CAPACITIES

The ultimate axial capacities of 18-, 24-, 30-, and 36-inch diameter CIDH piles were evaluated using the computer programs Shaft for the proposed structures. The CIDH piles will obtain support from friction in the underlying competent native alluvial materials. No end bearing is recommended. The frictional capacity of fill should be neglected.

Downdrag forces on the piles have also been neglected based on the assumption that the majority of fill settlement has already occurred. The depth to the bottom of the pile cap is assumed to be at least 3-feet.

The pile capacities are based on the strength of the soils; the strength of the pile section itself should be checked to verify the structural capacity of the pile. Piles should be spaced at least three pile diameters, center to center, and embedded at least 10-feet into competent material.

Graphs of the capacities are presented in Appendix D. Recommended axial capacities are presented in the table below, The recommended axial capacities shown are ultimate values and, therefore, suitable factors of safety should be incorporated. We recommend a minimum factor of safety of 2.5. The design factors of safety should be evaluated by the structural engineer based on the loading conditions.

AXIAL CAPACITIES OF PILES (ULTIMATE)

Pile Diameter (inches)	18	24	30	36
Depth of Embedment into Competent Materials (ft)	Downward Capacity (kips)			
10	24	31	39	47
15	59	79	99	119
20	105	140	175	210
25	159	212	266	319

The uplift resistance will be obtained by friction and the weight of the pile. Uplift capacity of piles may be taken as 2/3 of the downward axial capacities.

4.01.4 LATERAL CAPACITIES

Lateral loads may be resisted by the piles and passive resistance of the soils against the pile cap. The ultimate lateral capacities of 18-, 24-, 30-, and 36-inches CIDH diameter piles were evaluated using the computer program L-Pile for fixed and free head conditions of a single CIDH pile, with a minimum 28-day compressive strength of 4,000 psi. Graphs of the capacities are presented in Appendix E.

LATERAL PILE CAPACITIES

18-inch Diameter Pile				
Pile Head Deflection	¼ inch		½ inch	
Pile Head Condition	Free Head	Fixed Head	Free Head	Fixed Head
Lateral Load (kips)	10.6	23.8	15.2	31
Max Moment (kip-ft)	27.1	-65.0	41.7	-66.0
Depth to Max Moment (ft)	4.2	0	4.2	0

24-inch Diameter Pile				
Pile Head Deflection	¼ inch		½ inch	
Pile Head Condition	Free Head	Fixed Head	Free Head	Fixed Head
Lateral Load (kips)	18.8	44.1	27.9	59.3
Max Moment (kip-ft)	59.8	-150.0	93.6	-208.8
Depth to Max Moment (ft)	5.4	0	5.4	0

30-inch Diameter Pile				
Pile Head Deflection	¼ inch		½ inch	
Pile Head Condition	Free Head	Fixed Head	Free Head	Fixed Head
Lateral Load (kips)	30.7	70.3	44.8	100
Max Moment (kip-ft)	119.7	-281.7	176.7	-427.5
Depth to Max Moment (ft)	6.9	0	6.3	0

36-inch Diameter Pile				
Pile Head Deflection	¼ inch		½ inch	
Pile Head Condition	Free Head	Fixed Head	Free Head	Fixed Head
Lateral Load (kips)	44.1	98.9	64.1	146.4
Max Moment (kip-ft)	202.1	-452	286	-713.1
Depth to Max Moment (ft)	8.1	0	7.2	0

The above capacities are ultimate values, and the design factors of safety should be evaluated by the structural engineer based on the loading conditions.

For lateral resistance of pile caps, an allowable passive pressure of 350 psf per foot of depth may be used. The passive pressure can be increased by 1/3 when considering the total of loads, including wind or seismic forces. The upper 1-foot of soil should not be relied on for

passive support unless the ground is covered with pavements or slabs. For sliding resistance, a friction coefficient of 0.35 may be used at the concrete and soil interface.

When laterally loaded CIDH piles are used in closely spaced groups, a given pile will deflect more under a given loading condition than if loaded without the neighboring piles present. Correspondingly, a given pile will develop higher bending stresses under a given loading condition than if loaded without the neighboring piles present. It is therefore important to consider group effects when shaft spacing is less than approximately six diameters in any direction. Piles should be spaced at least three pile diameters, center to center. For piles spaced less than six pile diameters, recommended group effect factors that should be applied to the lateral capacity of the piles are provided in the table below.

GROUP EFFECT FACTORS FOR LATERALLY LOADED PILES

Pile Spacing (Center to Center)	3D	4D	5D	≥6D
Lead Row	0.7	0.85	1.0	1.0
2 nd Row	0.5	0.65	0.85	1.0
3 rd and Higher Row	0.35	0.5	0.7	1.0

4.01.5 SETTLEMENT CONSIDERATIONS

Foundation plans are not available at this time. On a preliminary basis, we estimate maximum static settlement of foundations designed and constructed in accordance with the recommendations presented to be on the order of 1-inch. Differential settlement between similarly loaded and adjacent piles are expected to be less than ½-inch across 40-feet, provided the piles are embedded in similar materials. Static settlement of foundations is expected to occur rapidly and should be essentially complete shortly after initial application of the loads. Once foundation plans are available, MTGL should review the plans and revise recommendations, if necessary.

4.01.6 OTHER DESIGN AND CONSTRUCTION CONSIDERATIONS

Piles should be designed with sufficient steel to adequately resist lateral loads and moments that develop in the pile. A preconstruction test pile and pile load test program may be required by the structural engineer to verify the geotechnical and structural capacities and should consider the contractor's construction means and methods.

During excavation, layers of cohesionless soils may be encountered; thus, some caving of the pile shafts should be anticipated. Special care should be taken during construction to stabilize the sides of the CIDH deep foundations, as necessary. A slurry and/or temporary

casing may be required to stabilize the sides of the CIDH pile shafts. The CIDH piles should be placed using a down-hole tremie to limit the concrete from striking the sides of the drilled shafts. Once concrete pumping has begun, a minimum head of 5-feet of concrete above the bottom of the tremie should be maintained throughout the concrete placement. If a steel casing is used, the casing must be removed slowly with the minimum concrete head maintained to prevent soils caving and necking of the pile. The concrete mix must be capable of disseminating around the reinforcing bars and in contact with the soils without arching during extraction of the casing.

The adequacy of the CIDH piles will depend heavily on construction methods and procedures. Large zones of disturbance around the CIDH piles can lead to lower skin friction due to excessive stress relief around the length of the piles. The piles should be constructed by qualified contractors experienced in this type of construction and monitored on a full-time basis by the geotechnical consultant.

Contract documents should specify that the contractor mobilize equipment capable of penetrating very dense and cemented materials to reduce the potential that claims for delays or extra work will arise.

The actual required depths of the piles must be field verified by the geotechnical engineer.

4.02 PLAN REVIEW

MTGL should review the grading and foundation plans to verify that the intent of the recommendations presented in this report has been implemented and that revised recommendations are not necessary as a result of changes after this report was completed.

5.00 GEOTECHNICAL OBSERVATION AND TESTING

The recommendations provided in this report are based on preliminary design information and subsurface conditions as interpreted from the investigation. Our preliminary conclusion and recommendations should be reviewed and verified during site grading and revised accordingly if exposed Geotechnical conditions vary from our preliminary findings and interpretations. The Geotechnical consultant should perform Geotechnical observation and testing during the following phases of grading and construction:

- During site grading and over-excavation.
- During foundation excavations and placement.
- Upon completion of retaining wall footing excavation prior to placing concrete.
- During excavation and backfilling of all utility trenches
- During processing and compaction of the subgrade for the access and parking areas and prior to construction of pavement sections.
- When any unusual or unexpected Geotechnical conditions are encountered during any phase of construction.

6.00 LIMITATIONS

The findings, conclusions, and recommendations contained in this report are based on the site conditions as they existed at the time of our investigation, and further assume that the subsurface conditions encountered during our investigation are representative of conditions throughout the site. Should subsurface conditions be encountered during construction that are different from those described in this report, this office should be notified immediately so that our recommendations may be re-evaluated.

This report was prepared for the exclusive use and benefit of the owner, architect, and engineer for evaluating the design of the facilities as it relates to geotechnical aspects. It should be made available to prospective contractors for information on factual data only, and not as a warranty of subsurface conditions included in this report.

Our investigation was performed using the standard of care and level of skill ordinarily exercised under similar circumstances by reputable soil engineers and geologists currently practicing in this or similar localities. No warranty, express or implied, is made as to the conclusions and professional advice included in this report.

This firm does not practice or consult in the field of safety engineering. We do not direct the Contractor's operations, and we are not responsible for their actions. The contractor will be solely and completely responsible for working conditions on the job site, including the safety of all persons and property during performance of the work. This responsibility will apply continuously and will not be limited to our normal hours of operation.

The findings of this report are considered valid as of the present date. However, changes in the conditions of a site can occur with the passage of time, whether they are due to natural events or to human activities on this or adjacent sites. In addition, changes in applicable or appropriate codes and standards may occur, whether they result from legislation or the broadening of knowledge.

Accordingly, this report may become invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and revision as changed conditions are identified.

FIGURES



SITE LOCATION MAP
SGVWC PLANT F20 NEW TANK
FONTANA, CALIFORNIA

MTGL Project No.:	Date:	Author:
2492A13	September, 2022	JCR

Figure No.

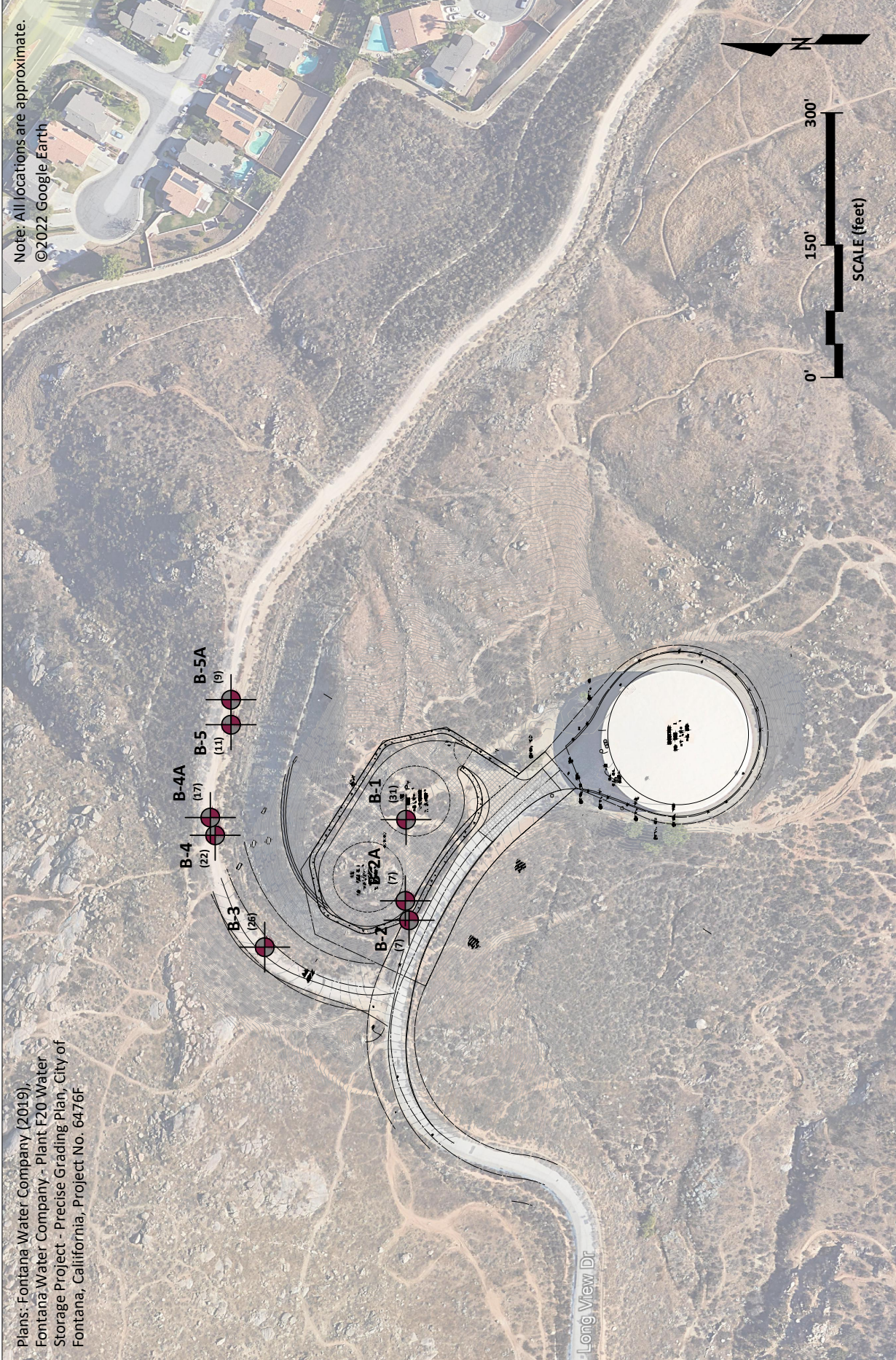
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Geotechnical Engineering
Construction Inspection
Materials Testing
Environmental

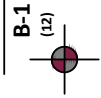


Plans: Fontana Water Company (2019),
Fontana Water Company - Plant F20 Water
Storage Project - Precise Grading Plan, City of
Fontana, California, Project No. 6476F

Note: All locations are approximate.
©2022 Google Earth



LEGEND



Location of Boring
- (Depth in Feet)

SUBSURFACE EXPLORATION MAP SGVWC PLANT F20 NEW TANK FONTANA, CALIFORNIA

MTGL Project No.:
2492A13

Date:
September, 2022

Author:
JCR

Geotechnical Engineering
Construction Inspection
Materials Testing
Environmental



Figure No.

2

APPENDIX A

REFERENCES

APPENDIX A
REFERENCES

American Society of Civil Engineers, 2017, ASCE 7-16 Minimum Design Loads and Associated Criteria for Building and Other Structures.

California Building Standards Commission, 2019, California Building Code, Title 24, California Code of Regulations.

California Geologic Survey, 2002, California Geomorphic Provinces, Note 36.

California Geologic Survey, 2007, Fault-Rupture Hazard Zones in California, Special Publication 42.

California Geological Survey, 2008, Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117.

Ensoft, Inc., SHAFT® and LPile® Software

Federal Emergency Management Agency, 2022, Flood Insurance Rate Map, National Flood Hazard Layer FIRMette, FEMA Map 06071C8665H.

MTGL, Inc., 2020, Geotechnical Investigation, San Gabriel Valley Water Company Plant F20 – Job No. 647F, 15151 Long View Drive, Fontana, San Bernardino County, California, October 23, 2020.

Morton and Miller, 2003, Preliminary Geologic Map of the San Bernardino 30' x 60' Quadrangle, California, United States Geological Survey, Scale 1:100,000.

OSHPD, 2021, Seismic Design Maps Calculator, <https://seismicmaps.org/>

Seed, H.B. and Whitman, R.V., 1970, Design of Earth Structures for Dynamic Loads in ASCE Specialty Conference, Lateral Stresses in the Ground and Design of Earth-Retaining Structures

United States Geological Survey, 2022, U.S. Quaternary Faults, <https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=5a6038b3a1684561a9b0aadf88412fcf>, accessed August 2022.

APPENDIX B

FIELD EXPLORATION PROGRAM

APPENDIX B

FIELD EXPLORATION PROGRAM

The subsurface conditions for this Geotechnical Investigation were explored by excavating exploratory borings with an 8-inch hollow-stem-auger and hand tools. All driven samples were obtained by SPT or a Modified California Tube Sampler. The approximate locations of the borings are shown on the Subsurface Exploration Map (Figure 2). The field exploration was performed under the supervision of our engineer and geologist who maintained a continuous log of the subsurface soils encountered and obtained samples for laboratory testing.

Subsurface conditions are summarized on the accompanying Logs of Borings. The logs contain descriptive information and interpretation of subsurface conditions based on the obtained samples. The stratum indicated on these logs represents the approximate boundary between earth units, however, transitions may be gradual. The logs show subsurface conditions at the dates and locations indicated and may not be representative of subsurface conditions at other locations and times.

Identification of the soils encountered during the subsurface exploration was made using the field identification procedure of the Unified Soils Classification System (ASTM D2488). A legend indicating the symbols and definitions used in this classification system and a legend defining the terms used in describing the relative compaction, consistency or firmness of the soil are attached in this appendix. Bag samples of the major earth units were obtained for laboratory inspection and testing, and the in-place density of the various strata encountered in the exploration was determined

The exploratory borings were backfilled in general accordance with DEH requirements and patched where appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM						
No. 200 U.S. Standard Sieve is the smallest particle visible	Coarse-grained soils >1/2 of materials is larger than #200 sieve	GRAVELS are more than half of coarse fraction larger than #4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	
			Gravels with fines	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines	
		SANDS are more than half of coarse fraction larger than #4 sieve	Clean Sands (less than 5% fines)	GM	Silty Gravels, poorly-graded gravel- sand-silt mixtures	
			Sands with fines	GC	Clayey Gravels, poorly-graded gravel- sand-clay mixtures	
	Fine-grained Soils >1/2 of materials is smaller than #200 sieve	SILTS AND CLAYS Liquid Limit Less than 50			SW	Well-graded sands, gravelly sands, little or no fines
					SP	Poorly-graded sands, gravelly sands, little or no fines
					SM	Silty Sands, poorly-graded sands- gravel-clay mixtures
					SC	Clayey Sands, poorly-graded sand- gravel-silt mixtures
					ML	Inorganic clays of low to med plasticity, gravelly, sandy, silty, or lean clays
		SILTS AND CLAYS Liquid Limit Greater than 50			CL	Inorganic clays of low to med plasticity, gravelly, sandy, silty, or lean clays
					OL	Organic silts and clays of low plasticity
					MH	Inorganic silts, micaceous or diatomaceous fine sands or silts
					CH	Inorganic clays of high plasticity, fat clays
					OH	Organic silts and clays of medium to high plasticity
	Highly Organic Soils			PT	Peat, humus swamp soils with high organic content	

GRAIN SIZE				SIZE PROPORTION
Description	Sieve Size	Grain Size	Approximate Size	
Boulders	>12"	>12"	Larger than basketball-sized	Trace – Less than 5%
Cobbles	3" - 12"	3" - 12"	Fist-sized to basketball-sized	Few – 5% to 10%
Gravel	Coarse ¾" - 3"	¾" - 3"	Thumb-sized	Little – 15% to 20%
	Fine #4 - ¾"	0.19" - 0.75"	Peat-sized to thumb-sized	Some – 30% to 45%
Sand	Coarse #10 - #4	0.079" - 0.19"	Rock salt-sized to pea-sized	Mostly – 50% to 100%
	Medium #40 - #10	0.017" - 0.079"	Sugar-sized to rock salt-sized	MOISTURE CONTENT
	Fine #200 - #40	0.0029" - 0.017"	Flour-sized to sugar-sized	Dry – Absence of moisture
Fines	Passing #200	<0.0029"	Flour-sized or smaller	Moist – Damp but not visible
				Wet – Visible free water

CONSISTENCY FINE GRAINED SOILS			RELATIVE DENSITY COARSE GRAINED SOILS		
Apparent Density	SPT (Blows/Foot)	Mod CA Sampler (Blows/Foot)	Apparent Density	SPT (Blows/Foot)	Mod CA Sampler (Blows/Foot)
Very Soft	<2	<3	Very Loose	<4	<5
Soft	2-4	3-6	Loose	4-10	5-12
Firm	5-8	7-12	Medium Dense	11-30	13-35
Stiff	9-15	13-25	Dense	31-50	36-60
Very Stiff	16-30	26-50	Very Dense	>50	>60
Hard	>30	>50			

Project: **Plant F20 - Job No. 647F**

Project Location: **15151 Long View Drive, Fontana, CA**

Project Number: **2492A13**

Key to Log of Boring Sheet 1 of 1

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance	N60	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Lab Testing	REMARKS
1	2	3	4	5	6	7	8	9	10	11	12
COLUMN DESCRIPTIONS											
1 Elevation (feet): Elevation (MSL, feet).							9 Water Content, %: Water content of the soil sample, expressed as percentage of dry weight of sample.				
2 Depth (feet): Depth in feet below the ground surface.							10 Dry Unit Weight, pcf: Dry weight per unit volume of soil sample measured in laboratory, in pounds per cubic foot.				
3 Sample Type: Type of soil sample collected at the depth interval shown.							11 Lab Testing: Lab Tests being run on samples taken back to lab				
4 Sampling Resistance: Number of blows to advance driven sampler 0.5 feet (or distance shown) beyond seating interval using the hammer identified on the boring log.							12 REMARKS: Comments and observations regarding drilling or sampling made by driller or field personnel.				
5 N60: N60 Value calculated from blow counts											
6 Material Type: Type of material encountered.											
7 Graphic Log: Graphic depiction of the subsurface material encountered.											
8 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.											
FIELD AND LABORATORY TEST ABBREVIATIONS											
PI: Plasticity Index LL: Liquid Limit PL: Plastic Limit EI: Expansion Index DS: Direct Shear Test Performed CHEM: Chemical tests to assess corrosivity							COMP: Compaction test CONS: One-dimensional consolidation test LL: Liquid Limit, percent PI: Plasticity Index, percent SA: Sieve analysis (percent passing No. 200 Sieve) UC: Unconfined compressive strength test, Qu, in ksf WA: Wash sieve (percent passing No. 200 Sieve)				
MATERIAL GRAPHIC SYMBOLS											
 Silty SAND (SM)							 Well graded SAND (SW)				
TYPICAL SAMPLER GRAPHIC SYMBOLS											
 Auger sampler							 CME Sampler				
 Bulk Sample							 Grab Sample				
 3-inch-OD California w/ brass rings							 2.5-inch-OD Modified California w/ brass liners				
							 Pitcher Sample				
							 2-inch-OD unlined split spoon (SPT)				
							 Shelby Tube (Thin-walled, fixed head)				
OTHER GRAPHIC SYMBOLS											
							 Water level (at time of drilling, ATD)				
							 Water level (after waiting)				
							 Minor change in material properties within a stratum				
							 Inferred/gradational contact between strata				
							 Queried contact between strata				
GENERAL NOTES											
1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.											
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.											

