ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
PHONE (719) 531-5599
FAX (719) 531-5238

SUBSURFACE SOIL INVESTIGATION
MCLAUGHLIN ROAD OFFICE BUILDING
AND DRIVE-THROUGH RESTAURANT
7615 MCLAUGHLIN ROAD
EL PASO COUNTY, COLORADO

Prepared for:

T-Bone Construction
1310 Ford Street
Colorado Springs, CO 80915

Attn: Darin Weiss

September 22, 2020

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Daniel P. Stegman

COLORADO LICENSED PROFESSIONAL ENGINEER
MARK HOWARD HAUSCHILD
35140
9-22-2020

Reviewed by:

M H Hauschild

Mark H. Hauschild. P.E.
Senior Engineer

DPS/kah

Entech Job No. 201725
AAProjects/2019/201725/201725ssi

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1.0 INTRODUCTION

The project is to consist of the construction of a new office building and a new drive-through restaurant, with associated site improvements. The site is located east of McLaughlin Road and south of Greenough Road, in Falcon, Colorado, in El Paso County. The location of the project site is shown on the Vicinity Map, Figure 1. The test boring locations are shown on Figure 2, the Test Boring Location Map.

This report describes the subsurface investigation conducted for the planned structures and provides recommendations for foundation design and construction. The Subsurface Soil Investigation included the drilling of four test borings: two in each of the building footprints, collecting samples of soil, and conducting a geotechnical evaluation of the investigation findings. Pavement recommendations for the parking and drive areas will be provided in a separate report. All drilling and subsurface investigation activities were performed by Entech Engineering, Inc. (Entech). The contents of this report, including the geotechnical evaluation and recommendations, are subject to the limitations and assumptions presented in Section 6.0.

2.0 PROJECT AND SITE DESCRIPTION

The project will consist of the construction of a new office building and a new drive-through restaurant, with associated site improvements. The buildings will be single story structures utilizing slab on grade floors with no below grade construction. At the time of drilling, the site was vacant. Vegetation consisted of field grasses and weeds with scattered trees around the perimeter of the site. Topography of the site is generally flat. Adjacent properties consist of existing commercial development to the south and southeast, vacant property immediately southwest, and residential development to the northwest and northeast.

3.0 SUBSURFACE EXPLORATIONS AND LABORATORY TESTING

Subsurface conditions of the site were explored by drilling four test borings: two within each building footprint at the approximate locations shown on Figure 2, the Test Boring Location Plan. The borings were drilled to depths of 20 feet below the existing ground surface (bgs). The borings were drilled using a truck-mounted, continuous flight auger-drilling rig supplied and operated by Entech. Boring logs descriptive of the subsurface conditions encountered during drilling are presented in Appendix A. At the conclusion of drilling, and subsequent to drilling, observations for groundwater levels were made in each of the open boreholes.

Soil and bedrock samples were obtained from the borings utilizing the Standard Penetration Test (ASTM D-1586) using a California sampler. Results of the Standard Penetration Test (SPT) are included on the boring logs in terms of N-values expressed in blows per foot (bpf). Soil and bedrock samples recovered from the borings were visually classified and recorded on the boring logs. The soil and bedrock classifications were later verified utilizing laboratory testing and grouped by soil and bedrock type. The soil and bedrock type numbers are included on the boring logs. It should be understood that the soil and bedrock descriptions shown on the boring logs may vary between boring location and sample depth. It should also be noted that the lines of stratigraphic separation shown on the boring logs represent approximate boundaries between soil types and the actual stratigraphic transitions may be more gradual and vary with location.

Moisture content testing (ASTM D-2216) was performed on the samples recovered from the borings, and the results are shown on the boring logs. Grain-Size Analysis Testing (ASTM D-422) and Atterberg Limits testing (ASTM D-4318) were performed on selected samples to assist in classifying the materials encountered in the borings. Volume change testing was performed on selected samples using the Swell/Consolidation Test (ASTM D-4546) and the FHA Swell Test to determine the expansive characteristics of the soil. Soluble sulfate testing was also performed on selected samples to evaluate the potential for below grade degradation of concrete due to sulfate attack. The Laboratory Testing Results are summarized on Table 1 and are presented in Appendix B.

4.0 SUBSURFACE CONDITIONS

Two soil types and two bedrock types were encountered in the test borings drilled for the subsurface investigation: Type 1: silty to clayey and very clayey sand fill (SM, SC), Type 2: native silty sand (SM), Type 3: weathered to formational silty to clayey sandstone (SM, SC), and Type 4: sandy claystone (CL). Each soil and bedrock type was classified in accordance with the Unified Soil Classification System (USCS) using the laboratory testing results and the observations made during drilling.

4.1 Soil and Bedrock

Soil Type 1 classified as a silty to clayey and very clayey sand fill (SM, SC). The sand fill was encountered in three of the test borings at the existing ground surface and extending to depths of 7 to 8 feet below the ground surface (bgs). Standard Penetration Testing on the fill resulted in N-values of 12 to 41 blows per foot (bpf), indicating medium dense to dense states. Water content and grain site testing resulted in water contents of 4 to 11 percent, with approximately 27 to 43 percent of the soil size particles passing the No. 200 sieve. FHA Swell Testing resulted in an expansion pressure of 910 psf, indicating a low to moderate expansion potential. Sulfate testing resulted in less than 0.01 percent soluble Sulfate by weight, indicating a negligible potential for below grade concrete degradation due to sulfate attack.

Soil Type 2 classified as native silty sand (SM). The native sand was encountered in Test Boring No. 4 the existing ground surface and extending to a depth of 4 feet below the ground surface (bgs). Standard Penetration Testing on the native sand resulted in a N-value of greater than 50 bpf, indicating very dense states. Water content and grain size testing resulted in a water content of 5 percent, with approximately 25 percent of the soil size particles passing the No. 200 sieve. Atterberg limit testing indicated the native sand is non-plastic.

Soil Type 3 classified as weathered to formational silty to clayey sandstone (SM, SC). The sandstone was encountered in all of the test borings at depths ranging from 4 to 8 feet bgs and extending to the termination of the test borings (20 feet). Standard Penetration Testing on the sandstone resulted in N-values of 41 to greater than 50 bpf, indicating dense to very dense states. Water content and grain size testing resulted in a water content range of 5 to 16 percent, with approximately 18 to 19 percent of the soil size particles passing the No. 200 sieve. Atterberg limit testing indicated the silty sandstone is non-plastic. Sulfate testing resulted in less than 0.01 percent soluble sulfate by weight, indicating a negligible potential for below grade concrete degradation due to sulfate attack.

Soil Type 4 classified as sandy claystone (CL). The claystone was encountered in Test Boring Nos. 2 and 3 at depths of 13 and 14 feet bgs and extending to 16 feet and to the termination of Test Boring No. 3 (20 feet). Standard Penetration Testing on the claystone resulted in N-values greater than 50 bpf, indicating hard consistencies. Water content and grain size testing resulted in water contents of 14 to 17 percent, with approximately 73 to 88 percent of the soil size particles passing to No. 200 sieve. Atterberg limits testing resulted in a liquid limit of 44 and a plastic index of 21. Swell/Consolidation Testing resulted in volume changes of 1.7 and 2.3 percent. These results indicated the claystone exhibits moderate expansion potential; however, claystone in the area is known to be highly expansive.

4.2 Groundwater

Depth to groundwater was measured in each of the borings at the conclusion of drilling and subsequent to drilling. Groundwater was encountered in all of the test borings at depths ranging from 14 to 16.5 feet, subsequent to drilling.

It is anticipated groundwater should not affect the construction of shallow foundations proposed for this site. Groundwater may affect deeper excavations for utilities. Unstable conditions should be expected where excavations approach the groundwater level. Stabilization using shot rock or geo grids may be necessary. It should be noted that groundwater levels could change due to seasonal variations, changes in land runoff characteristics and future development of nearby areas.

5.0 GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

The following discussion is based on the subsurface conditions encountered in the borings drilled in the building footprints. If subsurface conditions different from those described herein are encountered during construction or if the project elements change from those described, Entech Engineering, Inc. should be notified so that the evaluation and recommendations presented can be reviewed and revised if necessary.