Figure B-3

Project: **Plant F20 - Job No. 647F**Project Location: **15151 Long View Drive, Fontana, CA**Project Number: **2492A13**

Log of Boring B-1

Sheet 1 of 2

Date(s) Drilled 8/4/22	Logged By JCR	Checked By DJR
Drilling Method Hollow Stem Auger	Drill Bit Size/Type 8" / HSA	Total Depth of Borehole 31 ft
Drill Rig Type CME-95	Drilling Contractor Baja Exploration	Approximate Surface Elevation 1217 ft
Groundwater Level and Date Measured Not Encountered	Sampling Method(s) Bulk, Cal, SPT	Hammer Data 140 lb / 30" Drop
Borehole Backfill Soil Cuttings	Location 34.03887, -117.47278	

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance	N60	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Lab Testing	REMARKS
1217	0				SW		Surface - Gravelly SAND. Well-graded SAND with silt, dense, light brown, dry.			SA	
1212	5		30 50-3"	>50			Very dense, brown with some black.			DS	
1207	10		50-3"	>50	SM		Silty SAND, very dense, brown, dry.			DS	
1202	15		50-6"	>50	SW		Well-graded SAND, very dense, brown with some black, dry, granitic rock particles in sampler.			DS	
1197	20		50-5"	>50							
1192	25		50-3"	>50			Light brown, some sandstone/siltstone in sampler.				
1187	30										

Project: **Plant F20 - Job No. 647F**

Project Location: **15151 Long View Drive, Fontana, CA**

Project Number: **2492A13**

Log of Boring B-1

Sheet 2 of 2

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance	N60	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Lab Testing	REMARKS
1187	30	X	50-3"	>50	SW		Well-graded SAND, very dense, brown with some black, dry, granitic rock particles in sampler. End of boring due to refusal at 31 feet. No free groundwater encountered. Boring backfilled with soil cuttings on 8/4/22.				
1182	35										
1177	40										
1172	45										
1167	50										
1162	55										
1157	60										
1152	65										

Project: **Plant F20 - Job No. 647F**Project Location: **15151 Long View Drive, Fontana, CA**Project Number: **2492A13**

Log of Boring B-2

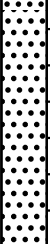
Sheet 1 of 1

Date(s) Drilled 8/4/22	Logged By JCR	Checked By DJR
Drilling Method Hollow Stem Auger	Drill Bit Size/Type 8" / HSA	Total Depth of Borehole 7 ft
Drill Rig Type CME-95	Drilling Contractor Baja Exploration	Approximate Surface Elevation 1205 ft
Groundwater Level and Date Measured Not Encountered	Sampling Method(s) Bulk, Cal, SPT	Hammer Data 140 lb / 30" Drop
Borehole Backfill Soil Cuttings	Location 34.03887, -117.47315	

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance	N60	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Lab Testing	REMARKS
1205	0				SW		Surface - Gravelly SAND. Well-graded SAND with silt, dense, light brown, dry.				
1200	5		50-5"	>50			Well-graded SAND, very dense, light brown with black and white, granitic rock particles in sampler.	0.4	122.3	SA	
1195	10						End of boring due to refusal at 7 feet. No free groundwater encountered. Boring backfilled with soil cuttings on 8/4/22. Moved 5 feet northeast to redrill B-2A.				
1190	15										
1185	20										
1180	25										
1175	30										

Project: Plant F20 - Job No. 647F Project Location: 15151 Long View Drive, Fontana, CA Project Number: 2492A13	Log of Boring B-2A Sheet 1 of 1
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Date(s) Drilled 8/4/22	Logged By JCR	Checked By DJR
Drilling Method Hollow Stem Auger	Drill Bit Size/Type 8" / HSA	Total Depth of Borehole 7 ft
Drill Rig Type CME-95	Drilling Contractor Baja Exploration	Approximate Surface Elevation 1206 ft
Groundwater Level and Date Measured Not Encountered	Sampling Method(s) Bulk, Cal, SPT	Hammer Data 140 lb / 30" Drop
Borehole Backfill Soil Cuttings	Location 34.03886, -117.47312	

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance	N60	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Lab Testing	REMARKS
1206	0				SW		Surface - Gravelly SAND. Well-graded SAND with silt, dense, light brown, dry.				
1201	5										
1196	10						End of boring due to refusal at 7 feet. No free groundwater encountered. Boring backfilled with soil cuttings on 8/4/22.				
1191	15										
1186	20										
1181	25										
1176	30										

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Project: **Plant F20 - Job No. 647F**Project Location: **15151 Long View Drive, Fontana, CA**Project Number: **2492A13**

Log of Boring B-3

Sheet 1 of 1

Date(s) Drilled 8/4/22	Logged By JCR	Checked By DJR
Drilling Method Hollow Stem Auger	Drill Bit Size/Type 8" / HSA	Total Depth of Borehole 26 ft
Drill Rig Type CME-95	Drilling Contractor Baja Exploration	Approximate Surface Elevation 1182 ft
Groundwater Level and Date Measured Not Encountered	Sampling Method(s) Bulk, Cal, SPT	Hammer Data 140 lb / 30" Drop
Borehole Backfill Soil Cuttings	Location 34.03933, -117.47325	

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance	N60	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Lab Testing	REMARKS
1182	0				SW		Surface - Gravelly SAND. Well-graded SAND, dense, light brown, dry.				
1177	5	50-2"	>50		SM		Very dense, light brown with black and white, granitic rock particles in sampler. Silty fine SAND, very dense, light brown, dry.	0.3		SA, Max, DS	
1172	10	50-1"	>50		SW		Well-graded SAND, very dense, brown with black and white, granitic rock particles in sampler.	0.3			
1167	15	50-1"	>50							DS	
1162	20	50-2"	>50		SM		Silty SAND, very dense, brown with black and white, dry, granitic rock particles in sampler.			SA	
1157	25	50-2"	>50								
1152	30						End of boring due to refusal at 26 feet. No free groundwater encountered. Boring backfilled with soil cuttings on 8/4/22.				

Project: **Plant F20 - Job No. 647F**Project Location: **15151 Long View Drive, Fontana, CA**Project Number: **2492A13****Log of Boring B-4****Sheet 1 of 1**

Date(s) Drilled 8/4/22	Logged By JCR	Checked By DJR
Drilling Method Hollow Stem Auger	Drill Bit Size/Type 8" / HSA	Total Depth of Borehole 22 ft
Drill Rig Type CME-95	Drilling Contractor Baja Exploration	Approximate Surface Elevation 1170 ft
Groundwater Level and Date Measured Not Encountered	Sampling Method(s) Bulk, Cal, SPT	Hammer Data 140 lb / 30" Drop
Borehole Backfill Soil Cuttings	Location 34.03945, -117.47288	

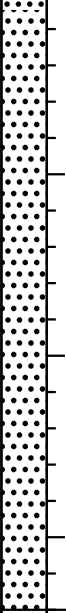
Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance	N60	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Lab Testing	REMARKS
1170	0				SW		Surface - Gravelly SAND. Well-graded SAND with silt, dense, light brown, dry.				
1165	5	50-6"	>50				Very dense.	0.3			
1160	10	50-6"	>50								No Recovery
1155	15	50-1"	>50		SM		Silty SAND, very dense, brown with black and white, dry, granitic rock particles in sampler.			DS	
1150	20	50-1"	>50				Light brown.				
1145	25						End of boring due to refusal at 22 feet. No free groundwater encountered. Boring backfilled with soil cuttings on 8/4/22. Moved 5 feet northeast to drill B-4A.				
1140	30										

Project: **Plant F20 - Job No. 647F**Project Location: **15151 Long View Drive, Fontana, CA**Project Number: **2492A13**

Log of Boring B-4A

Sheet 1 of 1

Date(s) Drilled 8/4/22	Logged By JCR	Checked By DJR
Drilling Method Hollow Stem Auger	Drill Bit Size/Type 8" / HSA	Total Depth of Borehole 17 ft
Drill Rig Type CME-95	Drilling Contractor Baja Exploration	Approximate Surface Elevation 1169 ft
Groundwater Level and Date Measured Not Encountered	Sampling Method(s) Bulk, Cal, SPT	Hammer Data 140 lb / 30" Drop
Borehole Backfill Soil Cuttings	Location 34.03946, -117.47285	

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance	N60	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Lab Testing	REMARKS
1169	0				SW		Surface - Gravelly SAND. Well-graded SAND, dense, light brown, dry.				
1164	5										
1159	10										
1154	15										
1149	20						End of boring due to refusal at 17 feet. No free groundwater encountered. Boring backfilled with soil cuttings on 8/4/22.				
1144	25										
1139	30										

Project: **Plant F20 - Job No. 647F**Project Location: **15151 Long View Drive, Fontana, CA**Project Number: **2492A13**

Log of Boring B-5

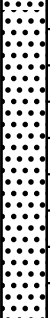
Sheet 1 of 1

Date(s) Drilled 8/4/22	Logged By JCR	Checked By DJR
Drilling Method Hollow Stem Auger	Drill Bit Size/Type 8" / HSA	Total Depth of Borehole 11 ft
Drill Rig Type CME-95	Drilling Contractor Baja Exploration	Approximate Surface Elevation 1156 ft
Groundwater Level and Date Measured Not Encountered	Sampling Method(s) Bulk, Cal, SPT	Hammer Data 140 lb / 30" Drop
Borehole Backfill Soil Cuttings	Location 34.03941, -117.47246	

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance	N60	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Lab Testing	REMARKS
1156	0				SW		Surface - Gravelly SAND. Well-graded SAND with silt, dense, light brown, dry.				No Recovery
1151	5	30 50-6"	>50				Very dense.				
1146	10	50-1"	>50	SM			Silty SAND, very dense, light brown, dry, granitic rock particles in sampler. End of boring due to refusal at 11 feet. No free groundwater encountered. Boring backfilled with soil cuttings on 8/4/22. Moved 5 feet northeast to redrill B-5A.				
1141	15										
1136	20										
1131	25										
1126	30										

Project: Plant F20 - Job No. 647F Project Location: 15151 Long View Drive, Fontana, CA Project Number: 2492A13	Log of Boring B-5A Sheet 1 of 1
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Date(s) Drilled 8/4/22	Logged By JCR	Checked By DJR
Drilling Method Hollow Stem Auger	Drill Bit Size/Type 8" / HSA	Total Depth of Borehole 9 ft
Drill Rig Type CME-95	Drilling Contractor Baja Exploration	Approximate Surface Elevation 1154 ft
Groundwater Level and Date Measured Not Encountered	Sampling Method(s) Bulk, Cal, SPT	Hammer Data 140 lb / 30" Drop
Borehole Backfill Soil Cuttings	Location 34.03941, -117.47242	

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance	N60	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Lab Testing	REMARKS
1154	0				SW		Surface - Gravelly SAND. Well-graded SAND with silt, dense, light brown, dry.				
1149	5										
1144	10						End of boring due to refusal at 9 feet. No free groundwater encountered. Boring backfilled with soil cuttings on 8/4/22.				
1139	15										
1134	20										
1129	25										
1124	30										

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APPENDIX C

LABORATORY TEST PROCEDURES

APPENDIX C
LABORATORY TESTING PROCEDURES

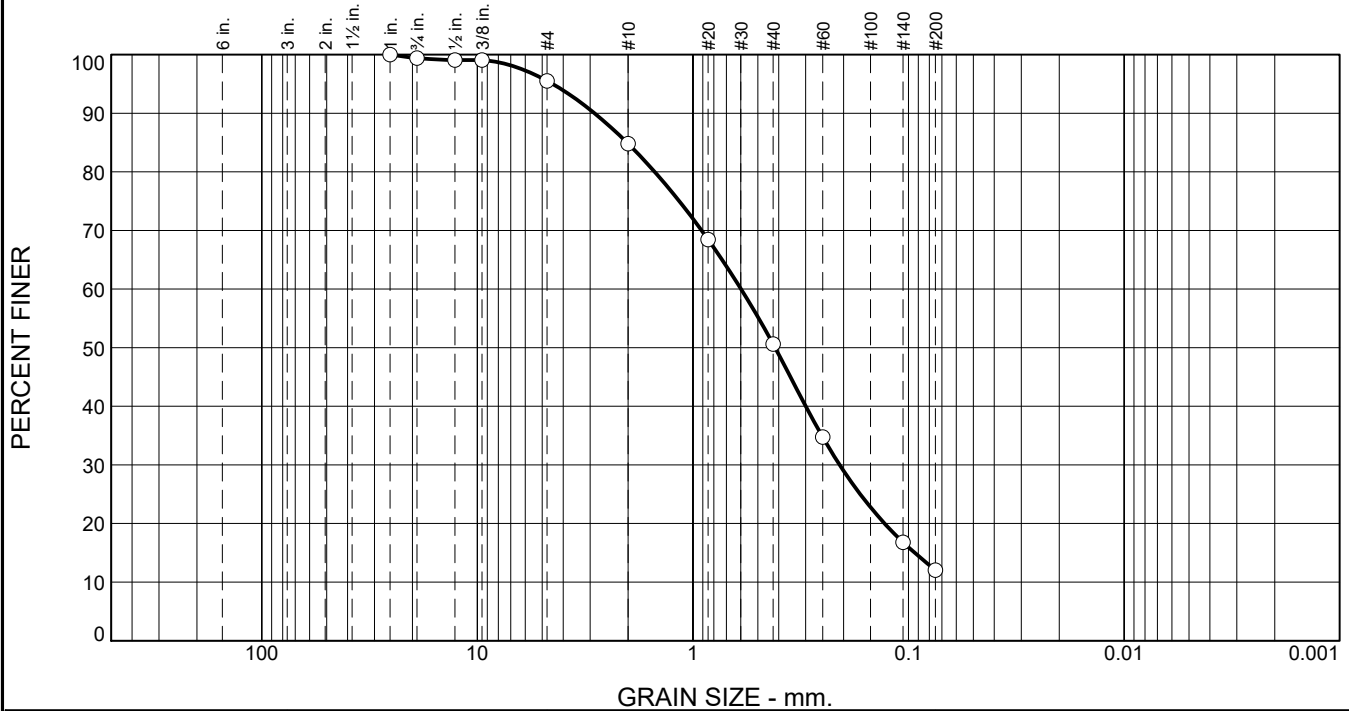
1. Particle Size Analysis
Particle size analysis on representative soil samples were determined using the standard test method of the ASTM D422.

4. Maximum Density
Maximum density tests were performed on a representative bag sample of the near surface soils in accordance with ASTM D1557.

5. Direct Shear
Direct Shear Tests were performed on in-place samples of site soils in accordance with ASTM D3080.

7. Corrosion
Chemical testing was performed on representative samples to determine the corrosion potential of the onsite soils. Testing consisted of pH, chlorides (CTM 422), soluble sulfates (CTM 417), and resistivity (CTM 643).

Particle Size Distribution Report (ASTM D6913)



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	1	3	11	34	39	12	

TEST RESULTS			
Opening Size	Percent Finer		
1	100		
.75	99		
.5	99		
.375	99		
#4	96		
#10	85		
#20	68		
#40	51		
#60	35		
#140	17		
#200	12		

Material Description

Well-graded SAND with SILT (SW-SM)

Date Received: 8/4/22 Date Tested: 8/16/22

Tested By: JH

Checked By: DR

Title: ENGINEER

Sample Number: B-1

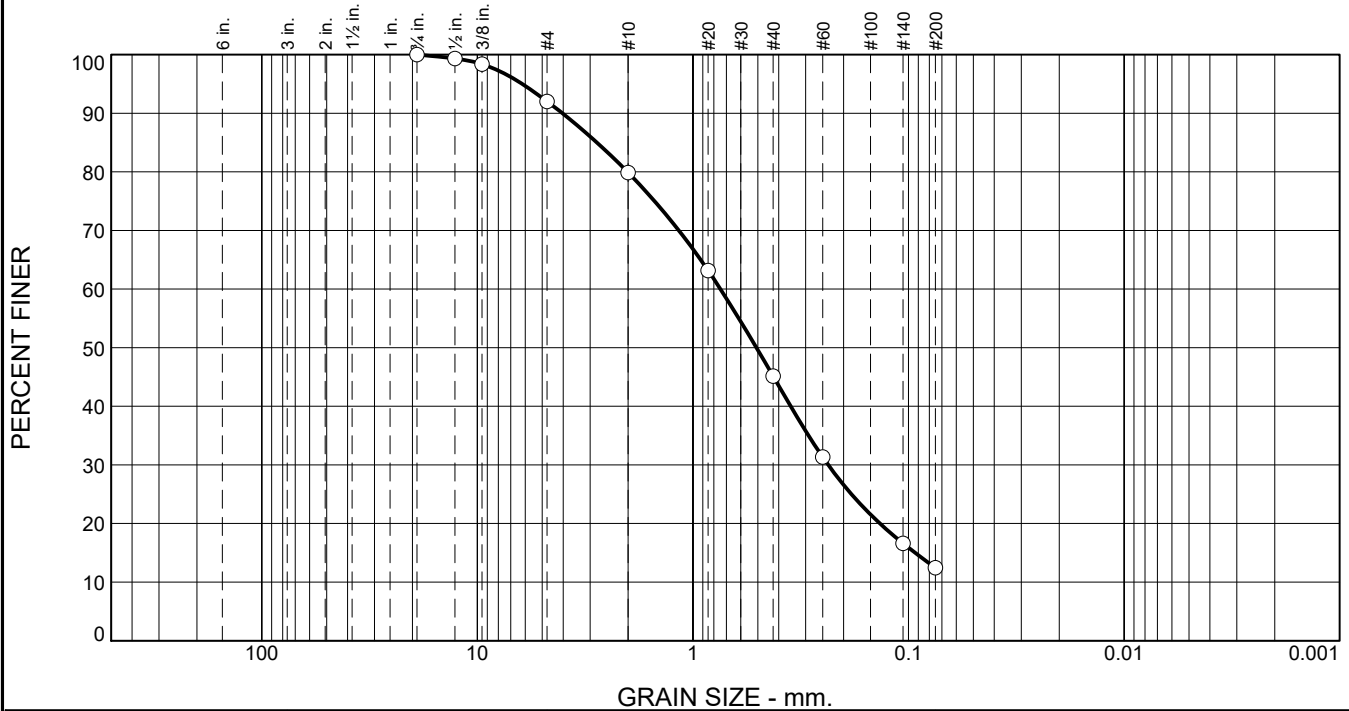
Depth: 0 - 5 Feet

Date Sampled: 8/4/22

MTGL, Inc.

San Gabriel Valley Water Company
Plant F20 - Job No. 647F
15151 Long View Drive Fontana, San Bernardino County, CA
Project No: 2492-A13 Figure

Particle Size Distribution Report (ASTM D6913)



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0			88			12	

TEST RESULTS			
Opening Size	Percent Finer		
.75	100		
.5	99		
.375	98		
#4	92		
#10	80		
#20	63		
#40	45		
#60	31		
#140	17		
#200	12		

Material Description
Well-graded SAND with SILT (SW-SM)

Date Received: 8/4/22 Date Tested: 8/16/22

Tested By: JH

Checked By: DR

Title: ENGINEER

Sample Number: B-2

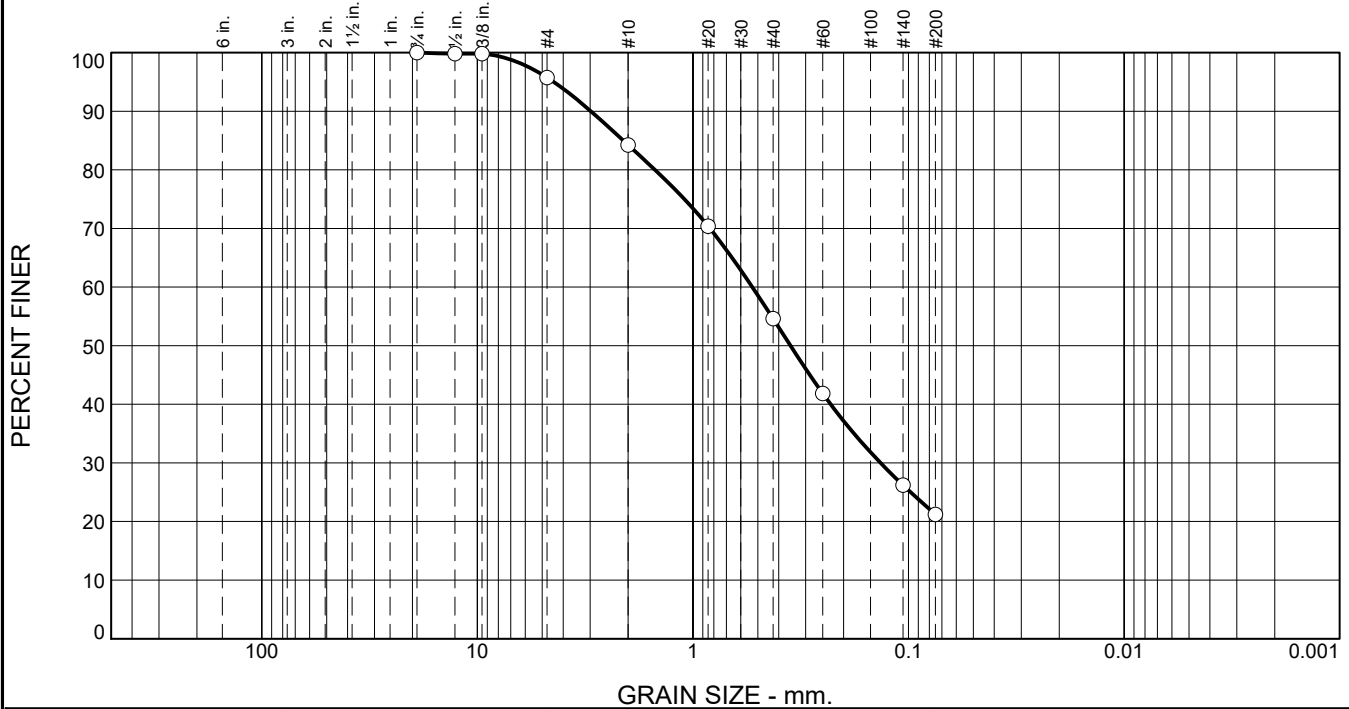
Depth: 0 - 5 Feet

Date Sampled: 8/4/22

MTGL, Inc.

San Gabriel Valley Water Company
Plant F20 - Job No. 647F
15151 Long View Drive Fontana, San Bernardino County, CA
Project No: 2492-A13 Figure

Particle Size Distribution Report (ASTM D6913)



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0			79			21	

TEST RESULTS			
Opening Size	Percent Finer		
.75	100		
.5	100		
.375	100		
#4	96		
#10	84		
#20	70		
#40	55		
#60	42		
#140	26		
#200	21		

Material Description

SILTY SAND (SM)

Date Received: 8/4/22 Date Tested: 8/16/22

Tested By: JH

Checked By: DR

Title: ENGINEER

Sample Number: B-3

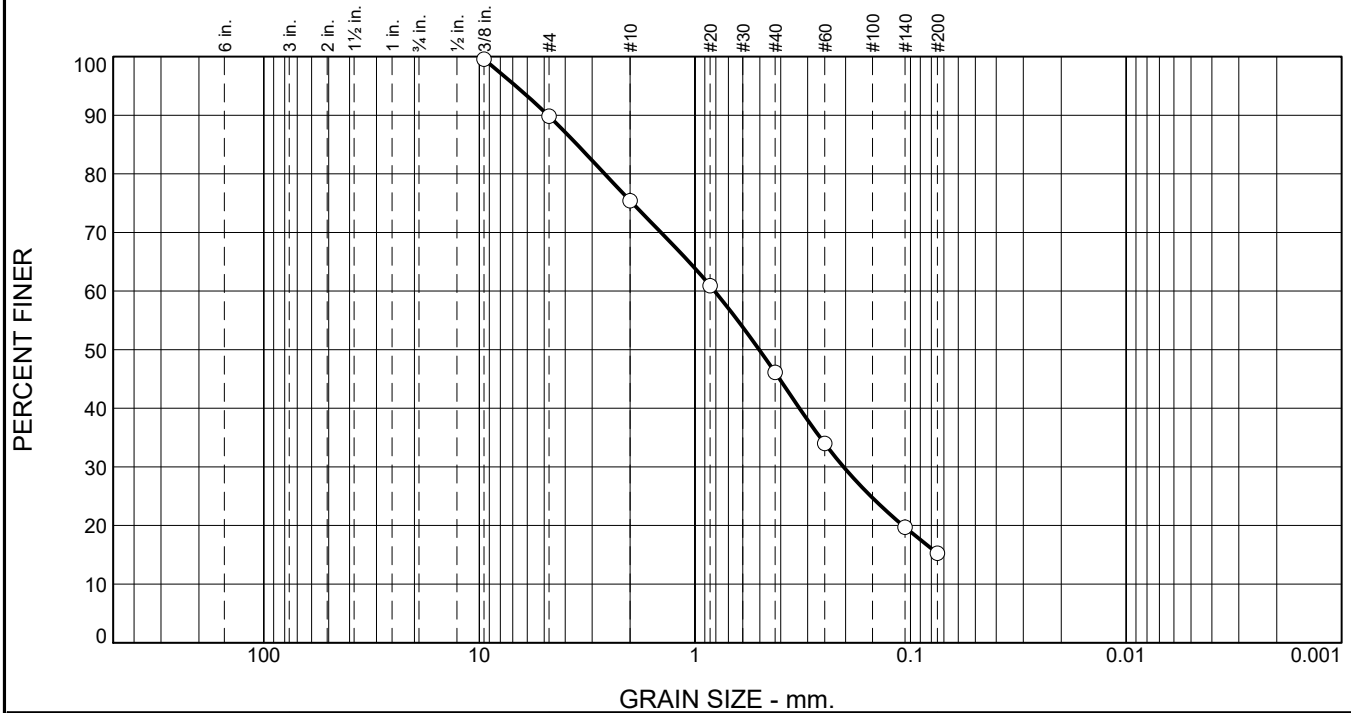
Depth: 6 to 10 Feet

Date Sampled: 8/4/22

MTGL, Inc.

San Gabriel Valley Water Company
Plant F20 - Job No. 647F
15151 Long View Drive Fontana, San Bernardino County, CA
Project No: 2492-A13 Figure

Particle Size Distribution Report (ASTM D6913)



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			85			15	

TEST RESULTS			
Opening Size	Percent Finer		
.375	100		
#4	90		
#10	75		
#20	61		
#40	46		
#60	34		
#140	20		
#200	15		

Material Description

SILTY SAND (SM)

Date Received: 8/4/22 Date Tested: 8/16/22

Tested By: JH

Checked By: DR

Title: ENGINEER

Sample Number: B-3

Depth: 20 Feet

Date Sampled: 8/4/22

MTGL, Inc.

San Gabriel Valley Water Company
Plant F20 - Job No. 647F
15151 Long View Drive Fontana, San Bernardino County, CA
Project No: 2492-A13 Figure

Laboratory Compaction - Modified Effort (ASTM D1557)

Project No.: 2492-A13

Date: 8/17/22

Project: Plant F20 - Job No. 647F

15151 Long View Drive

Fontana, San Bernardino County, California

Client: San Gabriel Valley Water Company

Sample Number: B-3

Depth: 6 to 10 Feet

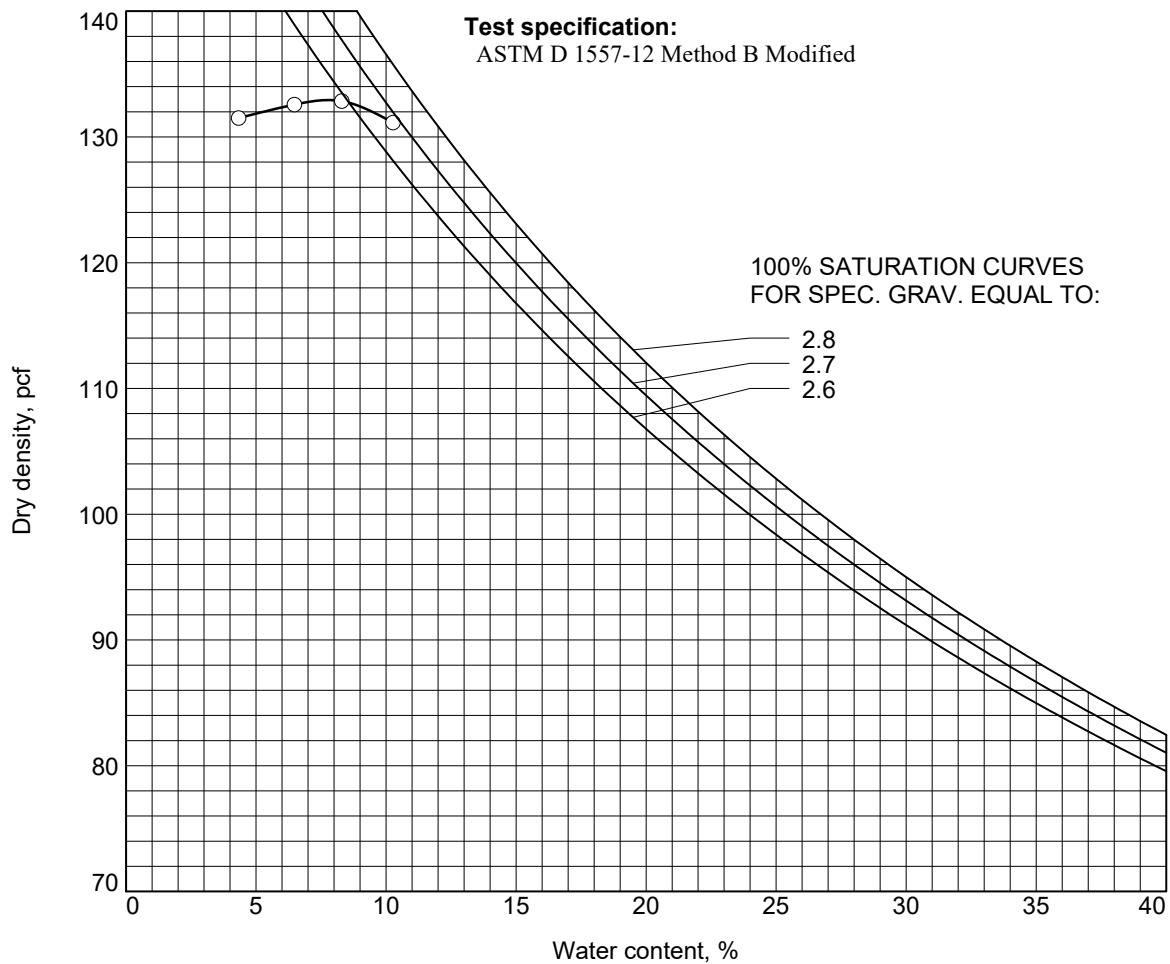
MATERIAL DESCRIPTION

Description: SILTY SAND (SM)

TEST RESULTS

Maximum dry density = 132.9 pcf

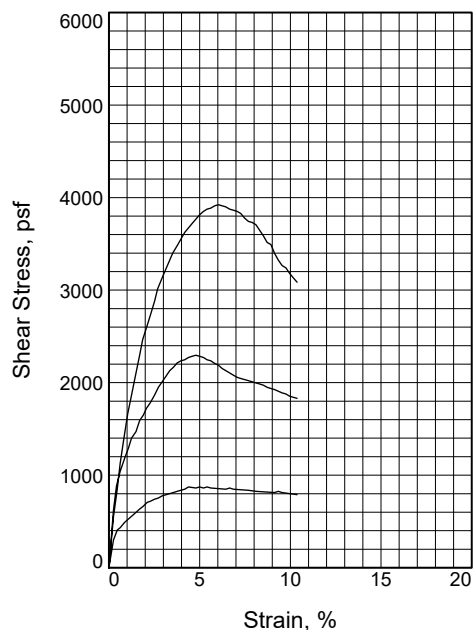
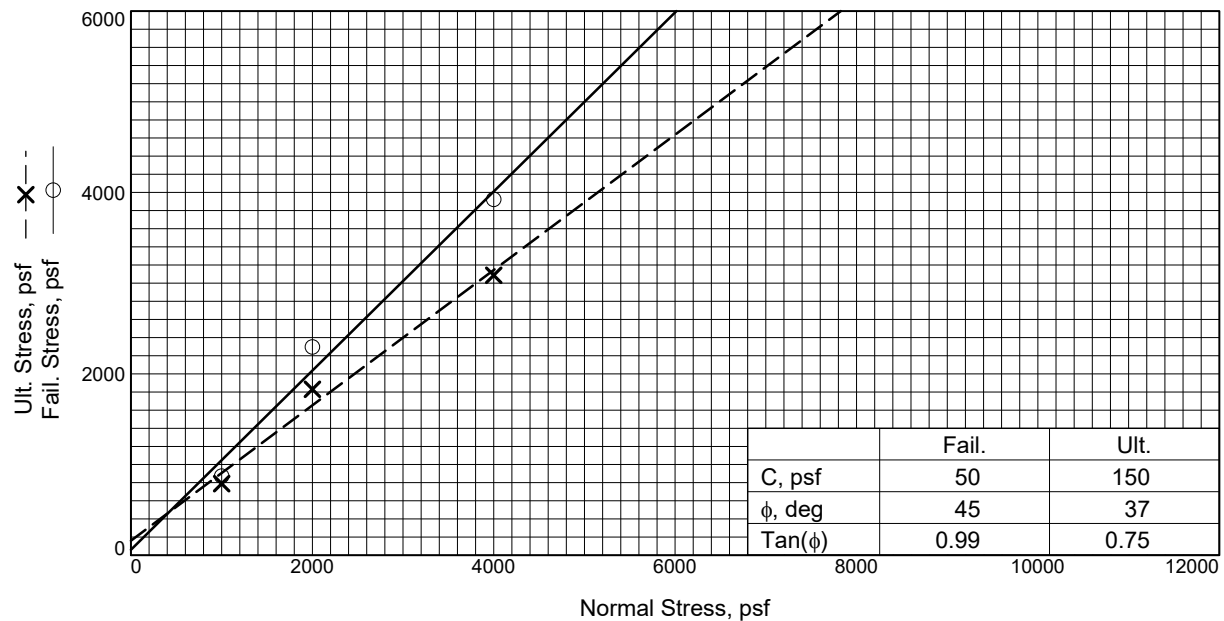
Optimum moisture = 7.8 %



MTGL, Inc.

Figure

Tested By: KS **Checked By:** JH



Sample No.		1	2	3
Initial	Water Content, %	1.0	1.2	1.1
	Dry Density, pcf	125.9	122.2	124.2
	Saturation, %	8.3	9.1	9.0
	Void Ratio	0.3141	0.3542	0.3325
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	10.6	11.7	9.8
	Dry Density, pcf	129.2	126.2	131.3
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.2806	0.3108	0.2599
	Diameter, in.	2.42	2.42	2.42
	Height, in.	0.97	0.97	0.95
Normal Stress, psf		1000	2000	4000
Fail. Stress, psf		873	2296	3923
Strain, %		4.4	4.8	6.0
Ult. Stress, psf		789	1830	3086
Strain, %		10.4	10.4	10.4
Strain rate, in./min.		0.010	0.010	0.010

Sample Type: Modified CAL Sampler
Description:

Assumed Specific Gravity= 2.65
Remarks:

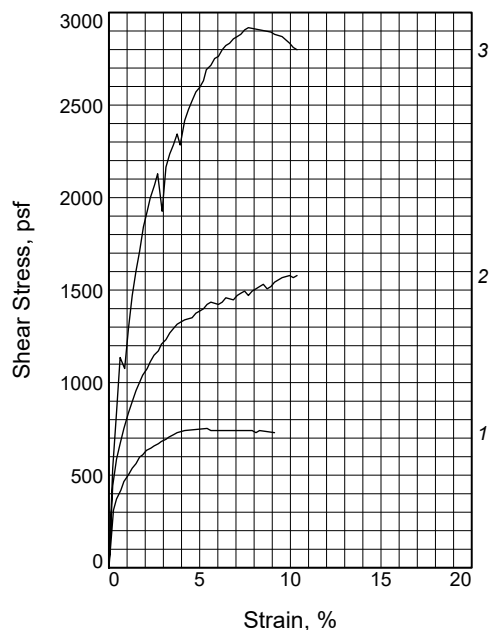
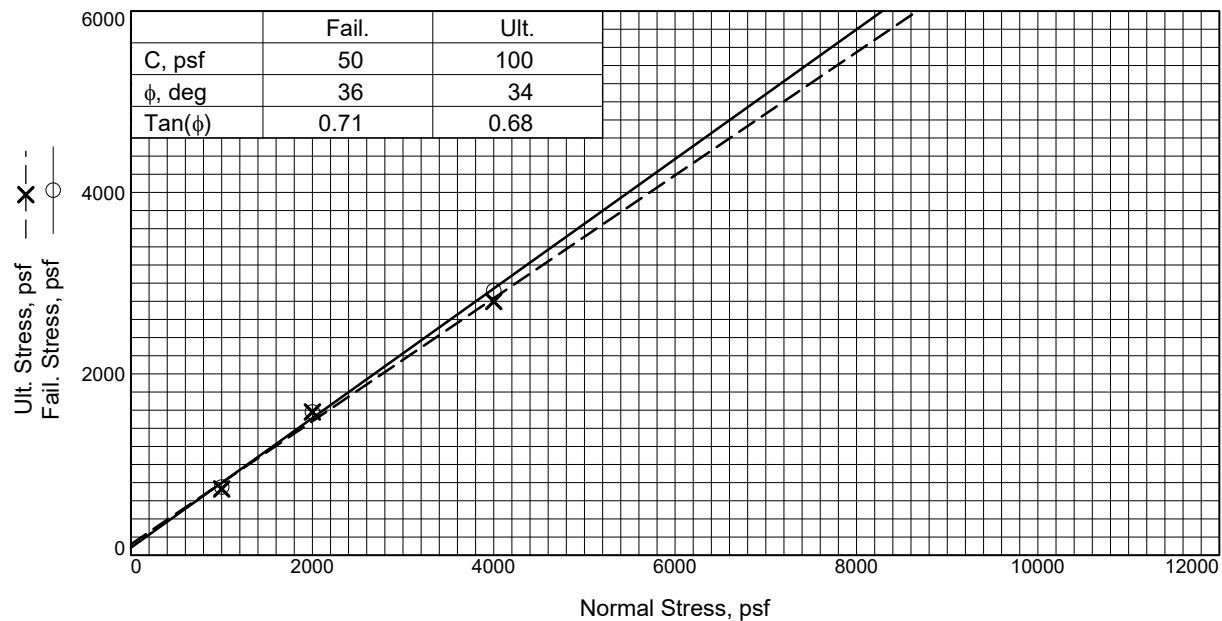
Figure _____

San Gabriel Valley Water Company
 Plant F20 - Job No. 647F
 15151 Long View Drive
 Fontana, San Bernardino County, California

Sample Number: B-1 **Depth:** 5 Feet

Proj. No.: 2492-A13 **Date Sampled:** 8/4/22

DIRECT SHEAR TEST REPORT
MTGL, Inc.