Subsurface soil conditions encountered in the test borings drilled for the planned structures generally consisted of silty to clayey and very clayey sand fill and native silty sand overlying weathered to formational clayey to silty sandstone and sandy claystone. Very clayey soil layers were encountered in Test Boring No. 1 at two feet. Up to eight feet of fill was encountered in three of the test borings. Records should be obtained to determine if the fill was placed in a controlled manner. Any uncontrolled fill encountered beneath foundations will require complete removal and recompaction according to the "Structural Fill" paragraph. Bedrock was encountered at depths ranging between 4 to 8 feet in all of the test borings. N-values measured in the native sand and sand fill indicated overall medium dense to very dense states. The medium dense to very dense native sand, approved controlled sand fill, and undisturbed sandstone are considered to exhibit an adequate in-place density for support of the planned buildings using shallow foundations (i.e. spread footings). Loose soils, if encountered, will require recompaction. Uncontrolled fill will require complete removal and recompaction. Expansive soils encountered beneath foundations will require removal and replacement with compacted non-expansive structural fill. It is anticipated groundwater will not affect shallow foundations. Groundwater may affect deeper excavations for utilities.

Expansive soil and claystone encountered at or near foundation grade will require mitigation. To mitigate expansive conditions where encountered, the foundation excavations should be overexcavated 3 to 4 feet below and 3 to 4 feet horizontally beyond the foundation and slab components. The excavation can be back-filled with on-site sands or imported granular structural fill compacted according to the "Structural Fill" paragraph.

Given the subsurface conditions encountered at the time of drilling and the site development as described, shallow footing foundation systems resting on approved well-compacted sand fill, native site sands, recompacted sands, undisturbed non-expansive sandstone or structural fill, where overexcavation is required, are recommended for this site. The granular site soils may be used as a structural fill, as approved by Entech Engineering, Inc. Design considerations are discussed in the following sections.

Excavation of the upper granular soils should be moderately easy with rubber-tired equipment. Sandstone and claystone, where encountered, may be moderate to difficult to excavate and may require track-mounted equipment. Granular nonexpansive site soils and sandstone fragments less than 3-inches diameter may be suitable for use as structural fill, pending approval by Entech Engineering, Inc.

5.1 Footing Subgrade Improvement and Bearing Capacity

Based on the conditions encountered in the test borings and the associated laboratory testing results, it is expected that the structures can be satisfactorily supported by shallow foundations resting on the approved granular controlled fill, native sand, recompacted sand, undisturbed sandstone, or structural fill. Removal and recompaction of loose sand soils, if encountered, may be required. Overexcavation and replacement of expansive soils and claystone, if encountered, may also be required. Mitigation to provide for similar bearing compacities may be required in some areas. The need for soil mitigation, if any, will be determined at the time of the open excavation observations for each building. Sections 5.2 through 5.13 provide foundation design and construction recommendations relative to the subsurface soil conditions encountered on this site.

To reduce the potential for slab and foundation movement, expansive clays or claystone should be overexcavated and replaced with granular structural fill. Structural fill should be a non-expansive granular fill approved by Entech. An overexcavation depth of 3 to 4 feet is anticipated for expansive materials. The depth of overexcavation, if needed, should be determined at the time of the excavation observation on each structure. Prior to placing fill, the overexcavation subgrade should be scarified to a depth of 12 inches, moisture-conditioned, and compacted to a minimum of 95 percent of its maximum Standard Proctor Dry Density (ASTM D-698) at a moisture content of 0 to + 3 percent above optimum moisture for cohesive soils and a minimum of 95 percent of its maximum Modified Proctor Dry Density (ASTM D-1557) at a moisture content of ±2 percent of optimum moisture for cohesionless soils.

Granular structural fill should be compacted to a minimum of 95 percent of its maximum Modified Proctor Dry Density (ASTM D-1557). The structural fill should be moisture-conditioned to within ±2 percent of its optimum moisture content to aid in compaction. Existing subgrade and overexcavated areas should be observed by a representative of Entech Engineering, Inc. prior to fill placement. The structural fill should be approved by Entech prior to hauling it to the site. The fill should be placed in maximum of 6-inch finished lifts. Density tests should be performed to verify compaction with the first density test performed at the compacted overexcavation subgrade and when each 12 to 18 inches of fill has been placed.

The foundations should be supported by soils with a similar bearing capacity (i.e., entirely on sand or entirely on suitable sandstone bedrock). If the majority of the foundation is supported by sandstone and a relatively small portion supported by sand, the sand may be overexcavated down to sandstone and replaced with structural fill compacted to a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557. If the majority of the foundation is supported by sand, the sandstone should be overexcavated a minimum of 2 feet and replaced with sand recompacted to a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557.

Groundwater was encountered at 14 to 16.5 feet in all of the test borings. Fluctuations in groundwater levels can change due to seasonal variations and changes in land runoff characteristics. Groundwater, may be encountered in deeper excavations for utilities. Groundwater will likely create unstable subgrade conditions, if approached or encountered. Stabilization with shot rock and/or geogrid in conjunction with underslab or interceptor drain systems may be required. It is anticipated groundwater is at sufficient depth on the majority of the site as to not affect construction of shallow foundations; however, depending on precipitation and the seasonal events when the site is developed perched groundwater conditions may exist that could affect development on this site.

5.2 Shallow Foundations

Provided the above recommendations are followed, the proposed structures can be supported with shallow spread footing foundations. A maximum allowable bearing pressure of 2200 pounds per square foot (psf) is recommended for the approved granular well-compacted fill and native sands. A maximum allowable bearing pressure of 2400 psf is anticipated for foundation members bearing on structural fill and recompacted site soils. For final design, continuous spread footings are recommended to have a minimum width of 16 inches, and individual column footings for main support beams should have minimum plan dimensions of 24 inches on each side in order to avoid punching failure into the supporting subgrade soils. Exterior footings should extend a minimum of 30 inches below the adjacent exterior site grade for frost protection.

Foundation walls should be designed to resist lateral pressures generated by the soils on this site. An equivalent hydrostatic fluid pressure (in the active state) of 40 pcf is recommended for the on-site granular soils and 45 pcf is recommended for very clayey sand, if encountered. Highly expansive soils are not recommended for backfill against the walls. It should be noted that these values apply to level backfill conditions. If sloping backfill conditions exist, pressures will increase substantially depending on the conditions adjacent to the walls. Surcharge loading should also be considered in wall designs. Equivalent fluid pressures for sloping conditions should be determined on an individual basis.

Entech should observe any overexcavated subgrades as well as the overall foundation excavation subgrade and evaluate if the exposed soil conditions are consistent with those described in this report. Entech should also provide recommendations for additional overexcavation depth, if required, and foundation drainage based on the excavation conditions observed at that time.

5.3 Site Seismic Classification

Based on the subsurface conditions encountered at the site and in accordance with section 1613 of the 2015 International Building Code (IBC), the site meets the conditions of a Site Class C.

5.4 On-Grade Floor Slabs

The floor slabs may be supported by the silty sand, recompacted granular soil, or non-expansive imported structural fill. The expansive clays are not recommended for slab support. If expansive soil is encountered at or near floor slab grade, it should be removed a minimum of 3 to 4 feet and replaced with a non-expansive on-site or imported structural fill. Uncontrolled fill should be completely penetrated and replaced with structural fill. The depth of overexcavation, if needed, should be determined at the time of the excavation observation. On-site granular soils, as approved by Entech, may be used as structural fill. Loose soils, if encountered, should be recompacted or removed and replaced with structural fill. Structural fill should be compacted to a minimum of 95 percent of its Maximum Modified Proctor Dry Density Test (ASTM D-1557). The fill should be moisture conditioned to ±2 percent of the optimum moisture content as determined to aid in compaction. All soil beneath the slab should be free of organics, debris and stone sized larger than 3 inches in diameter.

Grade supported floor slabs should be separated from other building structural components and utility penetrations to allow for possible future vertical movement unless they are designed as part of the foundation system. Control joints in grade-supported slabs are recommended and should be placed according to ACI Guidelines. If slab movement cannot be tolerated a structural floor system should be used.

5.5 Surface and Subsurface Drainage

Positive surface drainage is recommended around the building perimeter to minimize infiltration of surface water into the supporting foundation soils. A minimum ground surface slope of 5 percent in the first 10 feet adjacent to exterior foundation walls is recommended for unpaved areas. For paved areas and other impervious surfaces, a minimum slope of 2 percent is adequate. All roof drains and gutter downspouts should be extended to discharge well beyond the building's foundation backfill zone or be connected to a storm sewer system.

To help minimize infiltration of water into the foundation zone, vegetative plantings placed close to foundation walls should be limited to those species having low watering requirements and irrigated grass should not be located within 5 feet of the foundation. Similarly, sprinklers are not recommended to discharge water within 5 feet of foundations. Irrigation near foundations should be limited to the minimum amount sufficient to maintain vegetation. Application of more irrigation water than necessary can increase the potential for slab and foundation movement.

If the slab elevation is above exterior grade, foundation backfill is properly compacted, and positive drainage is maintained, an exterior perimeter drain will likely not be required. Perimeter drains are recommended for usable space below grade. A subsurface perimeter drain may also be recommended around the entire structure if an overexcavation is required. A typical perimeter drain detail is shown in Figure 3. The need for a perimeter drain will be determined at the time of the excavation observation.

5.6 Concrete Degradation Due to Sulfate Attack

Sulfate solubility testing was conducted on select samples recovered from the test borings to evaluate the potential for sulfate attack on concrete placed below surface grade. Test results indicated soluble sulfate (by weight) of less than 0.01 percent (Table 1). The test results indicate the sulfate component of the in-place soils presents a negligible exposure threat to concrete placed below the site grade.

Type II cement is recommended on this site. To further avoid concrete degradation during construction it is recommended that concrete not be placed on frozen or wet ground. Care should be taken to prevent the accumulation or ponding of water in the foundation excavation prior to the placement of concrete. If standing water is present in the foundation excavation, it should be removed by ditching to sumps and pumping the water away from the foundation area prior to concrete placement. If concrete is placed during periods of cold temperatures, the concrete must be kept from freezing. This may require covering the concrete with insulated blankets and adding heat to prohibit freezing.

5.7 Foundation Excavation Observation

Subgrade preparation for building foundations should be observed by Entech prior to construction of the footings and floor slabs in order to verify that (1) no anomalies are present, (2) materials of the proper bearing capacity have been encountered or placed, and (3) no soft spots, expansive or organic soil, soil or debris are present in the foundation area prior to concrete placement or backfilling. Entech should make final recommendations for over-excavation, if required, and foundation drainage at the time of excavation observation, if necessary.

5.8 Structural Fill

Compacted, non-expansive granular soil, free of organics, debris and cobbles greater than 3-inches in diameter, is recommended for structural fill beneath foundation components and floor slabs. All fill placed within the foundation area should be approved by Entech, and be compacted to a minimum of 95 percent of the soils maximum dry density as determined by the Modified Proctor Test (ASTM D-1557). Fill material should be placed in horizontal lifts such that each finished lift has a compacted thickness of six inches or less. Fill should be placed at water contents conducive to achieving adequate compaction, usually within ±2 percent of the optimum water content as determined by ASTM D-1557. The overexcavation subgrade should be scarified a minimum of 12 inches, moisture conditioned to 0 to +3 percent of optimum moisture and be compacted to a minimum of 95 percent of its Standard Proctor Dry Density, ASTM D-698 for clay and 95 percent compaction at ±2 percent optimum moisture content, utilizing a Modified Proctor dry density ASTM D-1557 for sand.

Mechanical methods can be used for placement and compaction of fill; however, heavy equipment should be kept at distance from foundation walls and below slab infrastructure to avoid overstressing. No water flooding techniques of any type should be used for compaction or placement of foundation or floor slab fill material. Entech should approve any imported fill to be used within the foundation area prior to delivery to the site.

5.9 Utility Trench Backfill

Fill placed in utility trenches should be compacted according to local specifications. Fill should be placed in horizontal lifts having a compacted thickness of six inches or less and at a water content conducive to adequate compaction, within ±2 percent of optimum water content. Mechanical methods should be used for fill placement; however, heavy equipment should be kept at a distance from foundation walls. No water flooding techniques of any type should be used for compaction or placement of utility trench fill. Trench backfill placement should be performed in accordance with El Paso County specifications. All excavation and excavation shoring/bracing should be performed in accordance with OSHA guidelines. Groundwater should be anticipated in the excavations.

5.10 General Backfill

Any areas to receive fill outside the foundation limits should have all topsoil, organic material, and debris removed. Fill must be properly benched into existing slopes in order to be adequately compacted. The fill receiving surface should be scarified to a depth of 12-inches and moisture conditioned to ±2 percent of the optimum water content, and compacted to a minimum of 95 percent of the ASTM D-1557 maximum dry density before the addition of new fill. Fill should be placed in thin lifts not to exceed 6 inches in thickness after compaction while maintaining at least 95 percent of the ASTM D-1557 maximum dry density. Fill material should be free of vegetation and other unsuitable material and shall not contain rocks or fragments greater than 3-inches. Topsoil and strippings should be segregated from all other fill sources on the site. Fill placement and compaction beneath and around foundations, in utility trenches, beneath roadways or other structural features of the project should be observed and tested by Entech during construction.

5.11 Excavation Stability

Excavation sidewalls must be properly sloped, benched and/or otherwise supported in order to maintain stable conditions. All excavation openings and work completed therein shall conform to OSHA Standards as put forward in CFR 29, Part 1926.650-652, (Subpart P).

5.12 Winter Construction

In the event construction of the planned facility occurs during winter, foundations and subgrades should be protected from freezing conditions. Concrete should not be placed on frozen soil and once concrete has been placed, it should not be allowed to freeze. Similarly, once exposed, the foundation subgrade should not be allowed to freeze. During site grading and subgrade preparation, care should be taken to eliminate burial of snow, ice or frozen material within the planned construction area.

5.13 Construction Observations

It is recommended that Entech observe and document the following activities during construction of the building foundations.

- Excavated subgrades and subgrade preparation.
- Placement of foundation perimeter drains (if installed).
- Placement/compaction of fill material for the foundation components and floor slab.
- Placement/compaction of utility bedding and trench backfill.

6.0 CLOSURE

The subsurface investigation, geotechnical evaluation and recommendations presented in this report are intended for use by T-Bone Construction with application to the office building and drive-through restaurant located at 7615 McLaughlin Road, in El Paso County, Colorado. In conducting the subsurface investigation, laboratory testing, engineering evaluation and reporting, Entech Engineering, Inc. endeavored to work in accordance with generally accepted professional geotechnical and geologic practices and principles consistent with the level of care and skill ordinarily exercised by members of the geotechnical profession currently practicing in same locality and under similar conditions. No other warranty expressed or implied is made. During final design and/or construction, if conditions are encountered which appear different from those described in this report, Entech Engineering, Inc. requests that it be notified so that the evaluation and recommendations presented herein can be reviewed and modified as appropriate.

If there are any questions regarding the information provided herein or if Entech Engineering, Inc. can be of further assistance, please do not hesitate to contact us.