Sample No.		1	2	3
Initial	Water Content, %	1.3	1.1	1.0
	Dry Density, pcf	108.7	112.8	111.3
	Saturation, %	6.6	6.3	5.3
	Void Ratio	0.5213	0.4665	0.4861
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	18.1	15.5	16.2
	Dry Density, pcf	111.9	117.3	115.7
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.4784	0.4104	0.4300
	Diameter, in.	2.42	2.42	2.42
	Height, in.	0.97	0.96	0.96
Normal Stress, psf		1000	2000	4000
Fail. Stress, psf		753	1579	2918
Strain, %		5.4	10.0	7.7
Ult. Stress, psf		730	1579	2799
Strain, %		9.1	10.4	10.4
Strain rate, in./min.		0.010	0.010	0.010

Sample Type: Modified CAL Sampler
Description:

Assumed Specific Gravity= 2.65
Remarks:

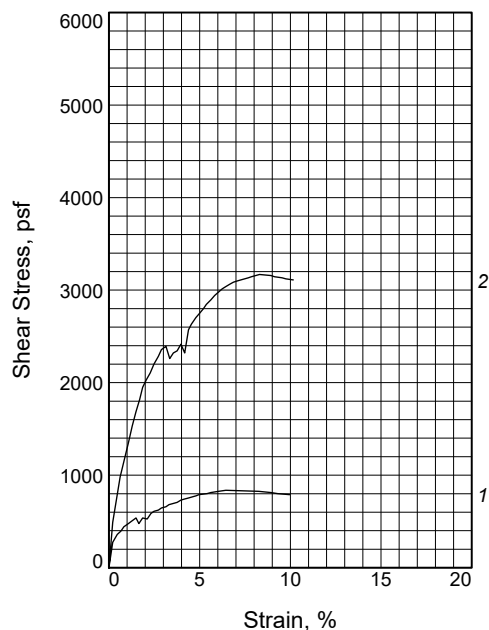
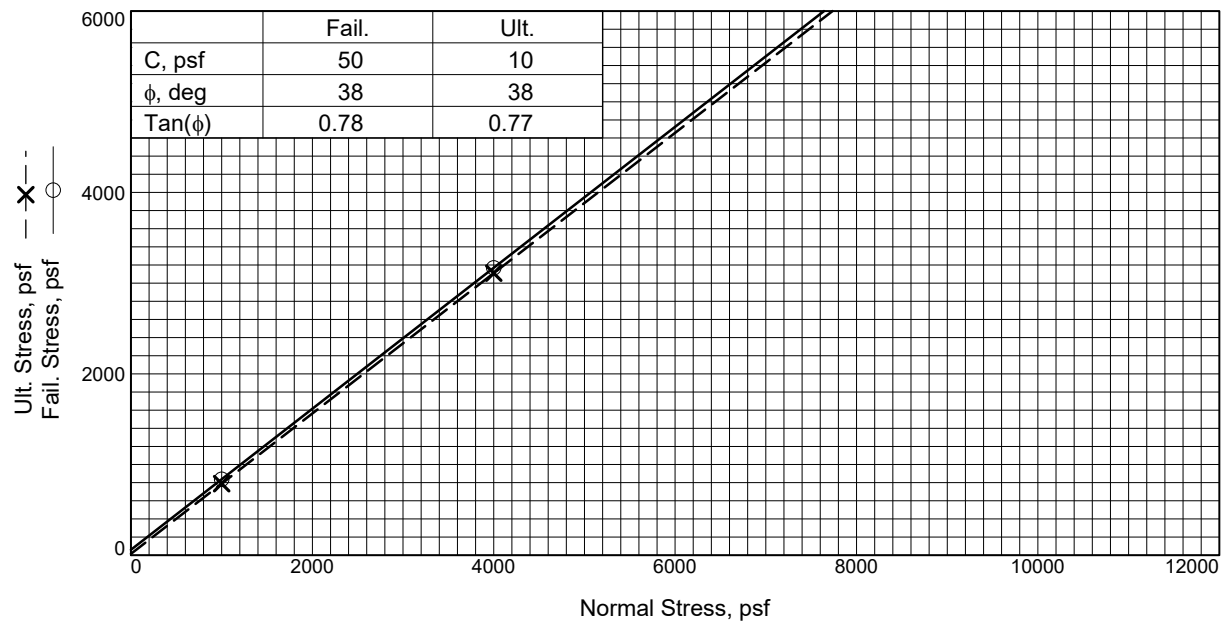
Figure _____

San Gabriel Valley Water Company
 Plant F20 - Job No. 647F
 15151 Long View Drive
 Fontana, San Bernardino County, California

Sample Number: B-1 **Depth:** 10 Feet

Proj. No.: 2492-A13 **Date Sampled:** 8/4/22

DIRECT SHEAR TEST REPORT
MTGL, Inc.



Sample No.		1	2
Initial	Water Content, %	1.2	1.1
	Dry Density, pcf	106.0	108.5
	Saturation, %	5.9	5.4
	Void Ratio	0.5605	0.5247
	Diameter, in.	2.42	2.42
	Height, in.	1.00	1.00
At Test	Water Content, %	19.5	16.7
	Dry Density, pcf	109.0	114.6
	Saturation, %	100.0	100.0
	Void Ratio	0.5176	0.4432
	Diameter, in.	2.42	2.42
	Height, in.	0.97	0.95
Normal Stress, psf		1000	4000
Fail. Stress, psf		837	3169
Strain, %		6.4	8.3
Ult. Stress, psf		789	3110
Strain, %		10.0	10.2
Strain rate, in./min.		0.010	0.010

Sample Type: Modified CAL Sampler
Description:

Assumed Specific Gravity= 2.65

Remarks: Only 2 rings available for testing

San Gabriel Valley Water Company
 Plant F20 - Job No. 647F
 15151 Long View Drive
 Fontana, San Bernardino County, California

Sample Number: B-1

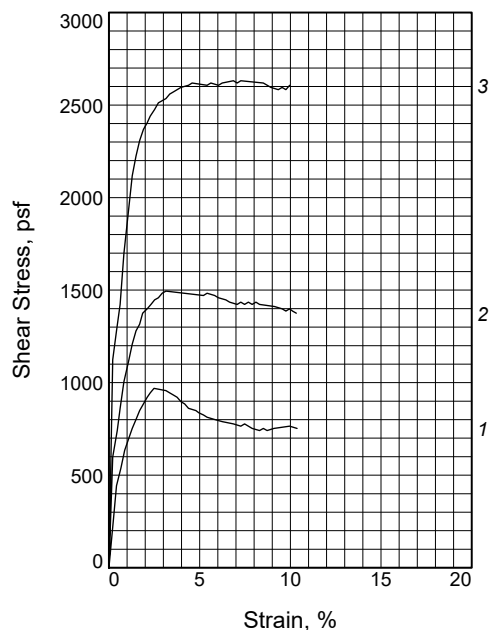
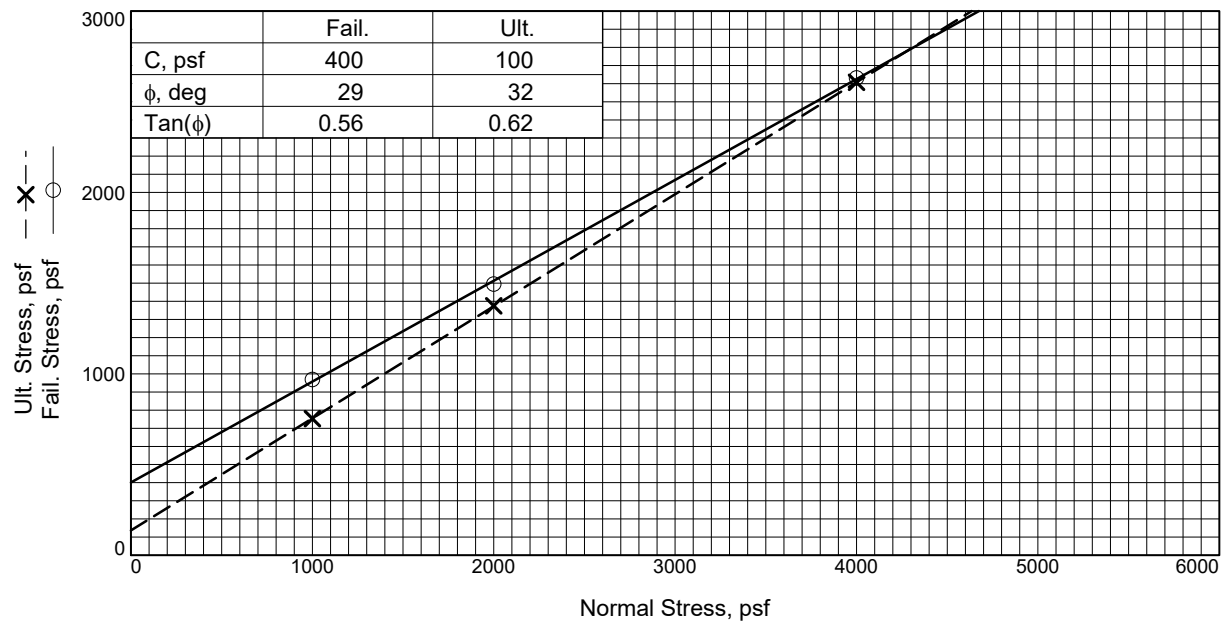
Depth: 15 Feet

Proj. No.: 2492-A13

Date Sampled: 8/4/22

DIRECT SHEAR TEST REPORT
MTGL, Inc.

Figure _____



Sample No.		1	2	3
Initial	Water Content, %	7.8	7.7	7.8
	Dry Density, pcf	119.7	119.8	119.7
	Saturation, %	53.7	53.3	53.7
	Void Ratio	0.3823	0.3813	0.3823
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	14.2	13.3	13.3
	Dry Density, pcf	120.2	122.4	122.3
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.3761	0.3518	0.3522
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	0.98	0.98
Normal Stress, psf		1000	2000	4000
Fail. Stress, psf		969	1495	2631
Strain, %		2.5	3.1	6.9
Ult. Stress, psf		753	1375	2607
Strain, %		10.4	10.3	10.0
Strain rate, in./min.		0.010	0.010	0.010

Sample Type: Bulk Bag Sample

Description:

Assumed Specific Gravity= 2.65

Remarks: Remolded at 90% Relative Compaction

San Gabriel Valley Water Company
Plant F20 - Job No. 647F
15151 Long View Drive
Fontana, San Bernardino County, California

Sample Number: B-3

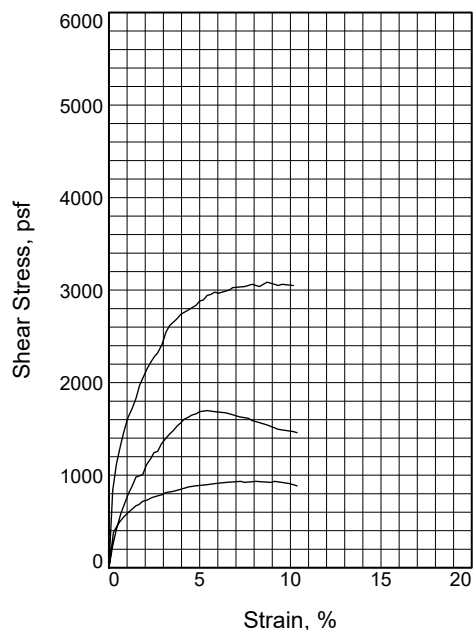
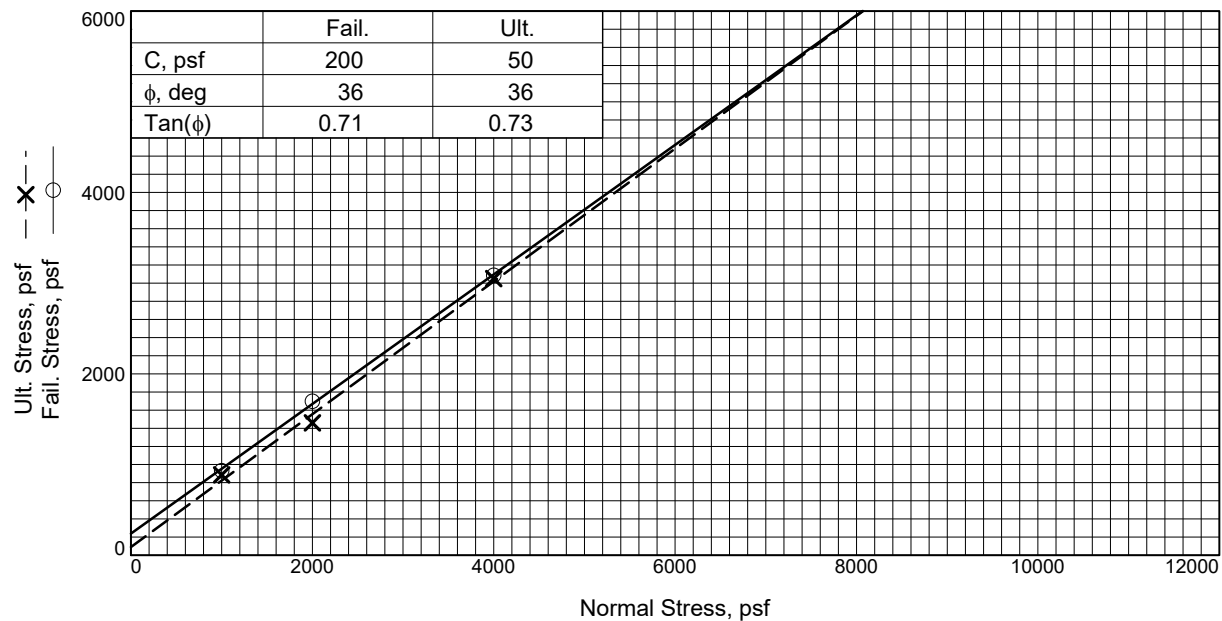
Depth: 6 to 10 Feet

Proj. No.: 2492-A13

Date Sampled: 8/4/22

DIRECT SHEAR TEST REPORT
MTGL, Inc.

Figure _____



Sample No.		1	2	3
Initial	Water Content, %	1.0	0.9	0.6
	Dry Density, pcf	113.6	115.0	112.6
	Saturation, %	5.9	5.2	3.3
	Void Ratio	0.4558	0.4391	0.4687
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	16.3	15.2	15.7
	Dry Density, pcf	115.6	117.9	116.8
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.4307	0.4026	0.4168
	Diameter, in.	2.42	2.42	2.42
	Height, in.	0.98	0.97	0.96
Normal Stress, psf		1000	2000	4000
Fail. Stress, psf		933	1698	3086
Strain, %		7.3	5.4	8.7
Ult. Stress, psf		885	1459	3050
Strain, %		10.4	10.4	10.2
Strain rate, in./min.		0.010	0.010	0.010

Sample Type: Modified CAL Sampler
Description:

Assumed Specific Gravity= 2.65

Remarks:

Figure _____

San Gabriel Valley Water Company
Plant F20 - Job No. 647F
15151 Long View Drive
Fontana, San Bernardino County, California

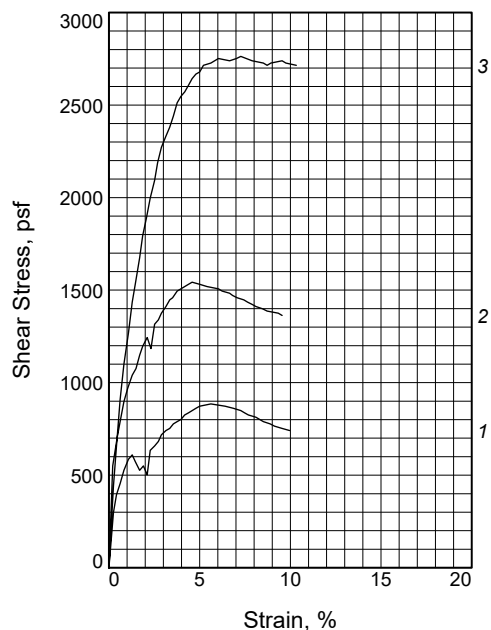
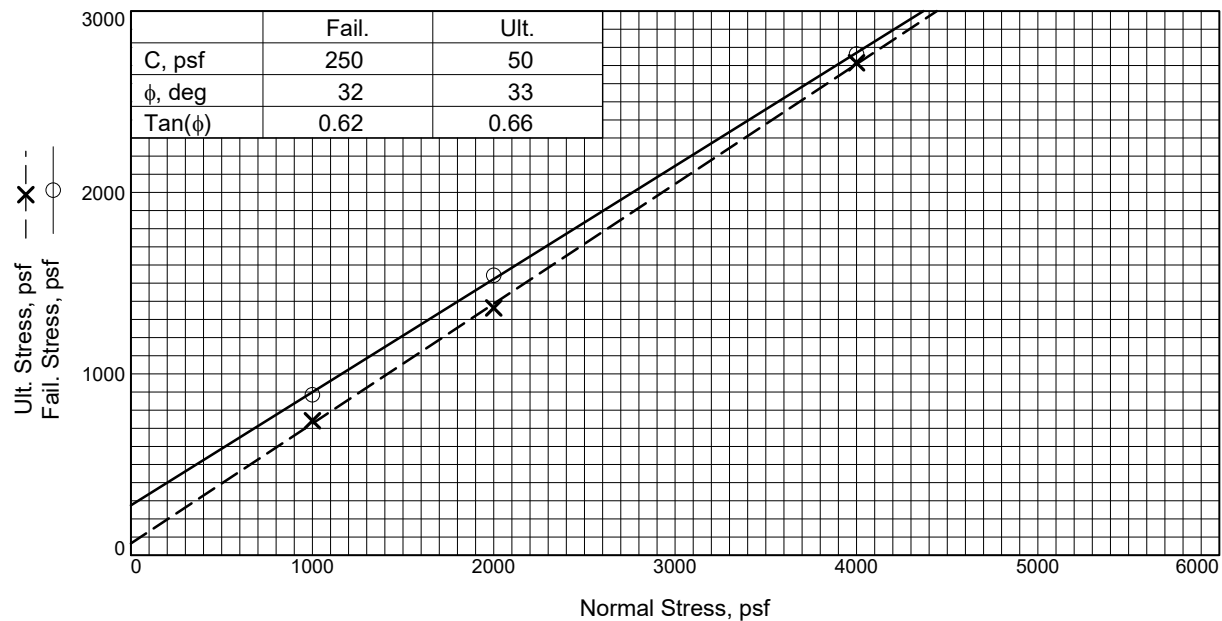
Sample Number: B-3

Depth: 15 Feet

Proj. No.: 2492-A13

Date Sampled: 8/4/22

DIRECT SHEAR TEST REPORT
MTGL, Inc.