TABLE

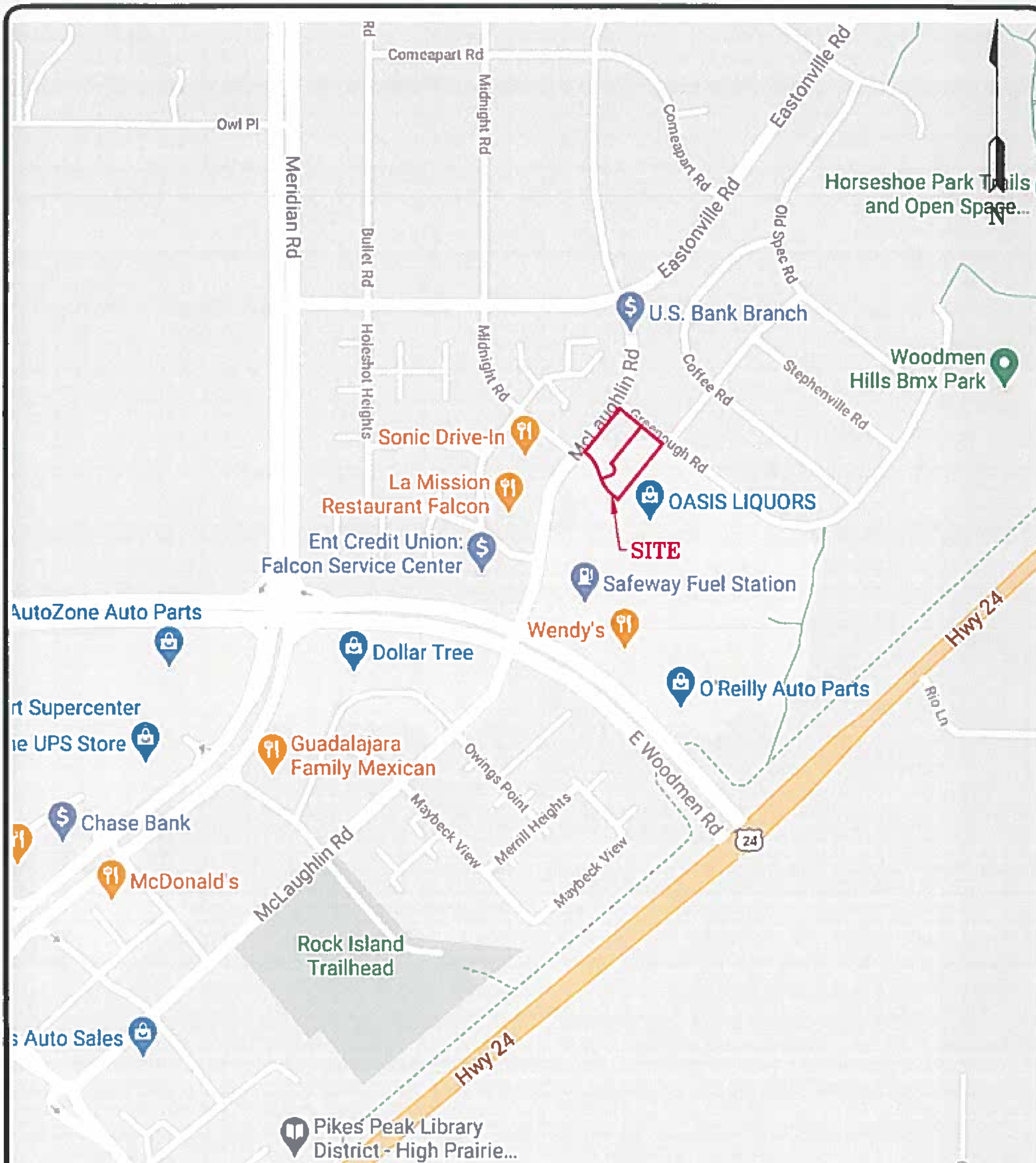
TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT T-BONE CONSTRUCTION
PROJECT 7615 McLAUGHLIN
JOB NO. 201725

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	1	2-3			42.7			<0.01	910		SC	FILL, SAND, VERY CLAYEY
1	2	5			26.9						SC	FILL, SAND, CLAYEY
2	4	2-3			25.4	NV	NP				SM	SAND, SILTY
3	1	15			17.7	NV	NP	<0.01			SM	SANDSTONE, SILTY
3	4	10			18.5						SM	SANDSTONE, SILTY
4	2	15	18.4	112.9	87.5	44	21	<0.01		2.3	CL	CLAYSTONE, SANDY
4	3	15	14.5	116.8	73.1					1.7	CL	CLAYSTONE, SANDY

FIGURES



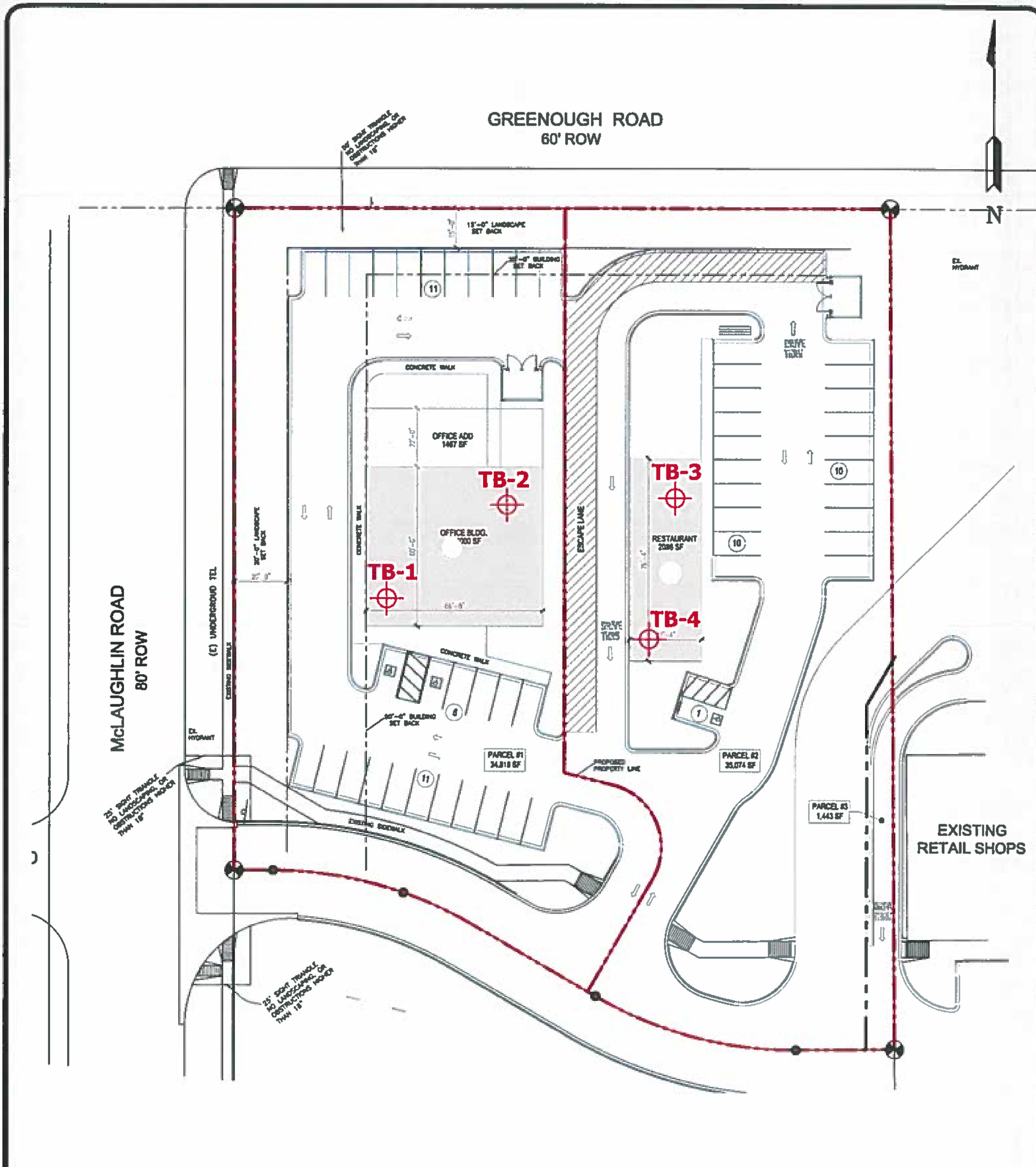
ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

VICINITY MAP
7615 MCLAUGHLIN ROAD
EL PASO COUNTY, CO
FOR: T-BONE CONSTRUCTION

DRAWN:	DATE:	CHECKED:	DATE:
JAC	09/16/20	KAH	

JOB NO.: 201725

FIG NO.: 1



TB- APPROXIMATE TEST BORING LOCATIONS AND NUMBERS

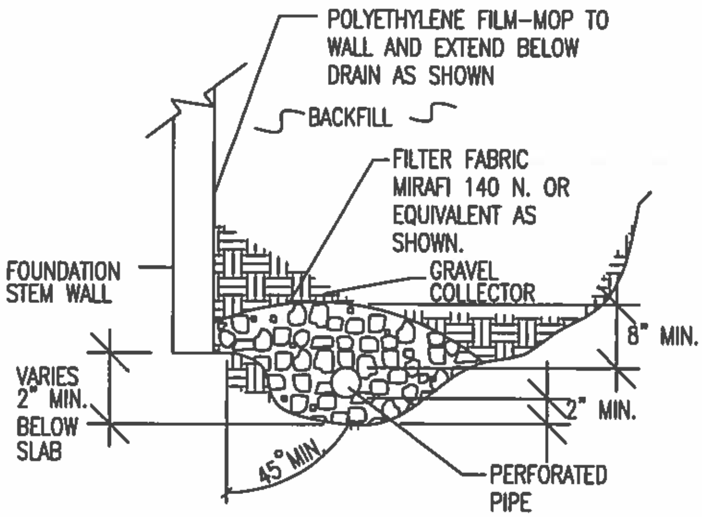
ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

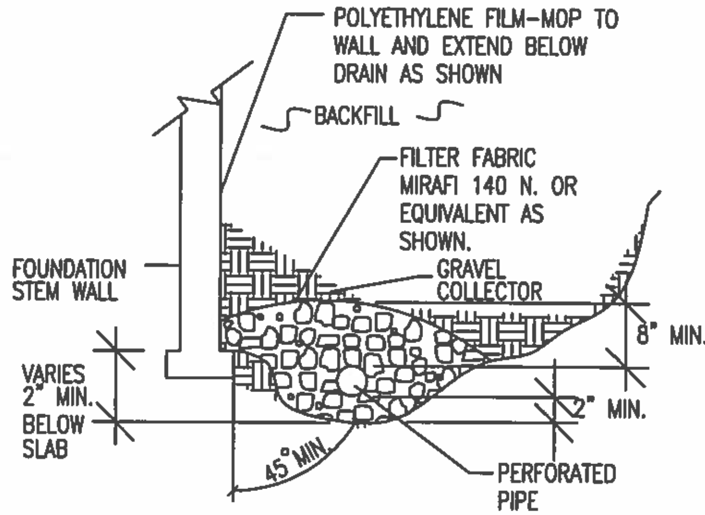
TEST BORING LOCATION MAP
7615 MCLAUGHLIN ROAD
EL PASO COUNTY, CO
FOR: T-BONE CONSTRUCTION

DRAWN:	DATE:	CHECKED:	DATE:
JAC	09/16/20	KAH	

JOB NO.: 201725

FIG NO.: 2





NOTES:

-GRAVEL SIZE IS RELATED TO DIAMETER OF PIPE PERFORATIONS-85% GRAVEL GREATER THAN 2x PERFORATION DIAMETER.

-PIPE DIAMETER DEPENDS UPON EXPECTED SEEPAGE. 4-INCH DIAMETER IS MOST OFTEN USED.

-ALL PIPE SHALL BE PERFORATED PLASTIC. THE DISCHARGE PORTION OF THE PIPE SHOULD BE NON-PERFORATED PIPE.

-FLEXIBLE PIPE MAY BE USED UP TO 8 FEET IN DEPTH, IF SUCH PIPE IS DESIGNED TO WITHSTAND THE PRESSURES. RIGID PLASTIC PIPE WOULD OTHERWISE BE REQUIRED.

-MINIMUM GRADE FOR DRAIN PIPE TO BE 1% OR 3 INCHES OF FALL IN 25 FEET.

-DRAIN TO BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. A SUMP AND PUMP MAY BE USED IF GRAVITY OUT FALL IS NOT AVAILABLE.

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

PERIMETER DRAIN DETAIL

DRAWN:	DATE:	DESIGNED:	CHECKED:

JOB NO.: 201725

FIG NO.: 3

APPENDIX A: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 8/27/2020
Job # 201725

REMARKS

WATER @ 15', 8/31/20

Description	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
FILL 0-8', SAND, VERY CLAYEY TO CLAYEY, FINE TO COARSE GRAINED, DARK BROWN, MEDIUM DENSE TO DENSE, MOIST			■	13	11.1	1
	5		■	34	4.9	1
SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, MOIST	10		■	50/6"	5.5	3
	15		■	50/8"	11.7	3
	20		■	50/6"	9.1	3

TEST BORING NO. 2
DATE DRILLED 8/27/2020
CLIENT T-BONE CONSTRUCTION
LOCATION 7615 McLAUGHLIN

REMARKS

WATER @ 14', 8/31/20

Description	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
FILL 0-7', SAND, CLAYEY, FINE TO COARSE GRAINED, DARK BROWN, MEDIUM ENSI TO DENSE, MOIST			■	12	7.0	1
	5		■	38	4.9	1
WEATHERED SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, DENSE, MOIST	10		■	47	6.8	3
CLAYSTONE, SANDY, GRAY BROWN, HARD, MOIST	15		■	50/7"	15.7	4
SANDSTONE, CLAYEY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, MOIST	20		■	50/8"	12.9	3

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		DS	9/22/20

JOB NO.: 201725
FIG NO.: A- 1

TEST BORING NO. 3
DATE DRILLED 8/27/2020
Job # 201725

REMARKS

WATER @ 16.5', 8/31/20

Description	Depth (ft)	Samples	Blows per foot	Watercontent %	Soil Type
FILL 0-7', SAND, SILTY TO CLAYEY, FINE TO COARSE GRAINED, DARK BROWN, DENSE TO MEDIUM DENSE, MOIST		■	41	4.3	1
	5	■	22	6.1	1
SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, MOIST	10	■	50/8"	7.7	3
CLAYSTONE, SANDY, GRAY BROWN, HARD, MOIST	15	■	50/9"	13.5	4
	20	■	50/7"	17.1	4

TEST BORING NO. 4
DATE DRILLED 8/27/2020
CLIENT T-BONE CONSTRUCTION
LOCATION 7615 McLAUGHLIN

REMARKS

WATER @ 16.5', 8/31/20

Description	Depth (ft)	Samples	Blows per foot	Watercontent %	Soil Type
SAND, SILTY, FINE TO MEDIUM GRAINED, BROWN, VERY DENSE, MOIST		■	50/11"	5.2	2
WEATHERED TO FORMATIONAL SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, DENSE TO VERY DENSE, MOIST	5	■	41	5.1	3
	10	■	50/8"	7.5	3
FINE GRAINED LENSES	15	■	50/7"	16.3	3
	20	■	50/7"	11.3	3

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TEST BORING LOG

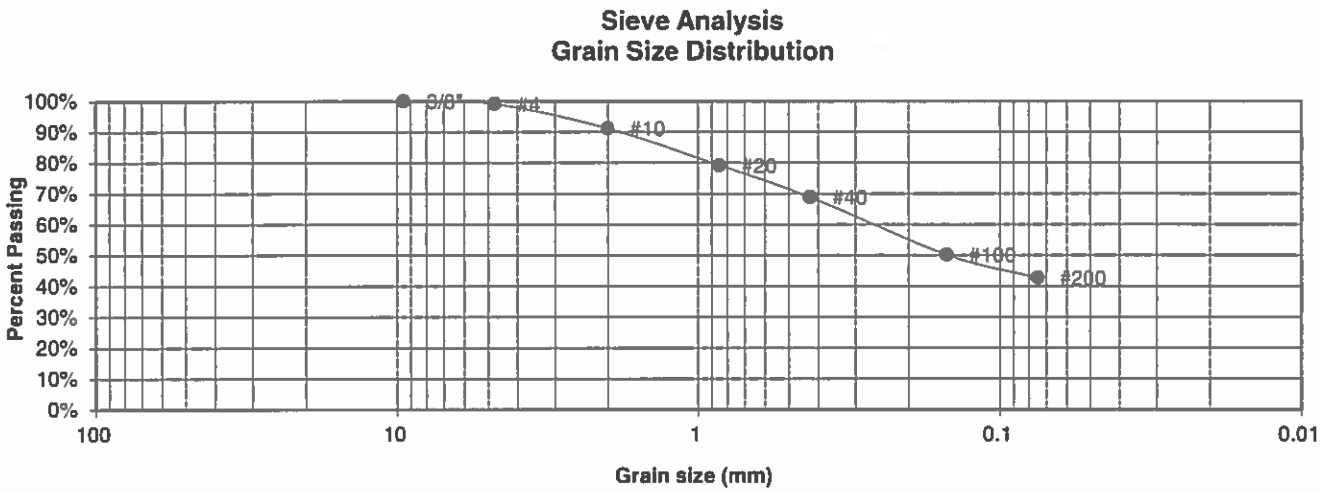
DRAWN: DATE: CHECKED: DATE: 9/10/20

JOB NO.: 201725

FIG NO.: A- 2

APPENDIX B: Laboratory Testing Results

UNIFIED CLASSIFICATION	SC	CLIENT	T-BONE CONSTRUCTION
SOIL TYPE #	1	PROJECT	7615 McLAUGHLIN
TEST BORING #	1	JOB NO.	201725
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.1%
10	91.2%
20	79.2%
40	68.9%
100	50.2%
200	42.7%

Atterberg Limits	
Plastic Limit	
Liquid Limit	
Plastic Index	

Swell	
Moisture at start	14.0%
Moisture at finish	23.5%
Moisture increase	9.5%
Initial dry density (pcf)	97
Swell (psf)	910