Sample No.		1	2	3
Initial	Water Content, %	0.8	0.8	0.6
	Dry Density, pcf	114.3	110.3	114.4
	Saturation, %	4.7	4.0	3.4
	Void Ratio	0.4474	0.4996	0.4464
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	16.3	16.7	14.3
	Dry Density, pcf	115.5	114.6	119.9
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.4322	0.4436	0.3798
	Diameter, in.	2.42	2.42	2.42
	Height, in.	0.99	0.96	0.95
Normal Stress, psf		1000	2000	4000
Fail. Stress, psf		885	1543	2763
Strain, %		5.6	4.6	7.3
Ult. Stress, psf		741	1363	2715
Strain, %		10.0	9.5	10.3
Strain rate, in./min.		0.010	0.010	0.010

Sample Type: Modified CAL Sampler

Description: SILTY SAND (SM)

Assumed Specific Gravity= 2.65

Remarks:

Figure _____

San Gabriel Valley Water Company

Plant F20 - Job No. 647F

15151 Long View Drive

Fontana, San Bernardino County, California

Sample Number: B-4

Depth: 15 Feet

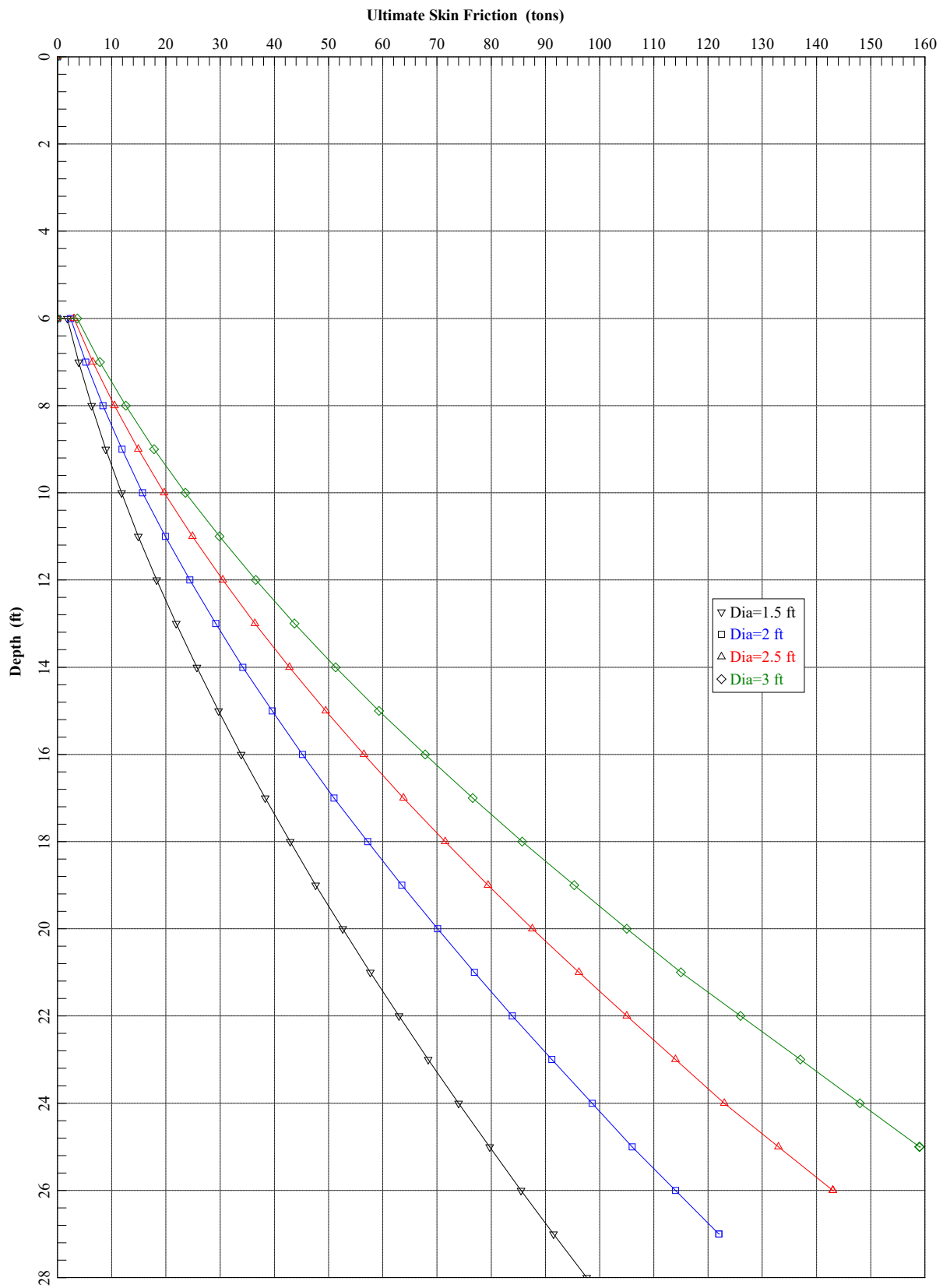
Proj. No.: 2492-A13

Date Sampled: 8/4/22

DIRECT SHEAR TEST REPORT
MTGL, Inc.