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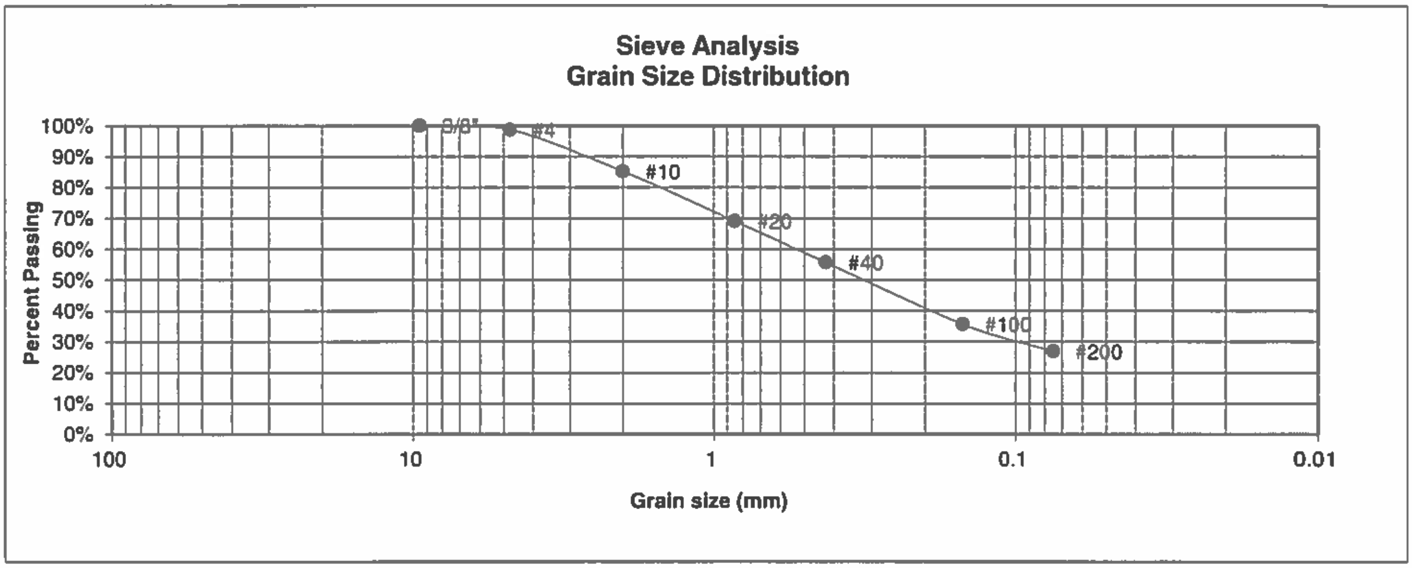
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 9/10/20

JOB NO.: 201725

FIG NO.: B-1

UNIFIED CLASSIFICATION	SC	CLIENT	T-BONE CONSTRUCTION
SOIL TYPE #	1	PROJECT	7615 McLAUGHLIN
TEST BORING #	2	JOB NO.	201725
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.7%
10	85.2%
20	69.1%
40	55.7%
100	35.7%
200	26.9%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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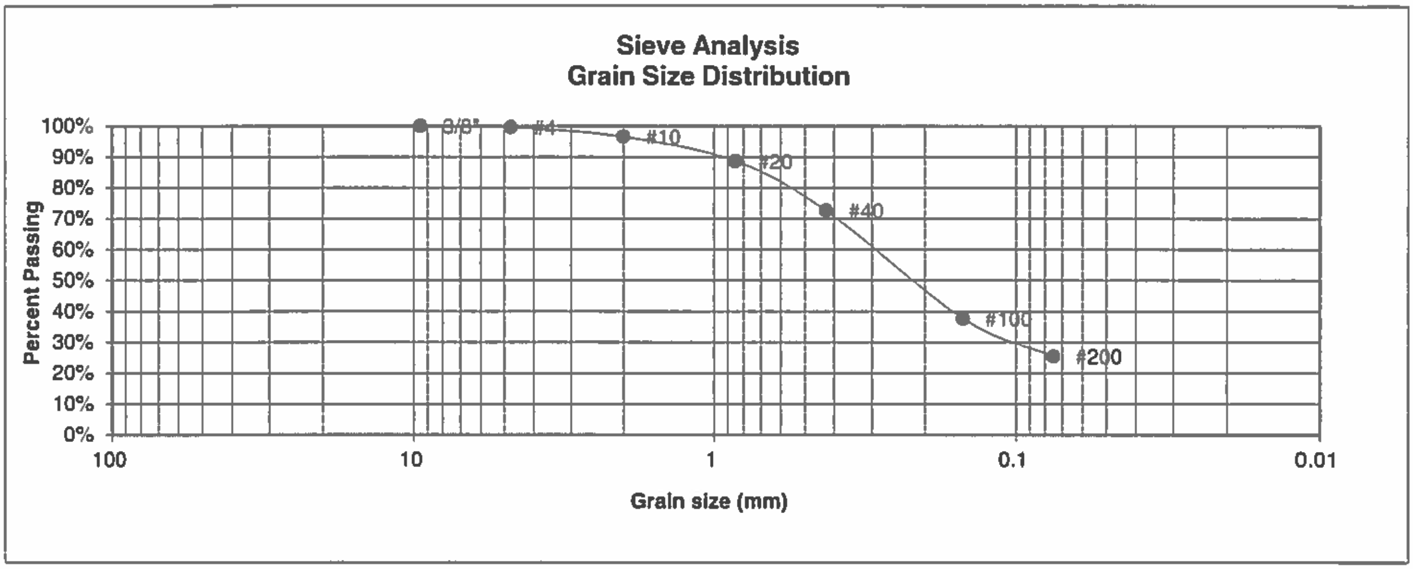
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LL	9/10/20

JOB NO.: 201725
FIG NO.: B-2

UNIFIED CLASSIFICATION	SM	CLIENT	T-BONE CONSTRUCTION
SOIL TYPE #	2	PROJECT	7615 McLAUGHLIN
TEST BORING #	4	JOB NO.	201725
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.6%
10	96.6%
20	88.6%
40	72.6%
100	37.7%
200	25.4%

Atterberg
Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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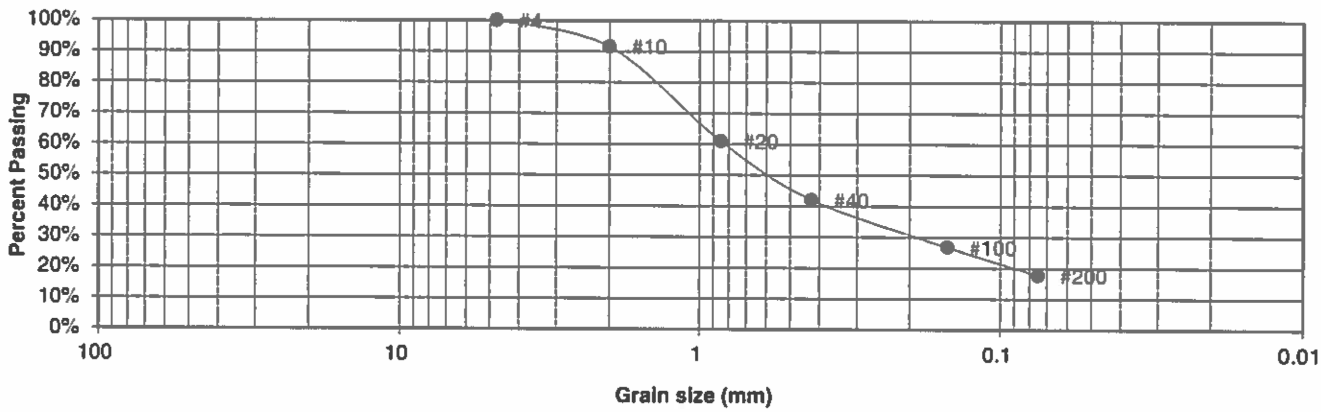
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 9/10/20