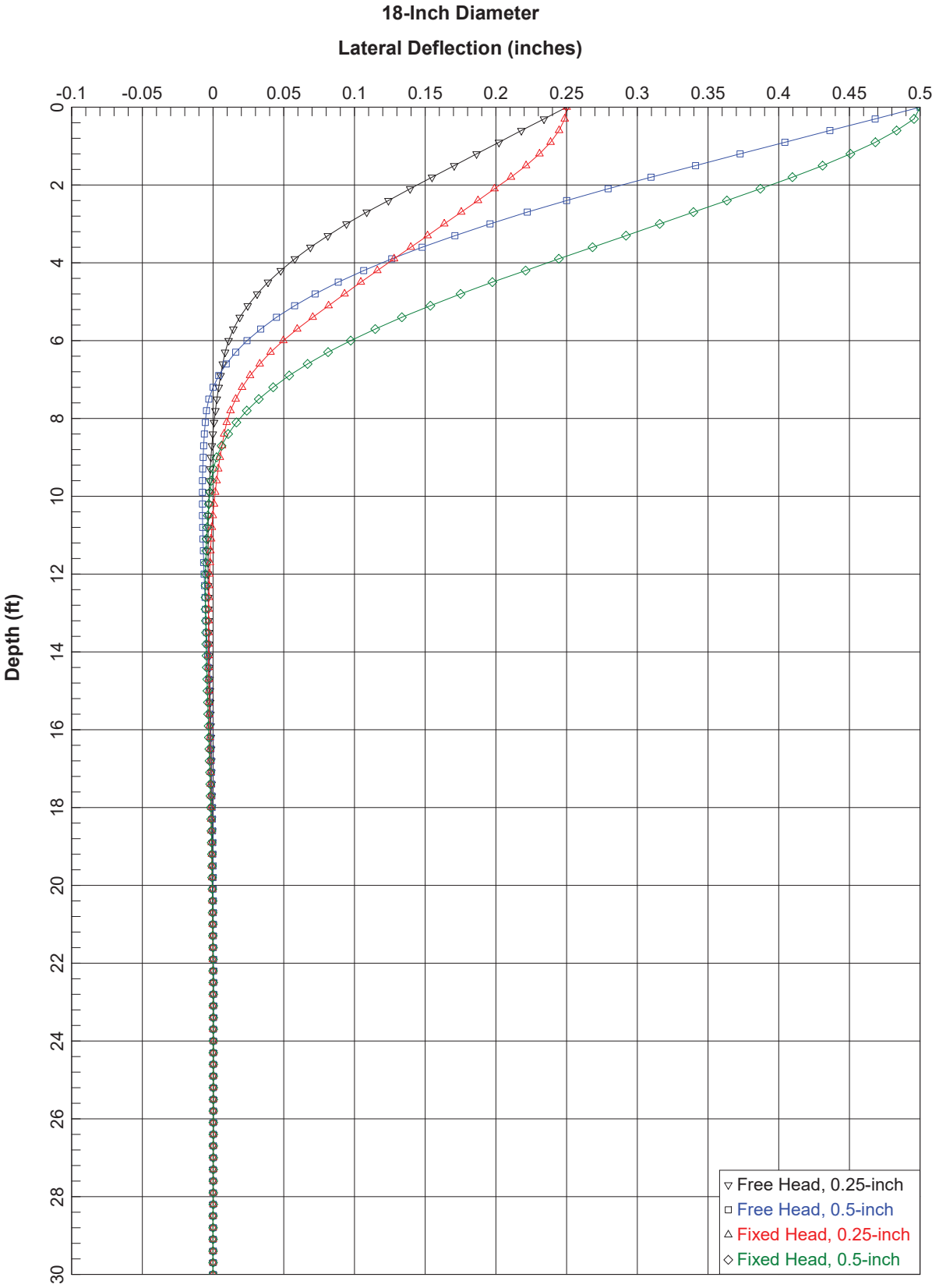
APPENDIX D

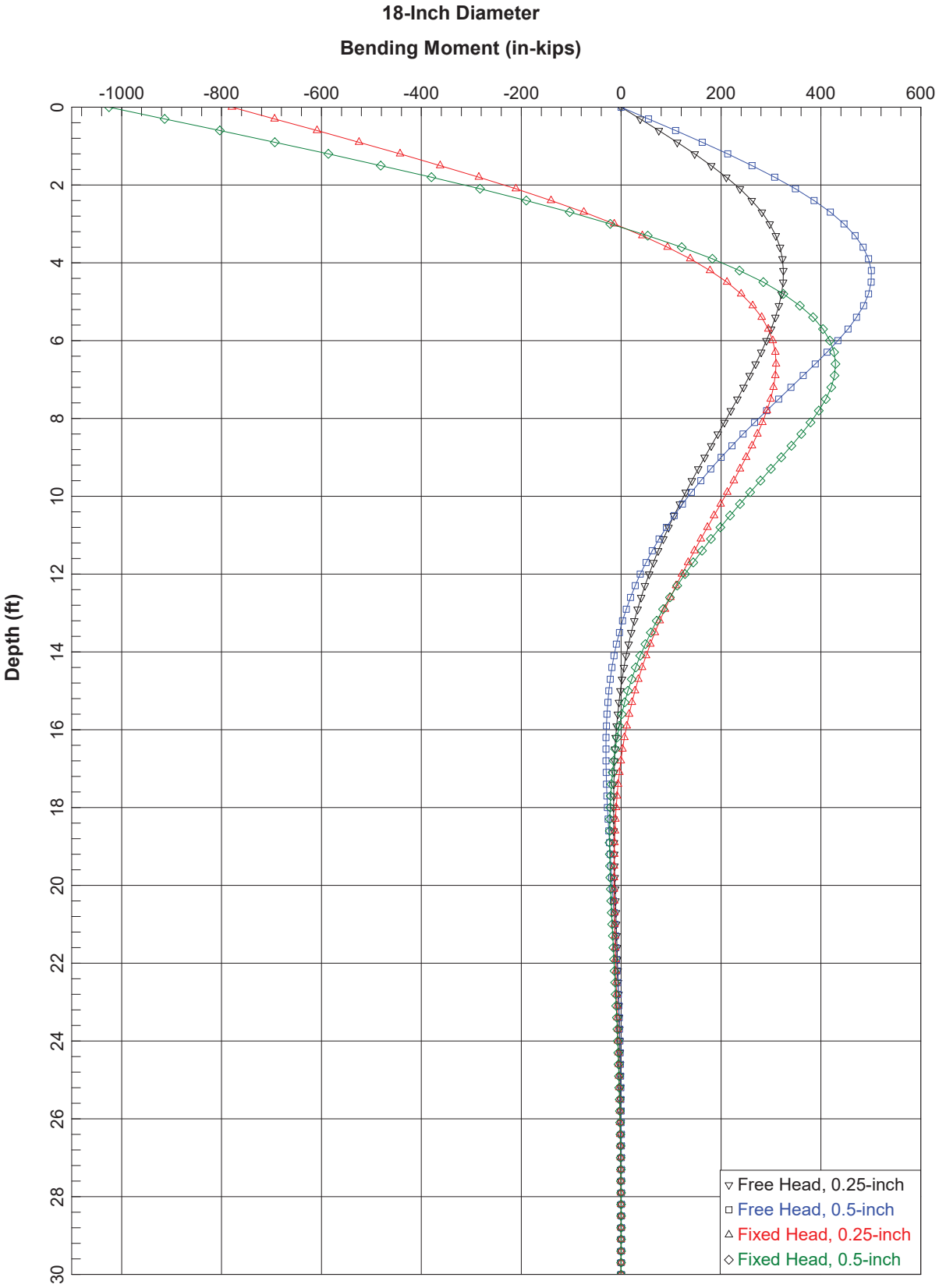
SHAFT SOFTWARE AXIAL CAPACITIES GRAPHS

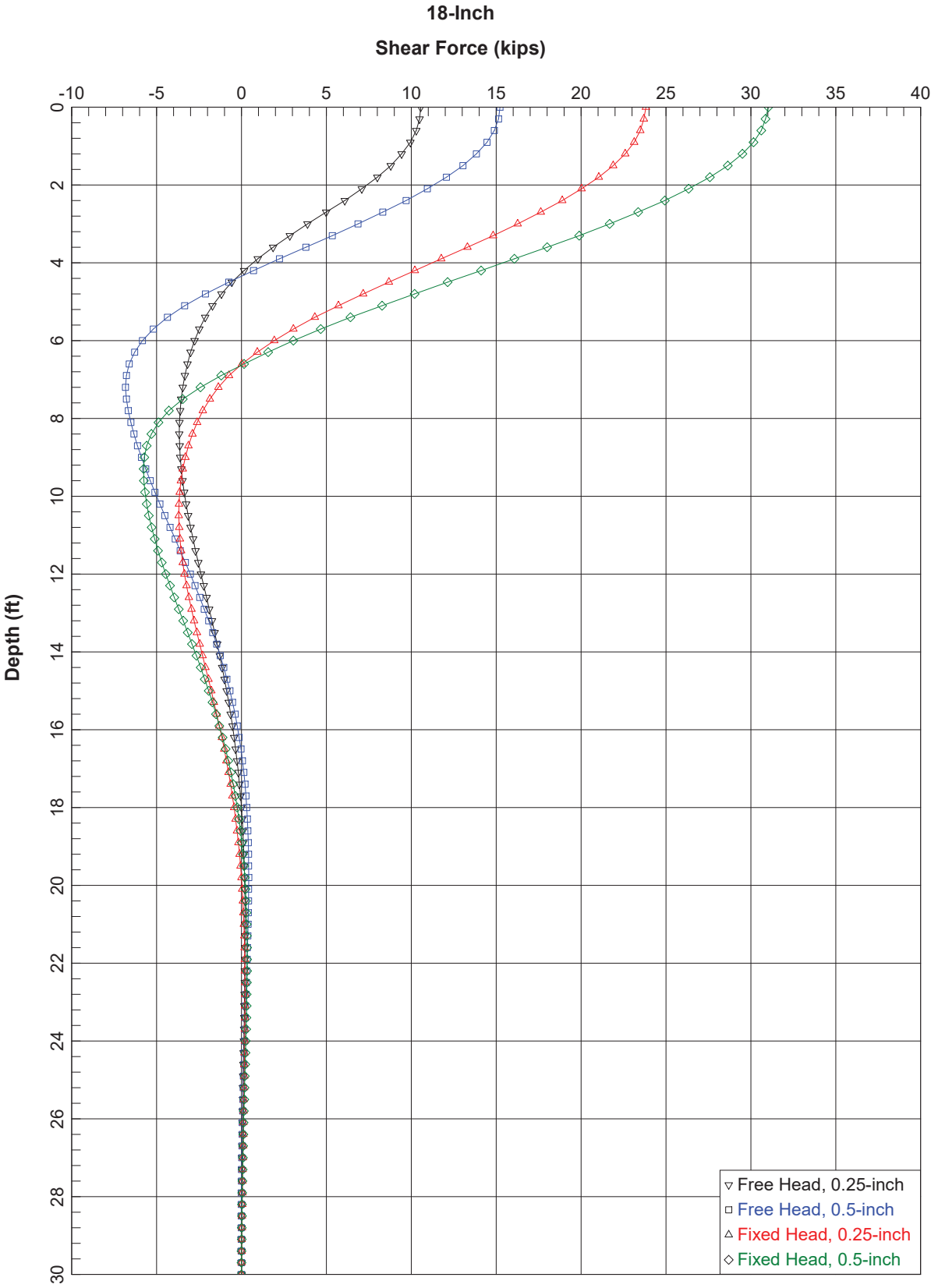


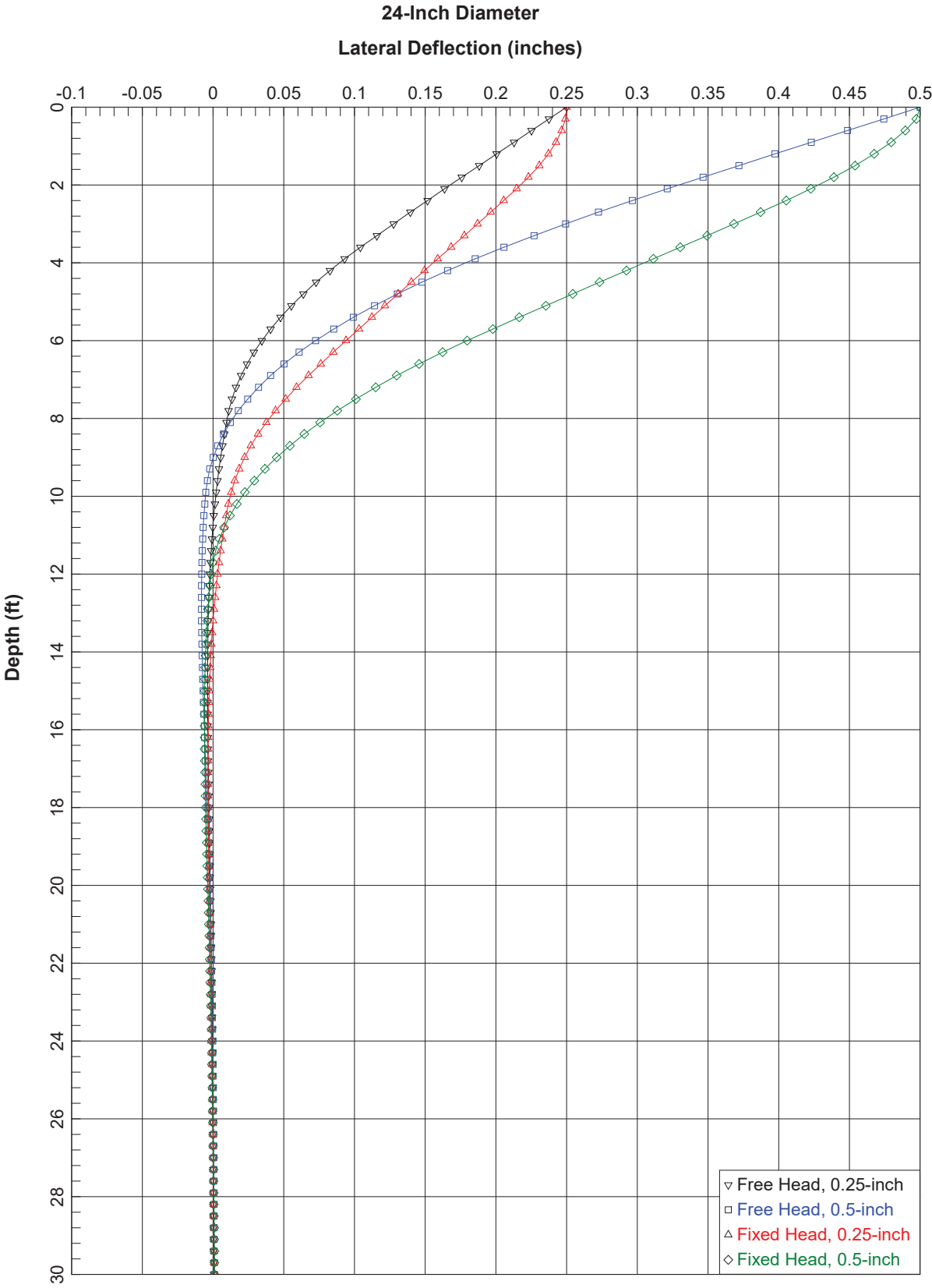
APPENDIX E

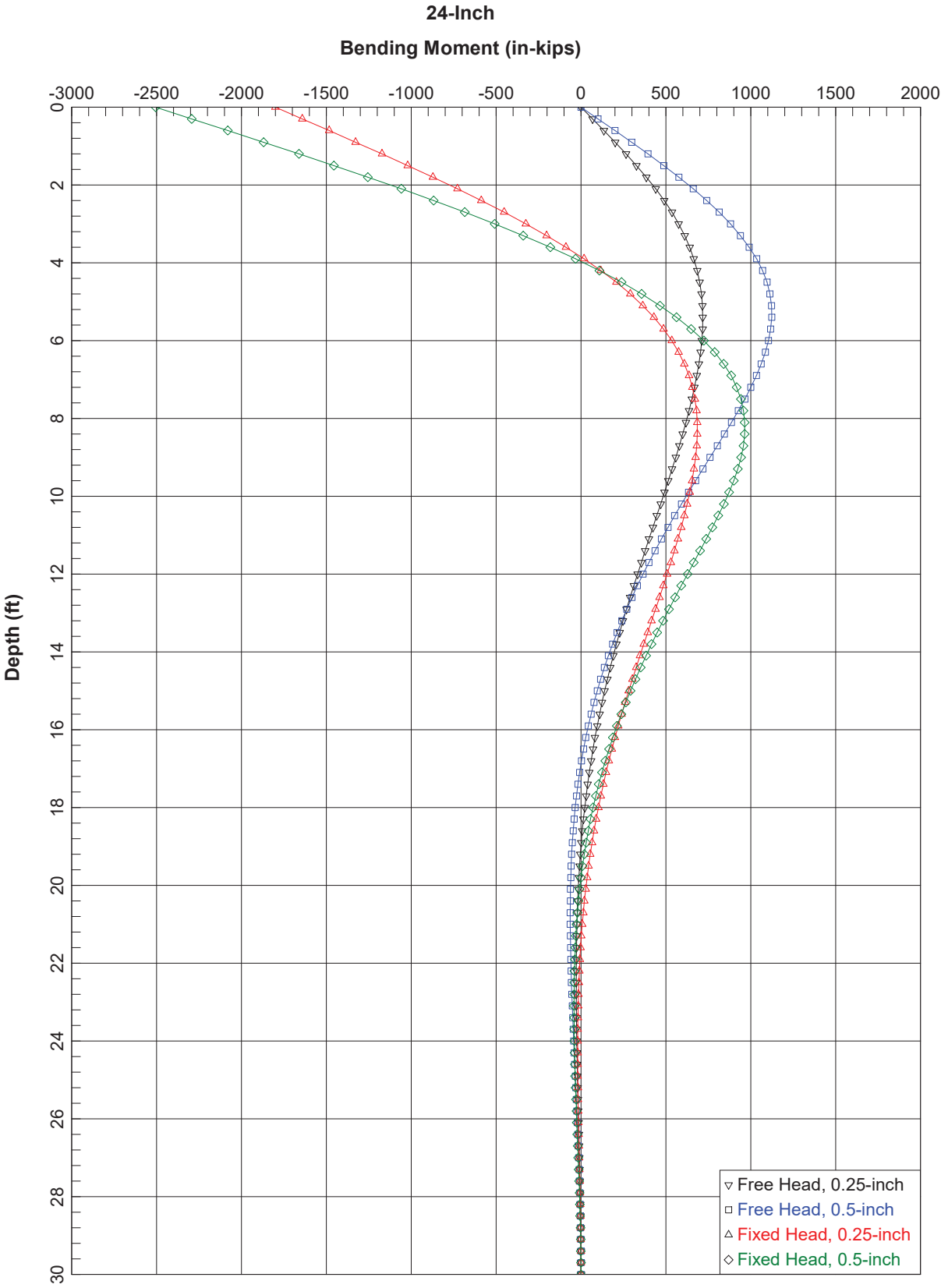
LPILE SOFTWARE LATERAL CAPACITIES GRAPHS

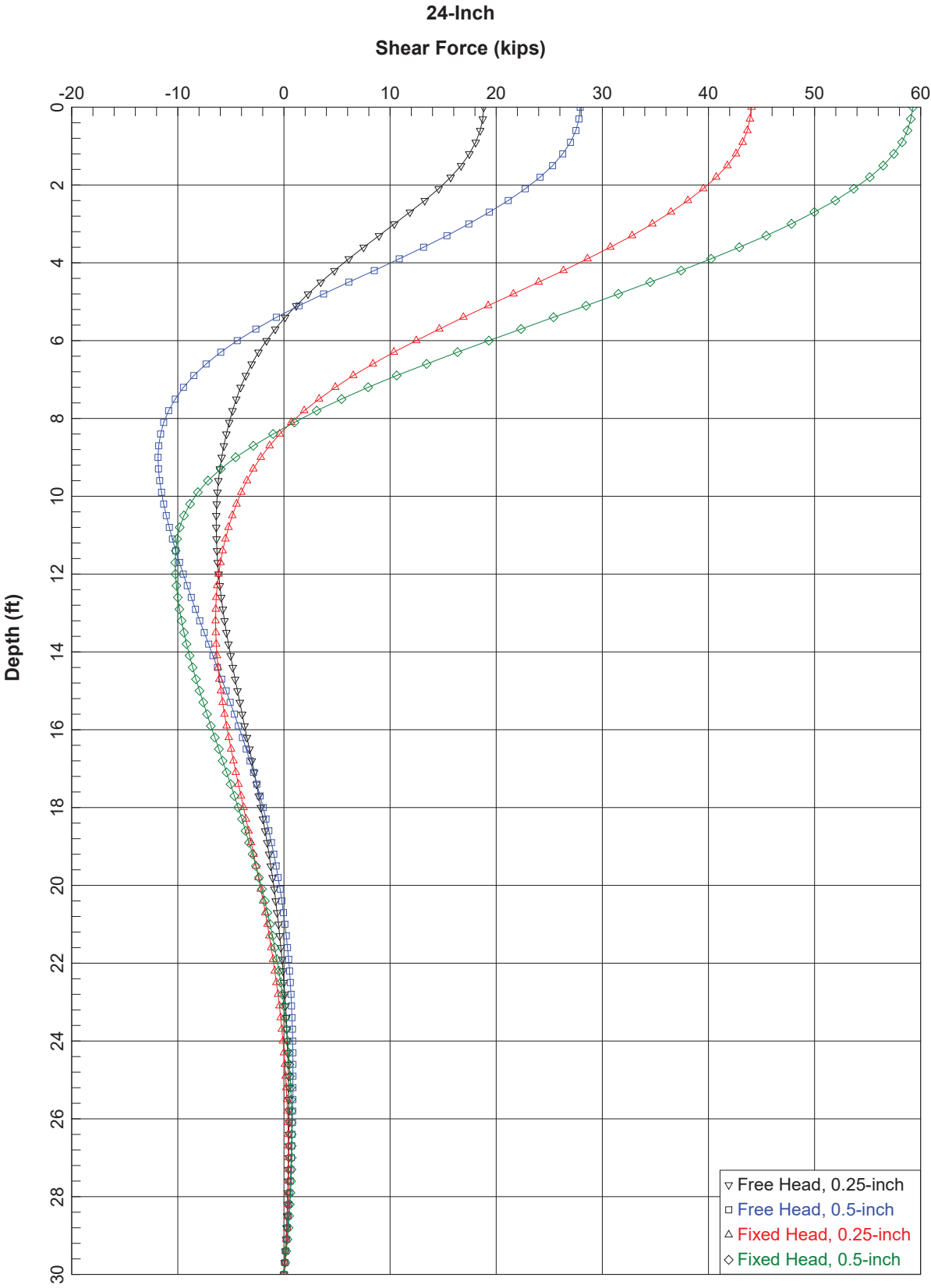


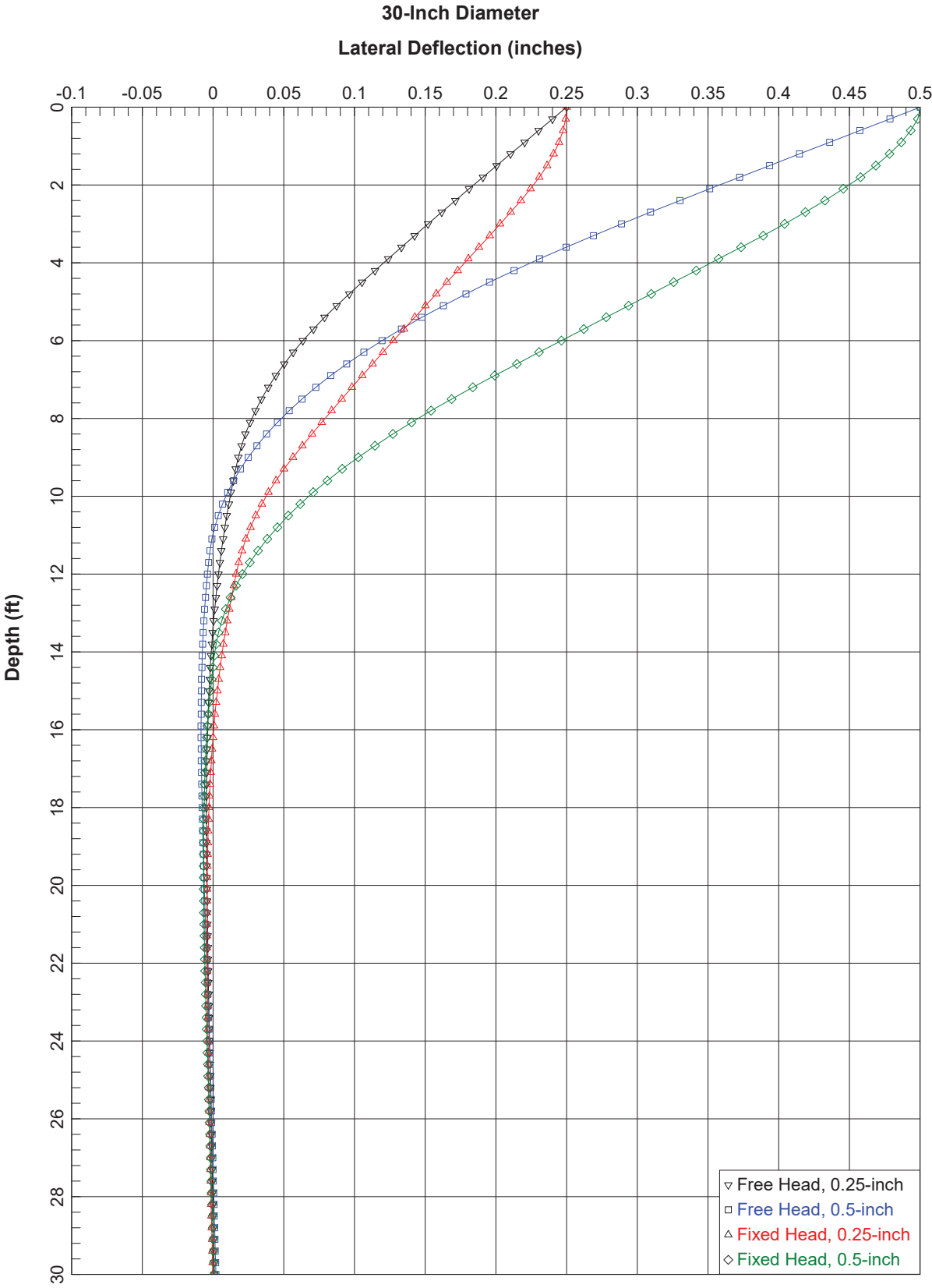


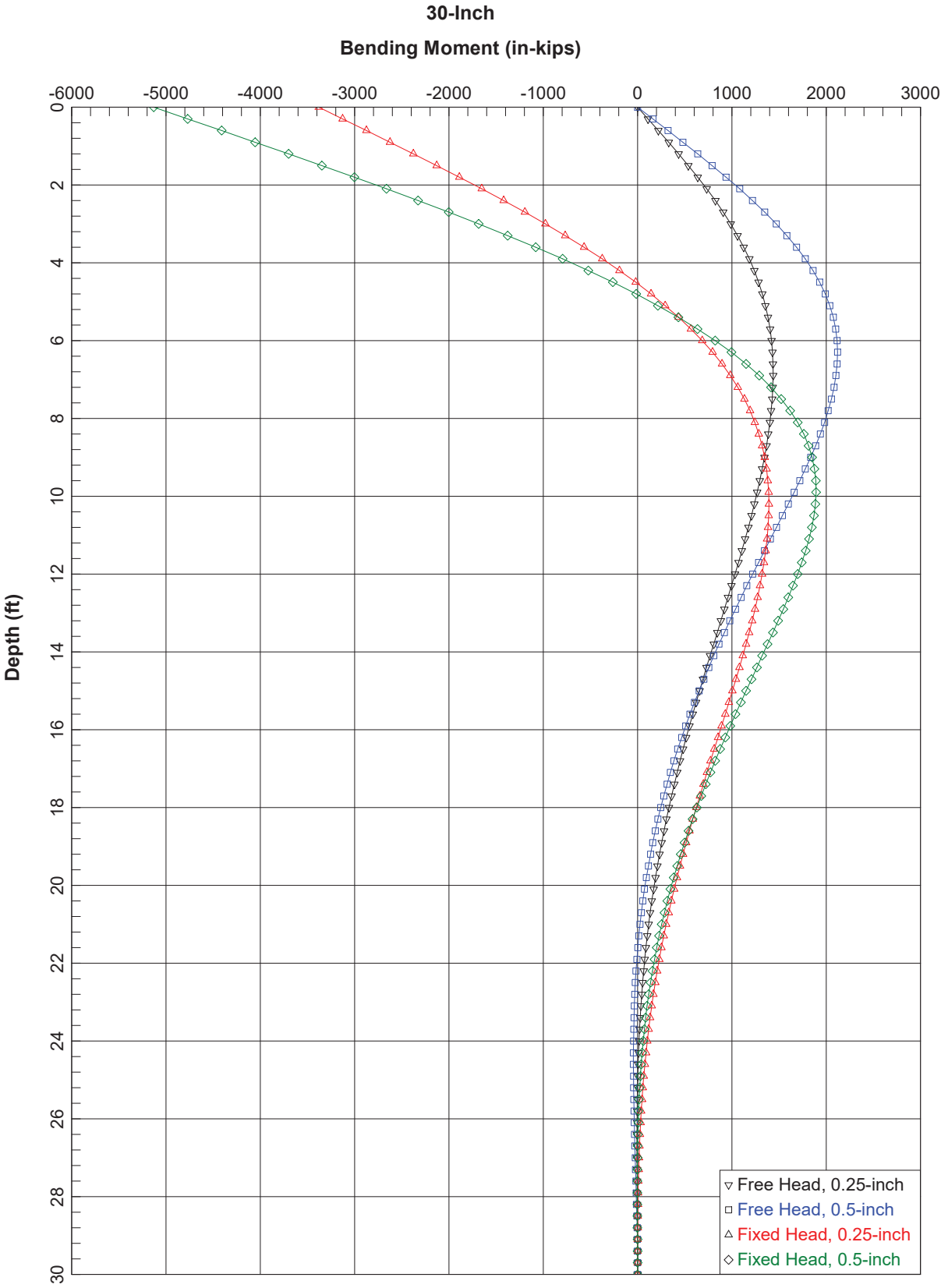


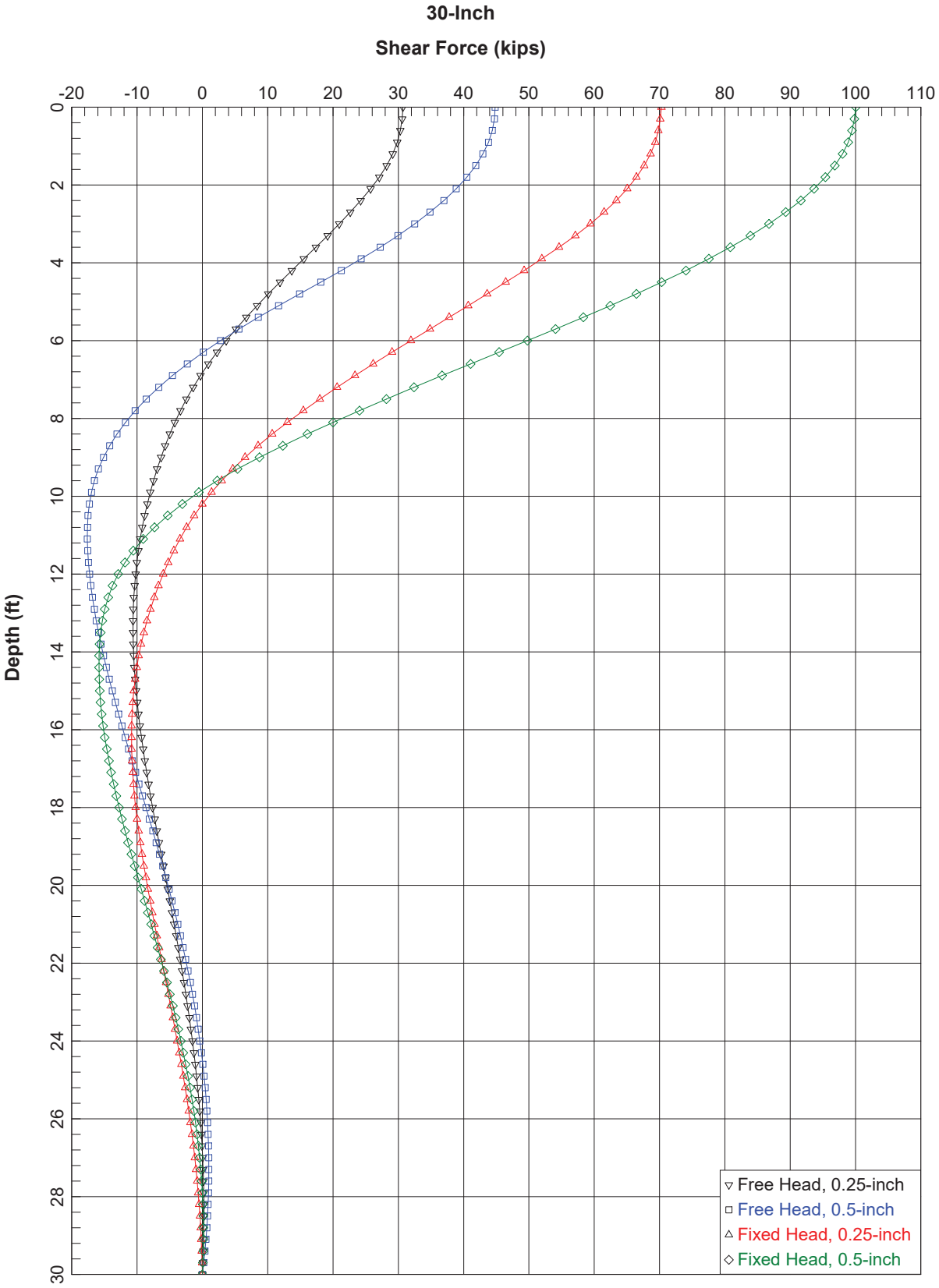


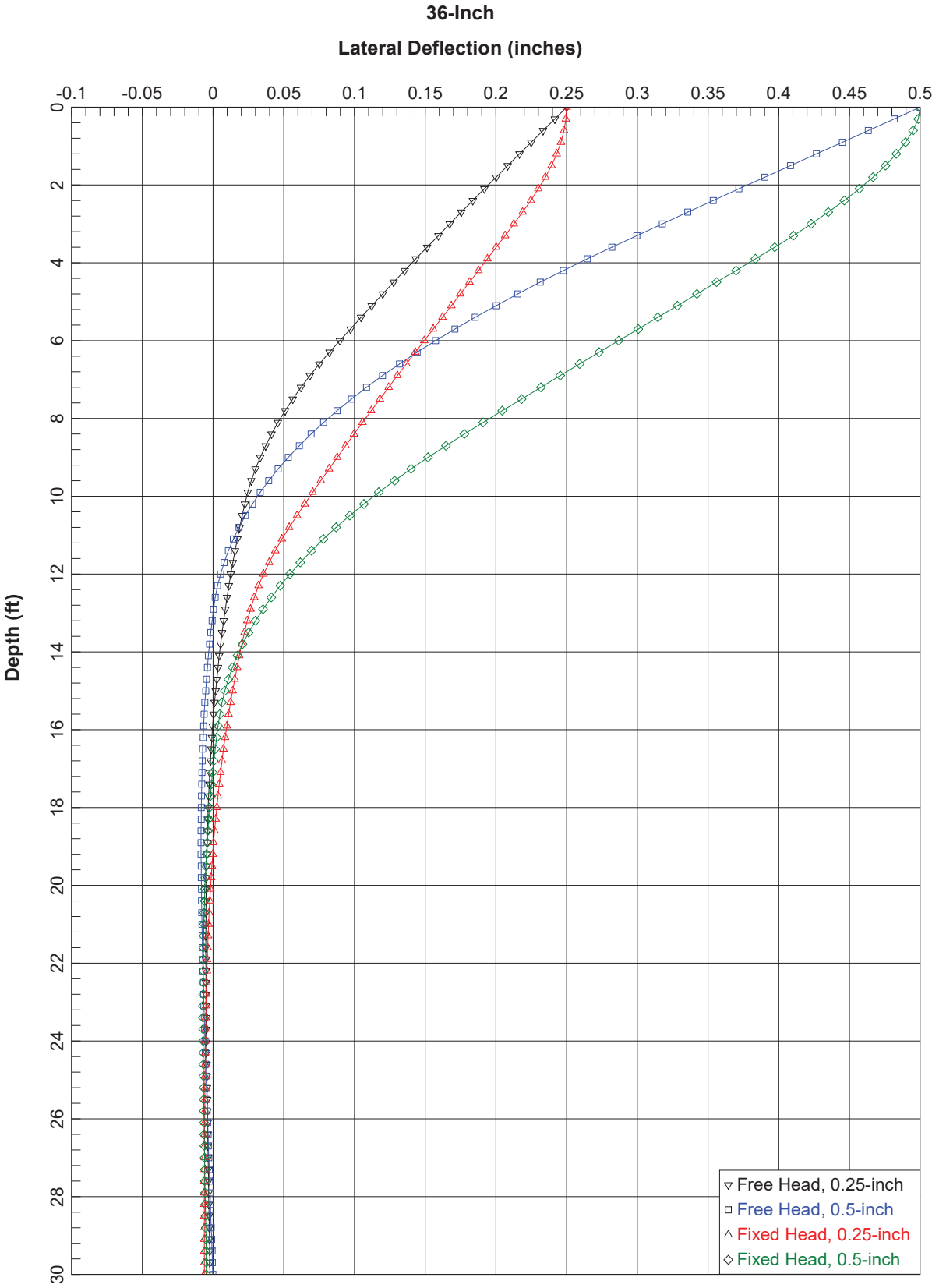


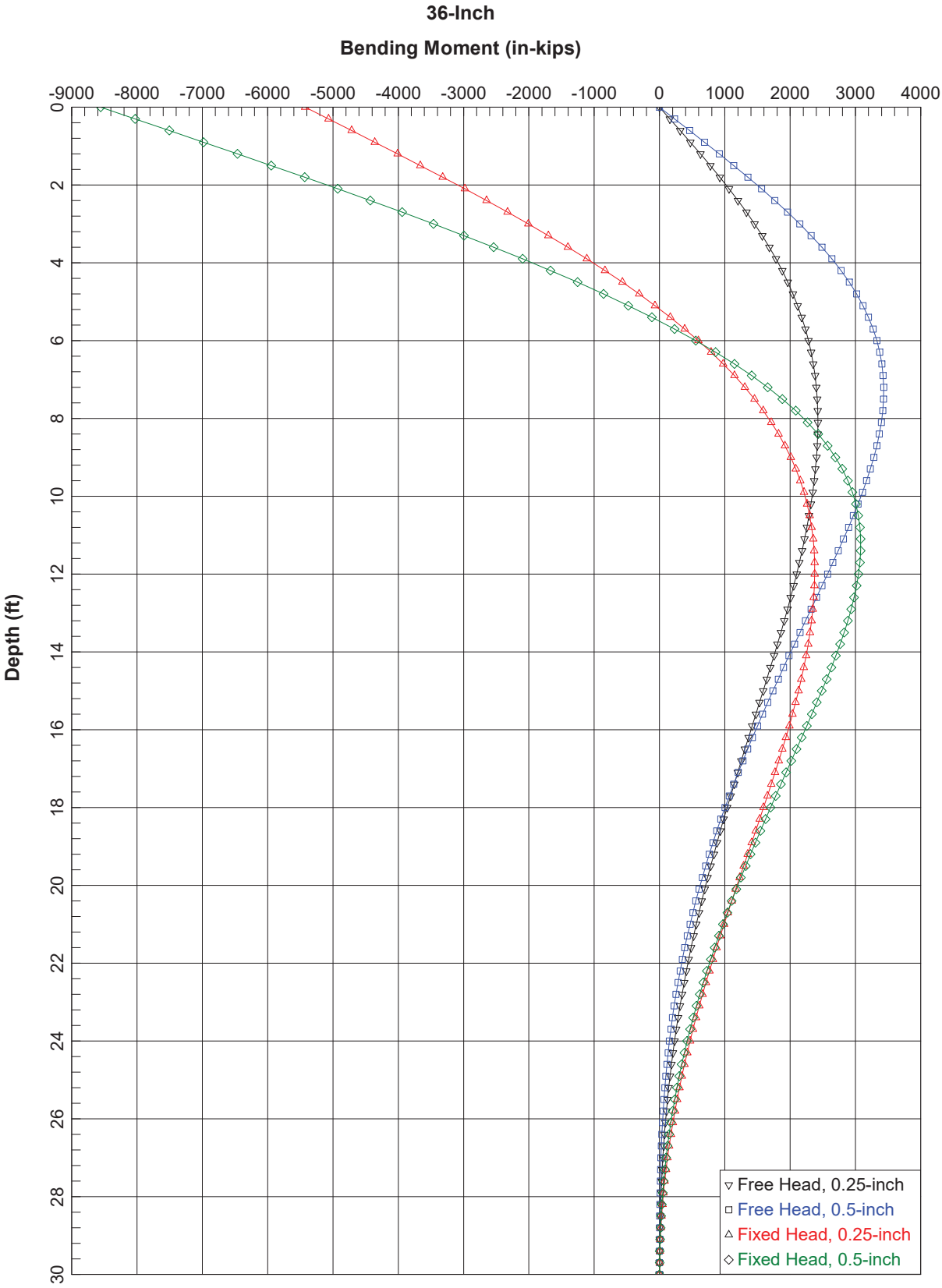


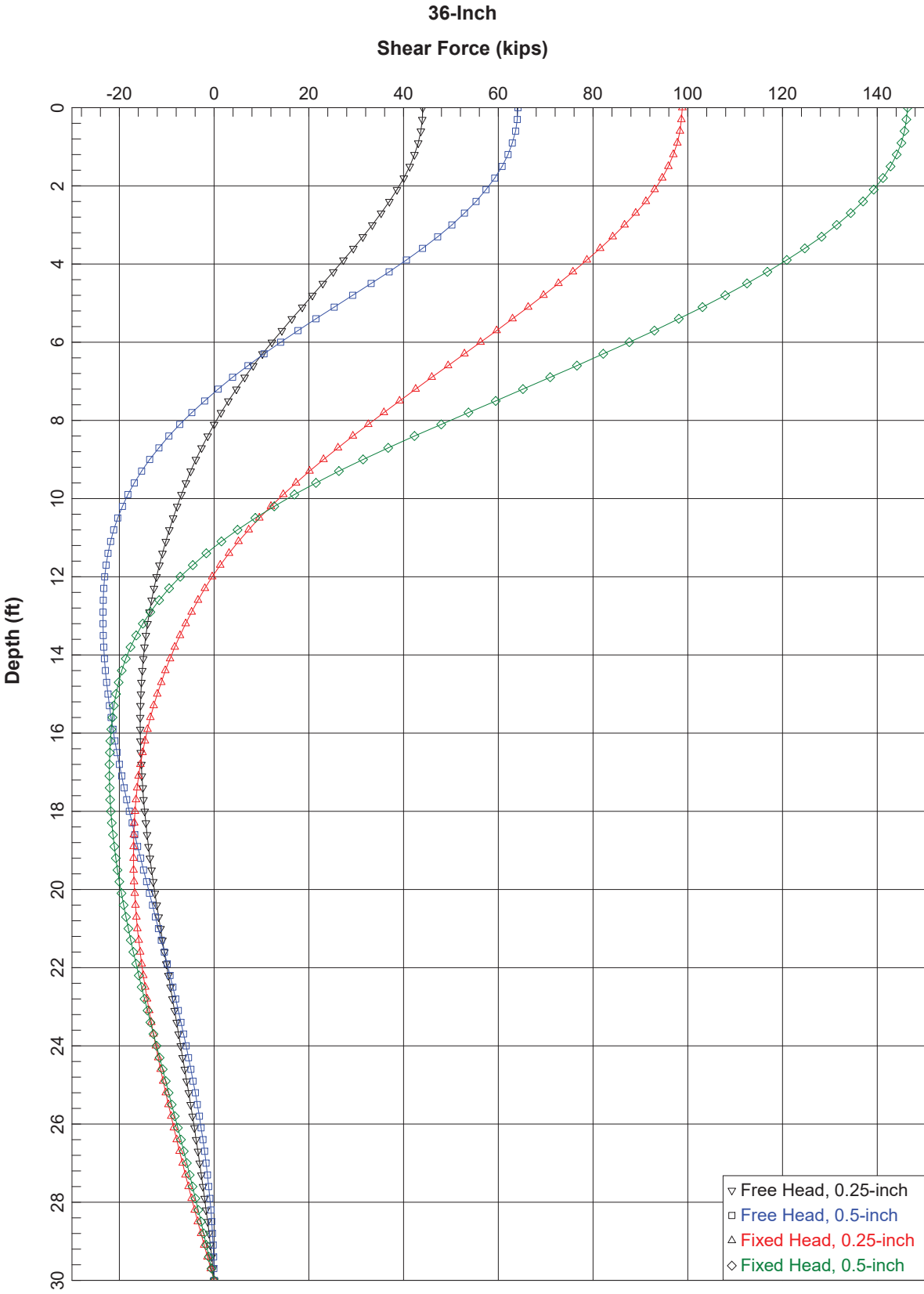














**GEOTECHNICAL ENGINEERING
CONSTRUCTION INSPECTION
MATERIALS TESTING
ENVIRONMENTAL**

OFFICE LOCATIONS

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Fax: 714.632.2974

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IMPERIAL COUNTY**

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Fax: 858.537.3990

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www.mtglinc.com

November 14, 2022

Karolina Guzman, Design Manager
San Gabriel Valley Water Company
11142 Garvey Avenue
El Monte, California 91733

MTGL Project No.: 2492A13

MTGL Log No.: 22-818

MTGL Branch: Anaheim

Subject: Geotechnical Addendum #3 – Infiltration Feasibility Study
San Gabriel Valley Water Company F20 Plant
Fontana, California

References:

- 1) MTGL, Inc. (2020). *Geotechnical Investigation, San Gabriel Valley Water Company F20 Plant, Job No. 647F*, MTLG Project No.2492A13, dated October 23.
- 2) MTGL, Inc. (2022). *Geotechnical Addendum #1, San Gabriel Valley Water Company F20 Plant, Job No. 647F*, MTLG Project No.2492A13, dated June 22.
- 3) MTGL, Inc. (2020). *Geotechnical Addendum #2, Supplemental Investigation, Deep Foundation Pile Design Development, San Gabriel Valley Water Company F20 Plant, Job No. 647F*, MTLG Project No.2492A13, dated September 27.

Dear Karolina,

In accordance with your request and our proposal P-22-011 dated January 3rd, 2022, MTGL is providing this geotechnical addendum letter to supplement the referenced geotechnical investigation report and previous addenda. Figure 1 presents an updated Subsurface Exploration Map.

SCOPE OF WORK

As part of our scope of work, we have reviewed the previous geotechnical investigation for the proposed reservoir (Reference 1) and the previous addenda (References 2 and 3). This information indicates that the proposed development area consists of a ridge at the northern slopes of the Jurupa Mountains with rock outcroppings observed throughout the surrounding vicinity. The proposed water tanks will be constructed at the top of the ridge at an approximate elevation of 1,219 feet above mean sea level. Slopes descend approximately 200 feet in elevation from the tank site to residential housing tracts located to the east and west.

The two previous geotechnical investigations consisted of drilling a total of eleven borings to a maximum depth of 31 feet below existing ground surface. No groundwater was encountered during the investigation. The subsurface soils consisted of coarse-grained silty sands to sands with gravel and boulders and refusal was encountered in each of our previous borings. Accordingly, our work was directed towards evaluating the soil percolation rates of the subsurface soils.

Our services consisted of field exploration, laboratory testing, a review of the compiled data and preparation of a written report containing recommendations in accordance to generally accepted engineering and geologic principles and practices.

FIELD INVESTIGATION

Prior to performing our field investigation, a site reconnaissance was performed by an MTGL engineer to observe the existing surface conditions, mark out proposed exploration locations, evaluate each location with respect to obvious subsurface structures and assess site access. Underground Service Alert (USA) was subsequently notified of the marked locations for utility clearance as required by law. In addition, a private utility locator was subcontracted to mark-out potential utility conflicts.

Our subsurface investigation was performed on October 12th, 2022, and consisted of excavating three (3) exploratory test pits within the project site. Figure 1 presents the exploration locations on a Subsurface Exploration Map.