JOB NO.: 201725
FIG NO.: B-3

UNIFIED CLASSIFICATION	SM	CLIENT	T-BONE CONSTRUCTION
SOIL TYPE #	3	PROJECT	7615 McLAUGHLIN
TEST BORING #	1	JOB NO.	201725
DEPTH (FT)	15	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	91.6%
20	61.0%
40	42.0%
100	26.8%
200	17.7%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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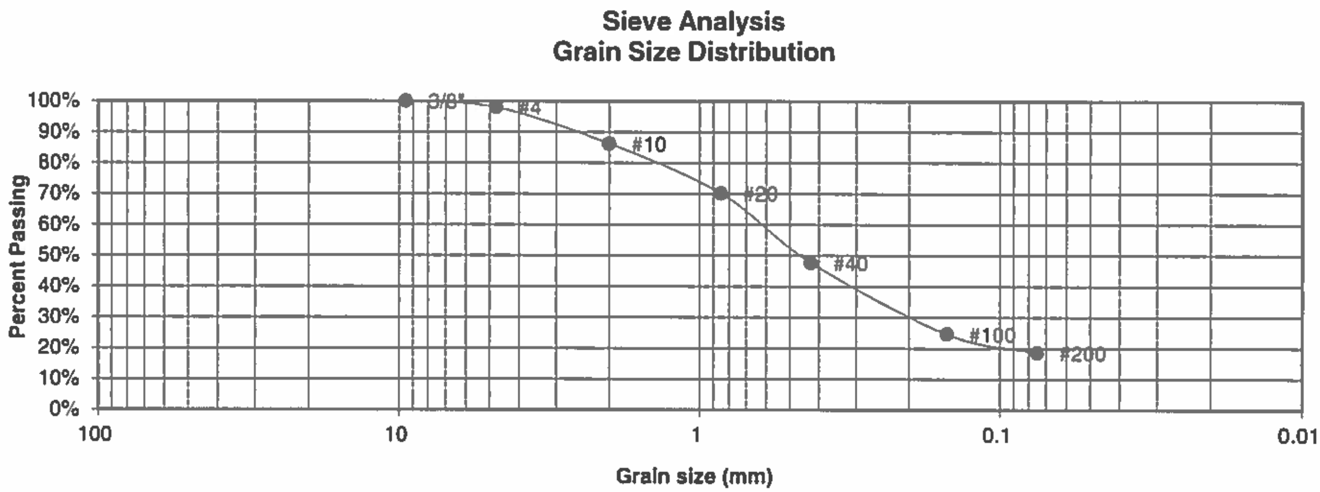
LABORATORY TEST RESULTS

DRAWN: DATE: CHECKED: L DATE: 9/10/20

JOB NO.: 201725

FIG NO.: B-4

UNIFIED CLASSIFICATION	SM	CLIENT	T-BONE CONSTRUCTION
SOIL TYPE #	3	PROJECT	7615 McLAUGHLIN
TEST BORING #	4	JOB NO.	201725
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.0%
10	86.2%
20	70.2%
40	47.7%
100	24.6%
200	18.5%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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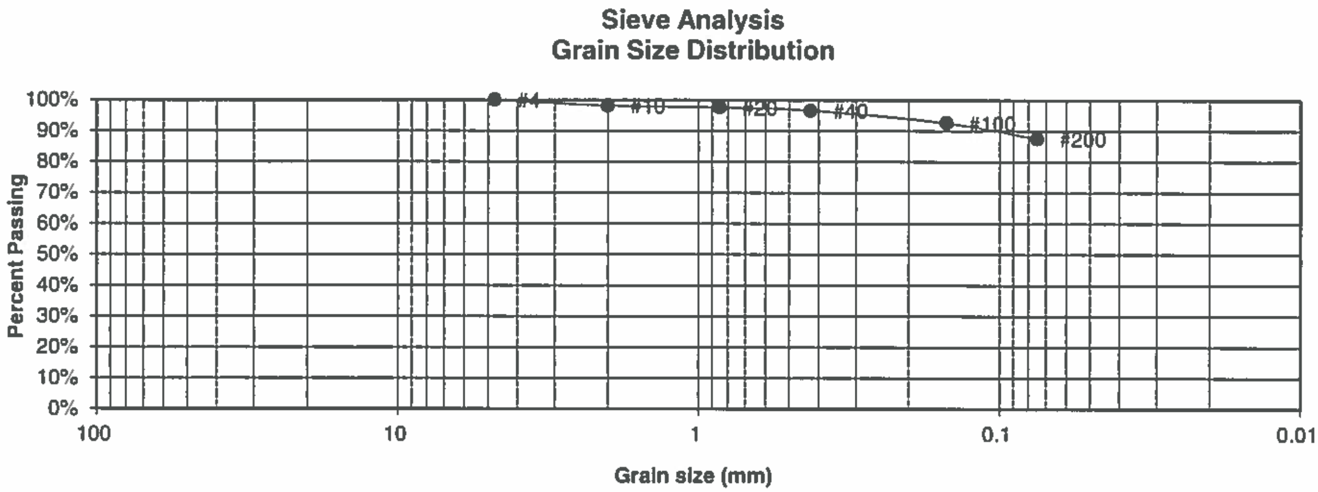
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		[signature]	4/10/20

JOB NO.: 201725

FIG NO.: B-5

UNIFIED CLASSIFICATION	CL	CLIENT	T-BONE CONSTRUCTION
SOIL TYPE #	4	PROJECT	7615 McLAUGHLIN
TEST BORING #	2	JOB NO.	201725
DEPTH (FT)	15	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.2%
20	97.6%
40	96.6%
100	92.6%
200	87.5%

Atterberg Limits

Plastic Limit	23
Liquid Limit	44
Plastic Index	21

Swell

Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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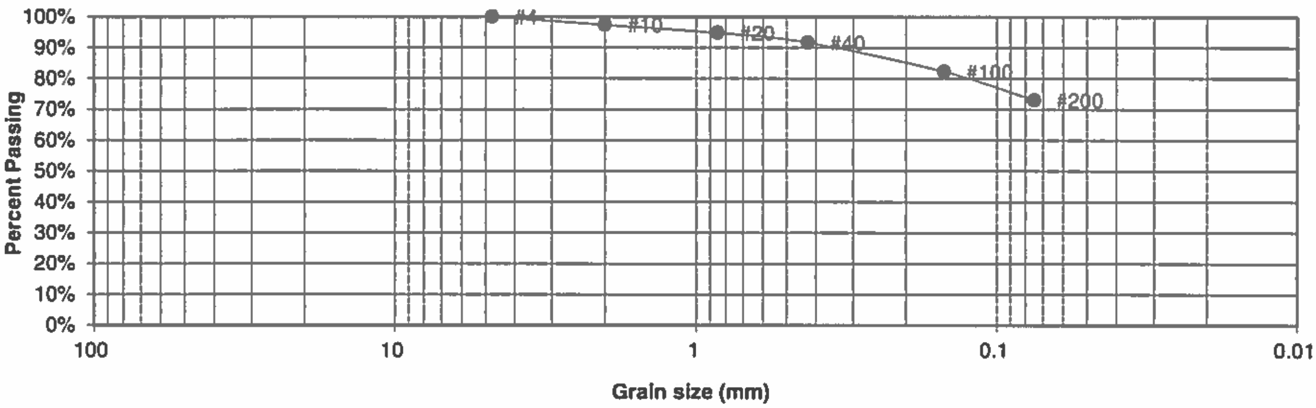
LABORATORY TEST RESULTS

DRAWN: | DATE: | CHECKED: [signature] | DATE: 9/10/20

JOB NO.: 201725

FIG NO.: B-6

UNIFIED CLASSIFICATION	CL	CLIENT	T-BONE CONSTRUCTION
SOIL TYPE #	4	PROJECT	7615 McLAUGHLIN
TEST BORING #	3	JOB NO.	201725
DEPTH (FT)	15	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	97.4%
20	94.8%
40	91.6%
100	82.3%
200	73.1%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		L	9/10/20