Two (2) test pits (TP-1 and TP-2) were drilled to depths up to approximately 3½ feet (BGS) using hand tools and an excavator with a 12-inch bucket. TP-3 was excavated to a depth of up to approximately 1.7 feet. Refusal was encountered within each of the exploration locations. TP-1 and TP-2 were converted to borehole percolation tests to evaluate infiltration feasibility. It should be noted that TP-3 encountered refusal on hard granitic rock and a percolation test was not reasonably able to be set up and performed. An MTGL engineer logged the borings and collected samples of the encountered materials for geotechnical laboratory testing. Representative disturbed bulk soil samples were obtained from the test pits. Appendix A presents logs of test pits and provides further discussion of the field exploration methods and logs of subsurface explorations.

LABORATORY TESTING

Laboratory testing was performed on a select sample to verify the field classification of the recovered samples and evaluate the geotechnical properties of the subsurface materials. Laboratory tests were performed in general conformance with applicable ASTM or State of California Department of Transportation (Caltrans) standard methods. The results of laboratory testing are presented in Appendix B.

INFILTRATION FEASIBILITY

MTGL conducted an infiltration feasibility study at the site on October 12th, 2022. At the time of this report, the project is in the planning phase. Proposed locations of BMP facilities were provided on preliminary exhibits; however, the locations were on steep slopes generally inaccessible for preparing and conducting percolation tests and were moved to the closest feasible location to setup and perform a percolation test. Our fieldwork consisted of converting two shallow geotechnical test pits (TP-1 and TP-3) into shallow borehole percolation tests to assess stormwater infiltration feasibility. TP-2 was excavated to a depth of approximately 3.5 feet below ground surface and encountered shallow refusal on hard granitic rock, and a percolation test could not be reasonably set up or run on the exposed hard granitic rock surface. The tests were performed in general accordance with the County of Riverside BMP design manual (2011). Please note that a design factor of safety was not applied to these preliminary infiltration test results. The initial results of the testing are presented in Appendix C.

Table 1: Infiltration Rate Test Results

Test Location	Test Depth (Feet)	Material Type at Test Depth (USCS Classification)	Tested Infiltration Rate* (Inches/Hour)
TP-1	3.5	GRANITIC ROCK (qdi): SILTY SAND (SM)	0.16
TP-3	1.6	GRANITIC ROCK (qdi): SILTY SAND (SM)	0.10

*Tested infiltration rates (No factor of safety applied).

Based on our observations, the tested soils do not support infiltration in an appreciable quantity. Additionally, we do not recommend infiltrating hard granitic rock due to the impermeable nature of the materials or into the slope due to introducing moisture into the supporting materials and possibly creating a hydraulic gradient that facilitates soil piping. Since BMP facilities should be kept at least 10-feet from structural foundations and not allowed to infiltrate into the slope, we recommend stormwater be collected in a pipe and can be transported offsite to a suitable outlet. At a minimum, we recommend that BMP facilities be lined with an impermeable geomembrane on the bottom and sides to reduce the potential for water-related distress from lateral migration of infiltrated stormwater to adjacent structures or improvements, and a subdrain system should be installed in BMP facilities to transport collected water.

The testing performed for this report was limited in nature and was intended for preliminary design. Should infiltration BMPs be implemented within the design of the project, additional testing is recommended during construction, to determine final infiltration suitability and design parameters.

We appreciate this opportunity to be of continued service to you on this project. Should you have any questions regarding this geotechnical addendum, please do not hesitate to contact us at your convenience.

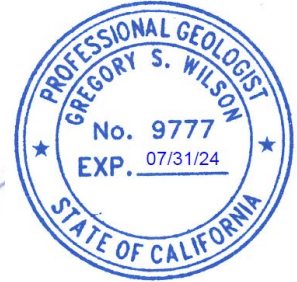
Respectfully Submitted,
MTGL, Inc.



Daniel Richardson, P.E.
Senior Engineer



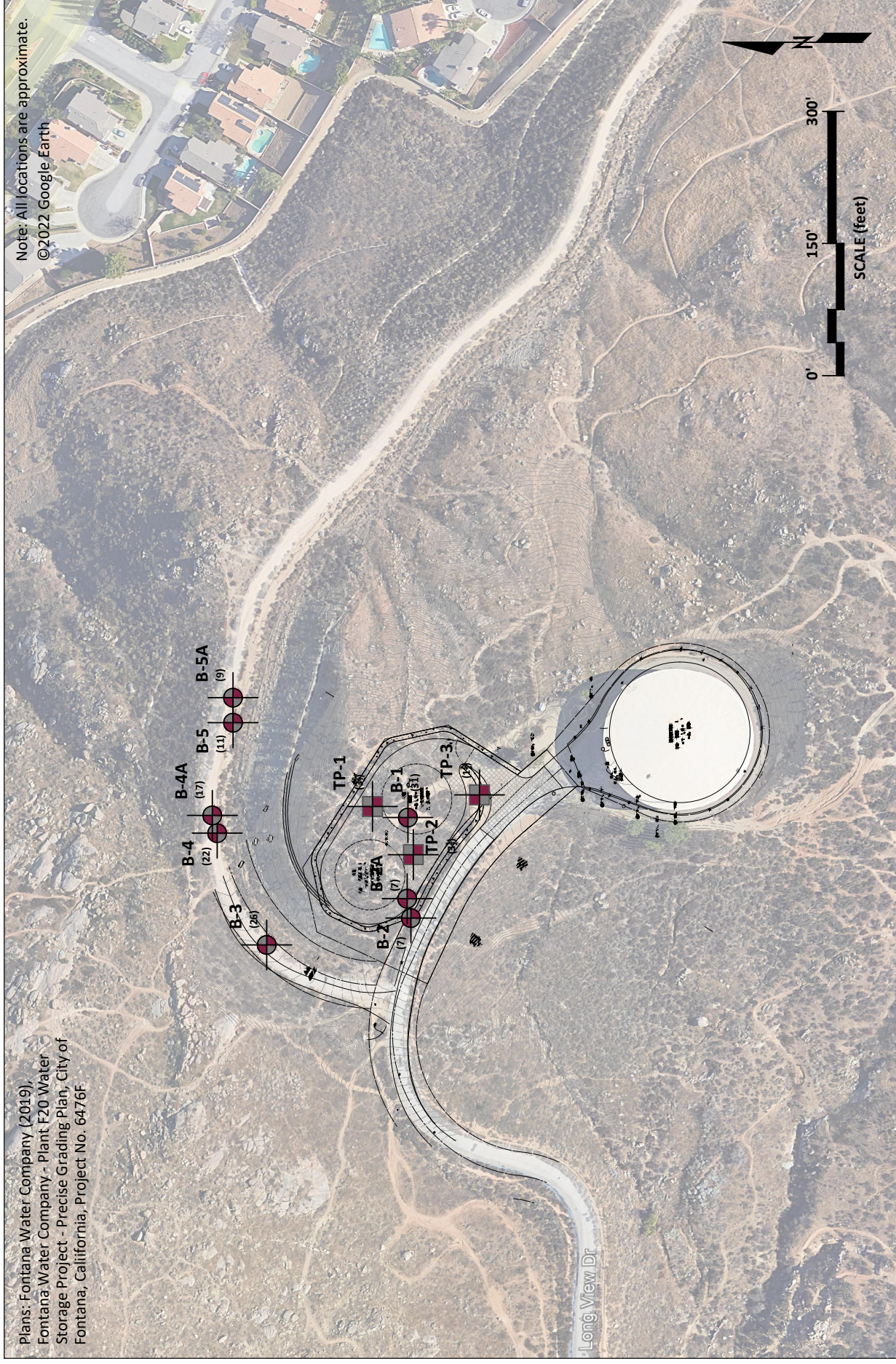
Greg Wilson, P.G.
Senior Geologist



Attachment: Figure 1 - Subsurface Exploration Map
 Appendix A - Subsurface Exploration Logs
 Appendix B - Laboratory Test Results
 Appendix C - Infiltration Test Results

Plans: Fontana Water Company (2019),
Fontana Water Company - Plant F20 Water
Storage Project - Precise Grading Plan, City of
Fontana, California, Project No. 6476F

Note: All locations are approximate.
©2022 Google Earth



LEGEND

- B-5 (11) - Location of Boring (Depth in Feet)
- TP-3 (34) - Location of Boring (Depth in Feet)

SUBSURFACE EXPLORATION MAP SGVWC PLANT F20 NEW TANK FONTANA, CALIFORNIA

MTGL Project No.:
2492A13

Date:
November, 2022

Author:
JCR

Figure No.

1

Geotechnical Engineering
Construction Inspection
Materials Testing
Environmental



APPENDIX A

FIELD EXPLORATION PROGRAM

The subsurface conditions for this geotechnical addendum were explored by excavating exploratory borings with an excavator equipped with a 12-inch diameter bucket and hand tools. The approximate locations of the borings are shown on the Subsurface Exploration Map (Figure 1). The field exploration was performed under the supervision of our engineer and geologist who maintained a continuous log of the subsurface soils encountered and obtained samples for laboratory testing.

Subsurface conditions are summarized on the accompanying Logs of Borings. The logs contain descriptive information and interpretation of subsurface conditions based on the obtained samples. The stratum indicated on these logs represents the approximate boundary between earth units, however, transitions may be gradual. The logs show subsurface conditions at the dates and locations indicated and may not be representative of subsurface conditions at other locations and times.

Identification of the soils encountered during the subsurface exploration was made using the field identification procedure of the Unified Soils Classification System (ASTM D2488). A legend indicating the symbols and definitions used in this classification system and a legend defining the terms used in describing the relative compaction, consistency or firmness of the soil are attached in this appendix. Bag samples of the major earth units were obtained for laboratory inspection and testing, and the in-place density of the various strata encountered in the exploration was determined.

The exploratory borings were backfilled in general accordance with DEH requirements and patched where appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM						
No. 200 U.S. Standard Sieve is the smallest particle visible	Coarse-grained soils >1/2 of materials is larger than #200 sieve	GRAVELS are more than half of coarse fraction larger than #4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	
			Gravels with fines	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	
		SANDS are more than half of coarse fraction larger than #4 sieve	Clean Sands (less than 5% fines)	GM	Silty Gravels, poorly graded gravel-sand-silt mixtures	
			Sands with fines	GC	Clayey Gravels, poorly graded gravel-sand-clay mixtures	
	Fine-grained Soils >1/2 of materials is smaller than #200 sieve	SILTS AND CLAYS Liquid Limit Less than 50			SW	Well-graded sands, gravelly sands, little or no fines
					SP	Poorly graded sands, gravelly sands, little or no fines
					SM	Silty Sands, poorly graded sands-gravel-clay mixtures
					SC	Clayey Sands, poorly graded sand-gravel-silt mixtures
					ML	Inorganic clays of low to med plasticity, gravelly, sandy, silty, or lean clays
		SILTS AND CLAYS Liquid Limit Greater than 50			CL	Inorganic clays of low to med plasticity, gravelly, sandy, silty, or lean clays
					OL	Organic silts and clays of low plasticity
					MH	Inorganic silts, micaceous or diatomaceous fine sands or silts
					CH	Inorganic clays of high plasticity, fat clays
					OH	Organic silts and clays of medium to high plasticity
	Highly Organic Soils			PT	Peat, humus swamp soils with high organic content	

GRAIN SIZE				SIZE PROPORTION
Description	Sieve Size	Grain Size	Approximate Size	
Boulders	>12"	>12"	Larger than basketball-sized	Trace – Less than 5%
Cobbles	3" - 12"	3" - 12"	Fist-sized to basketball-sized	Few – 5% to 10%
Gravel	Coarse	¾" - 3"	Thumb-sized	Little – 15% to 20%
	Fine	#4 - ¾"	Peat-sized to thumb-sized	Some – 30% to 45%
Sand	Coarse	#10 - #4	Rock salt-sized to pea-sized	Mostly – 50% to 100%
	Medium	#40 - #10	Sugar-sized to rock salt-sized	MOISTURE CONTENT
	Fine	#200 - #40	Flour-sized to sugar-sized	Dry – Absence of moisture
Fines	Passing #200	<0.0029"	Flour-sized or smaller	Moist – Damp but not visible
				Wet – Visible free water

CONSISTENCY FINE GRAINED SOILS			RELATIVE DENSITY COARSE GRAINED SOILS		
Apparent Density	SPT (Blows/Foot)	Mod CA Sampler (Blows/Foot)	Apparent Density	SPT (Blows/Foot)	Mod CA Sampler (Blows/Foot)
Very Soft	<2	<3	Very Loose	<4	<5
Soft	2-4	3-6	Loose	4-10	5-12
Firm	5-8	7-12	Medium Dense	11-30	13-35
Stiff	9-15	13-25	Dense	31-50	36-60
Very Stiff	16-30	26-50	Very Dense	>50	>60
Hard	>30	>50			

Figure A-1

Project: **SGVWC Plant F20**
 Project Location: **Fontana, California**
 Project Number: **2492A13**

Key to Log of Boring Sheet 1 of 1

Elevation (feet)	Depth (feet)	Sample Type	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7
COLUMN DESCRIPTIONS 1 Elevation (feet): Elevation (MSL, feet). 2 Depth (feet): Depth in feet below the ground surface. 3 Sample Type: Type of soil sample collected at the depth interval shown. 4 Material Type: Type of material encountered. 5 Graphic Log: Graphic depiction of the subsurface material encountered. 6 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text. 7 REMARKS AND OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field personnel. FIELD AND LABORATORY TEST ABBREVIATIONS CHEM: Chemical tests to assess corrosivity COMP: Compaction test CONS: One-dimensional consolidation test LL: Liquid Limit, percent PI: Plasticity Index, percent SA: Sieve analysis (percent passing No. 200 Sieve) UC: Unconfined compressive strength test, Qu, in ksf WA: Wash sieve (percent passing No. 200 Sieve) MATERIAL GRAPHIC SYMBOLS  AF  Granite  Silty SAND (SM) TYPICAL SAMPLER GRAPHIC SYMBOLS  Auger sampler  Bulk Sample  3-inch-OD California w/ brass rings  CME Sampler  Grab Sample  2.5-inch-OD Modified California w/ brass liners  Pitcher Sample  2-inch-OD unlined split spoon (SPT)  Shelby Tube (Thin-walled, fixed head) OTHER GRAPHIC SYMBOLS  Water level (at time of drilling, ATD)  Water level (after waiting)  Minor change in material properties within a stratum  Inferred/gradational contact between strata  Queried contact between strata GENERAL NOTES 1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests. 2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.						

Figure A-2

Project: **SGVWC Plant F20**
 Project Location: **Fontana, California**
 Project Number: **2492A13**

Log of Boring TP-1
Sheet 1 of 1

Date(s) Drilled 10/10/22	Logged By JCR	Checked By GSW
Drilling Method Trenching	Drill Bit Size/Type 12" Bucket	Total Depth of Borehole 3.5 Feet BGS
Drill Rig Type Miniature Backhoe	Drilling Contractor Baja Exploration	Approximate Surface Elevation 1217 Feet MSL
Groundwater Level and Date Measured Not Encountered	Sampling Method(s) Bulk	Hammer Data N/A
Borehole Backfill Soil Cuttings	Location 34.03897, -117.47278	

Elevation (feet)	Depth (feet)	Sample Type	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
1217	0		Fill		FILL (Qaf): SILTY SAND with trace gravel top soil, medium dense, grayish brown, moist, contained debris.	
1216	1				GRANITIC ROCK (qdi): Weathered GRANITIC ROCK that breaks down to SILTY fine to coarse SAND with GRAVEL, soft to moderately hard, reddish brown, moist, micaceous, decomposed.	
1215	2					
1214	3				Fresh, hard, grayish brown, breaks down to SILTY fine to coarse SAND.	
1213	4				Test pit terminated at 3.5 feet BGS due to refusal in fresh hard granitic rock. No groundwater encountered. Test pit converted to perc test hole on 10/10/22. Test pit backfilled on 10/10/22.	
1212	5					
1211	6					
1210	7					
1209	8					
1208	9					
1207	10					

Project: **SGVWC Plant F20**
 Project Location: **Fontana, California**
 Project Number: **2492A13**

Log of Boring TP-2
Sheet 1 of 1

Date(s) Drilled 10/10/22	Logged By JCR	Checked By GSW
Drilling Method Trenching	Drill Bit Size/Type 12" Bucket	Total Depth of Borehole 3.5 Feet BGS
Drill Rig Type Miniature Backhoe	Drilling Contractor Baja Exploration	Approximate Surface Elevation 1214 Feet MSL
Groundwater Level and Date Measured Not Encountered	Sampling Method(s) Bulk	Hammer Data N/A
Borehole Backfill Soil Cuttings	Location 34.03889, -117.47290	

Elevation (feet)	Depth (feet)	Sample Type	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
1214	0		Fill		FILL (Qaf): SILTY SAND with trace gravel top soil, medium dense, grayish brown, moist, contained debris.	
1213	1				GRANITIC ROCK (gdi): Weathered GRANITIC ROCK that breaks down to SILTY fine to coarse SAND with GRAVEL, soft to moderately hard, reddish brown, moist, micaceous, decomposed.	
1212	2					
1211	3					
1210	4				Fresh, hard, grayish brown, breaks down to SILTY fine to coarse SAND. Test pit terminated at 3.5 feet BGS due to refusal on fresh, hard, granitic rock. No groundwater encountered. Test pit could not be converted to perc test due to hard granitic rock at bottom of pit. Test pit backfilled on 10/10/22.	
1209	5					
1208	6					
1207	7					
1206	8					
1205	9					
1204	10					

Project: **SGVWC Plant F20**
 Project Location: **Fontana, California**
 Project Number: **2492A13**

Log of Boring TP-3
Sheet 1 of 1

Date(s) Drilled 10/10/22	Logged By JCR	Checked By GSW
Drilling Method Trenching	Drill Bit Size/Type 12" Bucket	Total Depth of Borehole 1.6 Feet BGS
Drill Rig Type Miniature Backhoe	Drilling Contractor Baja Exploration	Approximate Surface Elevation 1216 Feet MSL
Groundwater Level and Date Measured Not Encountered	Sampling Method(s) Bulk	Hammer Data N/A
Borehole Backfill Soil Cuttings	Location 34.03868, -117.47274	

Elevation (feet)	Depth (feet)	Sample Type	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
1216	0		Fill		FILL (Qaf): SANDY GRAVEL top soil, medium dense, grayish brown, moist, contained debris.	
		SM			COLLUVIUM: SILTY fine to coarse SAND with GRAVEL, medium dense, reddish brown, moist, rootlets, pinhole voids.	
1215	1				GRANITIC ROCK (qdi): Weathered GRANITIC ROCK that breaks down to SILTY fine to coarse SAND with GRAVEL, soft to moderately hard, reddish brown to grayish brown, moist, micaceous, decomposed.	
1214	2				Test pit terminated at 1.7 feet BGS due to refusal on fresh, hard granitic rock. No groundwater encountered. Test pit converted to perc test hole on 10/10/22. Test pit backfilled with soil cuttings on 10/10/22.	
1213	3					
1212	4					
1211	5					
1210	6					
1209	7					
1208	8					
1207	9					
1206	10					

APPENDIX B

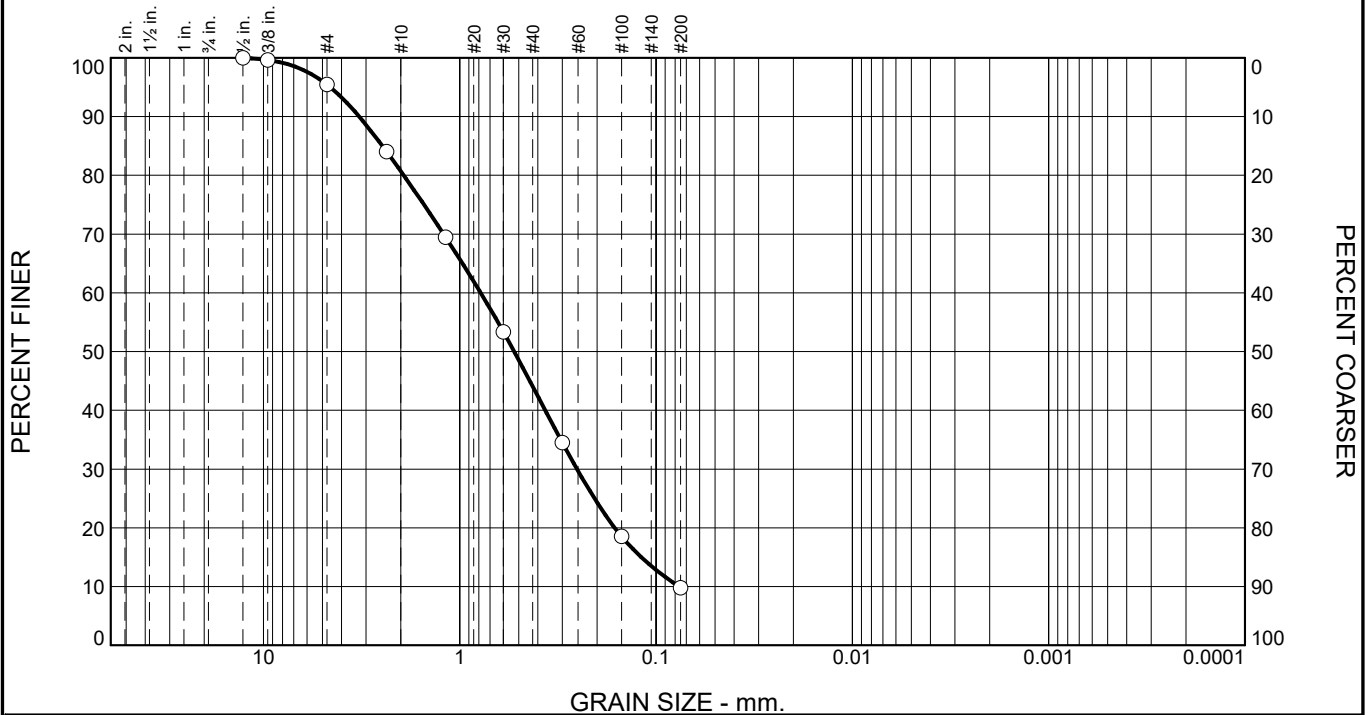
LABORATORY TEST PROCEDURES

APPENDIX B
LABORATORY TESTING PROCEDURES

1. Particle Size Analysis

Particle size analysis on representative soil samples were determined using the standard test method of the ASTM D6913.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.5	14.8	36.6	34.3	9.8	

Test Results (ASTM C 136 & ASTM C 117)

Opening Size	Percent Finer		
1/2"	100.0		
3/8"	99.6		
#4	95.5		
#8	84.0		
#16	69.4		
#30	53.4		
#50	34.5		
#100	18.5		
#200	9.8		

Group Symbol: **Group Name:**

BROWN SILTY SAND - SM

Remarks

SAMPLED BY JAY ROWERDINK
F.M.=2.45

Date Received: 10-21-2022 **Date Tested:** 10-24-2022

Tested By: RJS

Checked By: RJS

Title: PE,GE

Location & Depth: TP-1 at 1 to 3 Feet
Sample Number: 1228

Date Sampled: 10-12-2022



Client: SGVWC

Project: SGVWC Plant F20 Slope Stability and Percolation Study

Project No: 2492A13

APPENDIX C

INFILTRATION TEST RESULTS

Report of Borehole Percolation Testing

Storm Water Infiltration

Project Name: SGCWD Plant F20
 Job Number: 2492A13
 Date Drilled: 10/12/2022
 Drilling Method: Backhoe / 6-inch Hand Auger
 Drilled Depth (feet): 3.5
 Test Hole Diameter (inches): 6
 Gravel Pack: N
 Pipe Diameter (inches): 3
 USCS Soil Classification: **GRANITIC ROCK (qdi): Silty SAND**

Test Number: **TP-1**
 Tested By: JR
 Date Tested: 10/20/2022
 Presoak Time: 24 HR

Trial No.	Time	Time Interval, ΔT (min)	Initial Water Height, H _o (ft)	Final Water Height, H _f (ft)	Change in Water Height, ΔH (in)	Percolation Rate (min/in)
Sandy Soils Criteria Test : Does Not Pass						
1	10:33	0:25	3.00	2.84	1.92	13.0
	10:58					
2	10:58	0:25	3.00	2.80	2.40	10.4
	11:23					
1	11:23	0:30	3.00	2.84	1.92	15.6
	11:53					
2	11:53	0:30	3.00	2.84	1.92	15.6
	12:23					
3	12:23	0:30	3.00	2.84	1.92	15.6
	12:53					
4	12:53	0:30	3.00	2.80	2.40	12.5
	13:23					
5	13:23	0:30	3.00	2.84	1.92	15.6
	13:53					
6	13:53	0:30	3.00	2.84	1.92	15.6
	14:23					
Observed Percolation Rate:					15.6 min/in 3.8 in/hr	
*Tested Infiltration Rate, I _t :					0.16 in/hr	

*Tested infiltration rate using the Porchet Method:

$$I_t = \frac{\Delta H(60r)}{\Delta T(r + 2H_{avg})}$$

ΔH = Change in water head height over the time interval [in] = 1.9

r = Test hole radius [in] = 3

ΔT = Time interval [min] = 30

H_{avg} = Average water height over time interval = 12(H_o + H_f)/2 [in] = 35.0



SGVWC Plant 20 New Tank
Fontana, California

By: GSW Date: November, 2022
 Job No: 2492A13 Figure: C-1

Report of Borehole Percolation Testing

Storm Water Infiltration

Project Name: SGCWD Plant F20
 Job Number: 2492A13
 Date Drilled: 10/12/2022
 Drilling Method: Backhoe / 6-inch Hand Auger
 Drilled Depth (feet): 1.7
 Test Hole Diameter (inches): 6
 Gravel Pack: N
 Pipe Diameter (inches): 3
 USCS Soil Classification: **GRANITIC ROCK (qdi): Silty SAND**

Test Number: **TP-3**
 Tested By: JR
 Date Tested: 10/20/2022
 Presoak Time: 24 HR

Trial No.	Time	Time Interval, ΔT (min)	Initial Water Height, H _o (ft)	Final Water Height, H _f (ft)	Change in Water Height, ΔH (in)	Percolation Rate (min/in)
Sandy Soils Criteria Test : Does Not Pass						
1	9:20	0:25	4.84	4.59	3.00	8.3
	9:45					
2	9:45	0:25	4.84	4.51	3.96	6.3
	10:10					
1	10:18	0:30	4.84	4.67	2.04	14.7
	10:48					
2	10:48	0:30	4.84	4.63	2.52	11.9
	11:18					
3	11:18	0:30	4.84	4.67	2.04	14.7
	11:48					
4	11:48	0:30	4.84	4.67	2.04	14.7
	12:18					
5	12:18	0:30	4.84	4.63	2.52	11.9
	12:48					
6	12:48	0:30	4.84	4.67	2.04	14.7
	13:18					
Observed Percolation Rate:					14.7 min/in 4.1 in/hr	
*Tested Infiltration Rate, I _t :					0.10 in/hr	

*Tested infiltration rate using the Porchet Method:

$$I_t = \frac{\Delta H(60r)}{\Delta T(r + 2H_{avg})}$$

ΔH = Change in water head height over the time interval [in] = 2.0

r = Test hole radius [in] = 3

ΔT = Time interval [min] = 30

H_{avg} = Average water height over time interval = 12(H_o + H_f)/2 [in] = 57.1



SGVWC Plant 20 New Tank
Fontana, California

By: GSW Date: November, 2022
 Job No: 2492A13 Figure: C-2