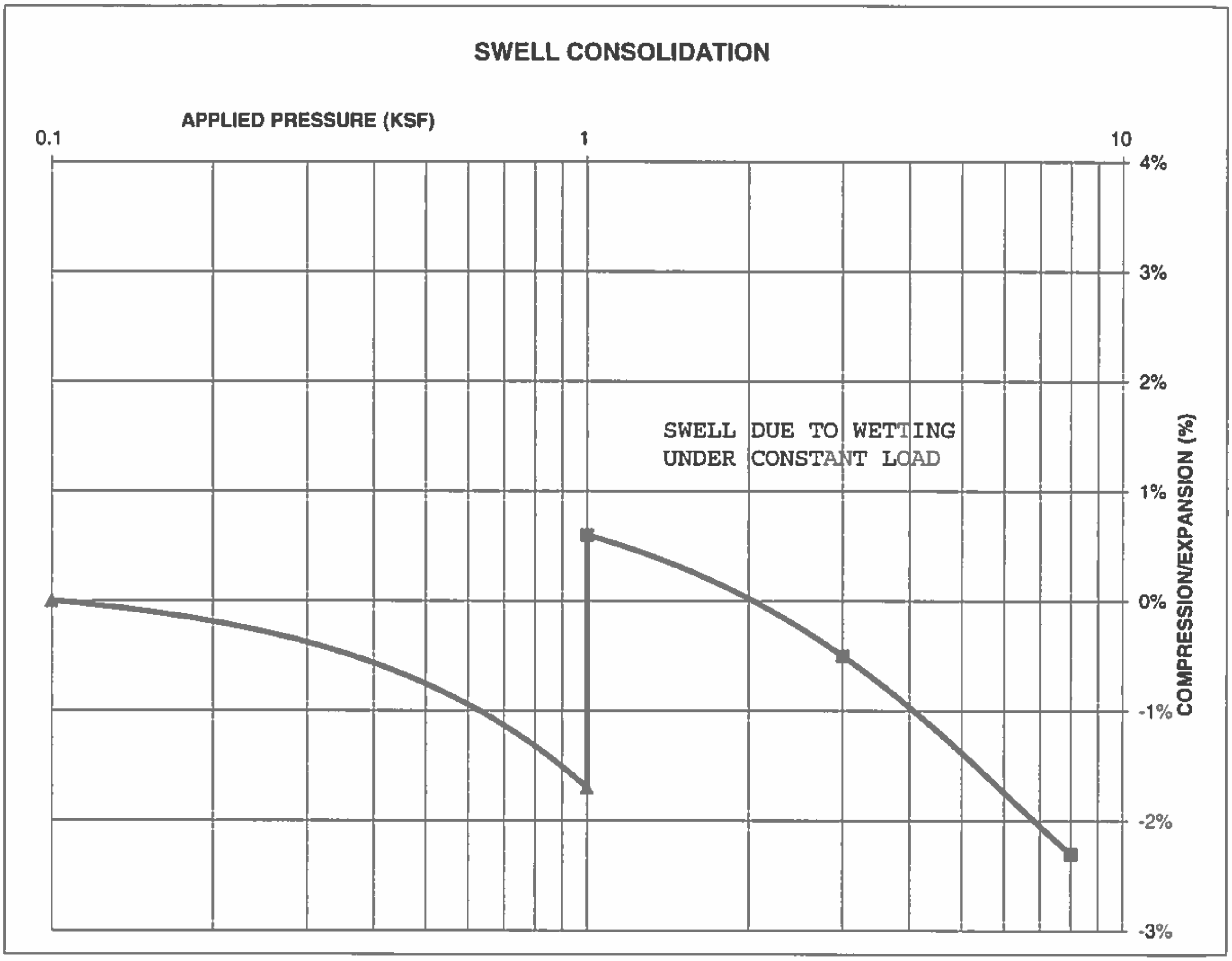
JOB NO.: 201725

FIG NO.: B-7

CONSOLIDATION TEST RESULTS

TEST BORING #	2	DEPTH(ft)	15
DESCRIPTION	CL	SOIL TYPE	3
NATURAL UNIT DRY WEIGHT (PCF)			113
NATURAL MOISTURE CONTENT			18.4%
SWELL/CONSOLIDATION (%)			2.3%

JOB NO. 201725
CLIENT T-BONE CONSTRUCTION
PROJECT 7615 McLAUGHLIN



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SWELL CONSOLIDATION
TEST RESULTS

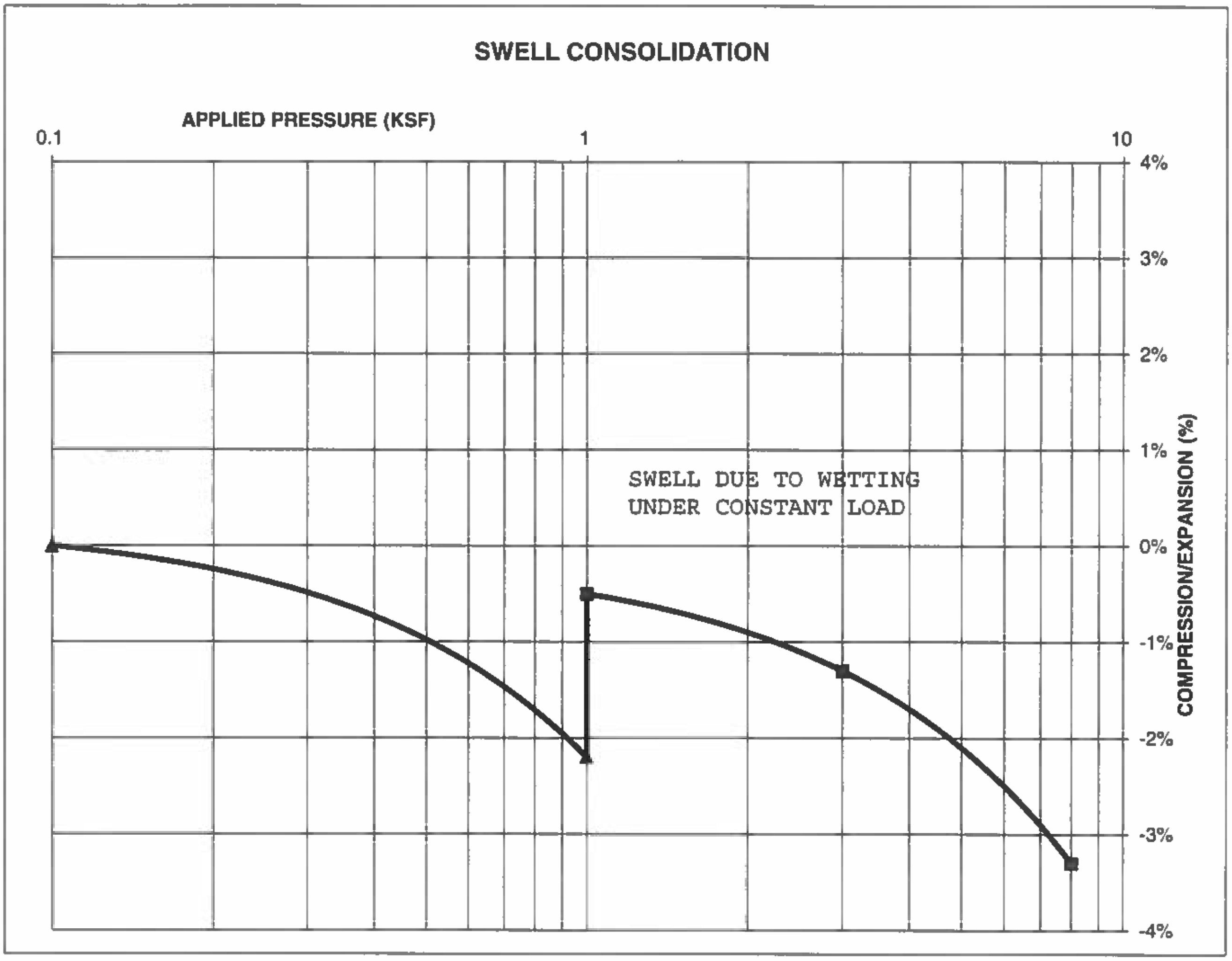
DRAWN:	DATE:	CHECKED: [signature]	DATE: 9/10/20

JOB NO.: 201725
FIG NO.: B-8

CONSOLIDATION TEST RESULTS

TEST BORING #	3	DEPTH(ft)	15
DESCRIPTION	CL	SOIL TYPE	3
NATURAL UNIT DRY WEIGHT (PCF)			117
NATURAL MOISTURE CONTENT			14.5%
SWELL/CONSOLIDATION (%)			1.7%

JOB NO. 201725
CLIENT T-BONE CONSTRUCTION
PROJECT 7615 McLAUGHLIN



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SWELL CONSOLIDATION
TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 9/10/20

JOB NO.: 201725
FIG NO.: B-9

CLIENT	T-BONE CONSTRUCTION	JOB NO.	201725
PROJECT	7615 McLAUGHLIN	DATE	9/1/2020
LOCATION	7615 McLAUGHLIN	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-1	2-3	1	SC	<0.01
TB-1	15	3	SM	<0.01
TB-2	15	4	CL	<0.01

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LABORATORY TEST
SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 9/10/20

JOB NO.: 201725

FIG NO.: B-10