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SOILS AND GEOLOGY STUDY
LIFE CHURCH AT BENT GRASS NORTH
PARCEL NOS. 53010-00-026 and 53010-00-033
EL PASO COUNTY, COLORADO

Prepared for:

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July 16, 2026

Respectfully Submitted,

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1 SUMMARY

Project Location

The project site is located within the NE¼ of Section 1, Township 13 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located in the Bent Grass subdivision at the northwest corner of Bent Grass Drive and Meridian Road in Falcon, Colorado. The location of the site is as shown in the Vicinity Map (Figure 1).

Project Description

The site development consists of a 39,338 square foot church building with associated site improvements for the 6.8-acre parcel. The site will be serviced by central water and sewer. A detention pond is proposed in the southeast portion of the site.

Scope of Report

This report presents the results of our geologic evaluation and treatment of engineering geologic hazard study with respect to the proposed subdivision.

Land Use and Engineering Geology

This site was found to be suitable for the proposed development; however, geologic conditions in certain areas will impose some minor constraints on development and land use. These include areas of artificial fill, potentially expansive soils, shallow bedrock, potentially shallow seasonally groundwater areas, and the potential for elevated radon levels. These conditions are discussed in greater detail in this report.

In general, it is our opinion that the development can be achieved if the observed geologic conditions on site are either properly mitigated or avoided. All recommendations are subject to the limitations discussed in the report.

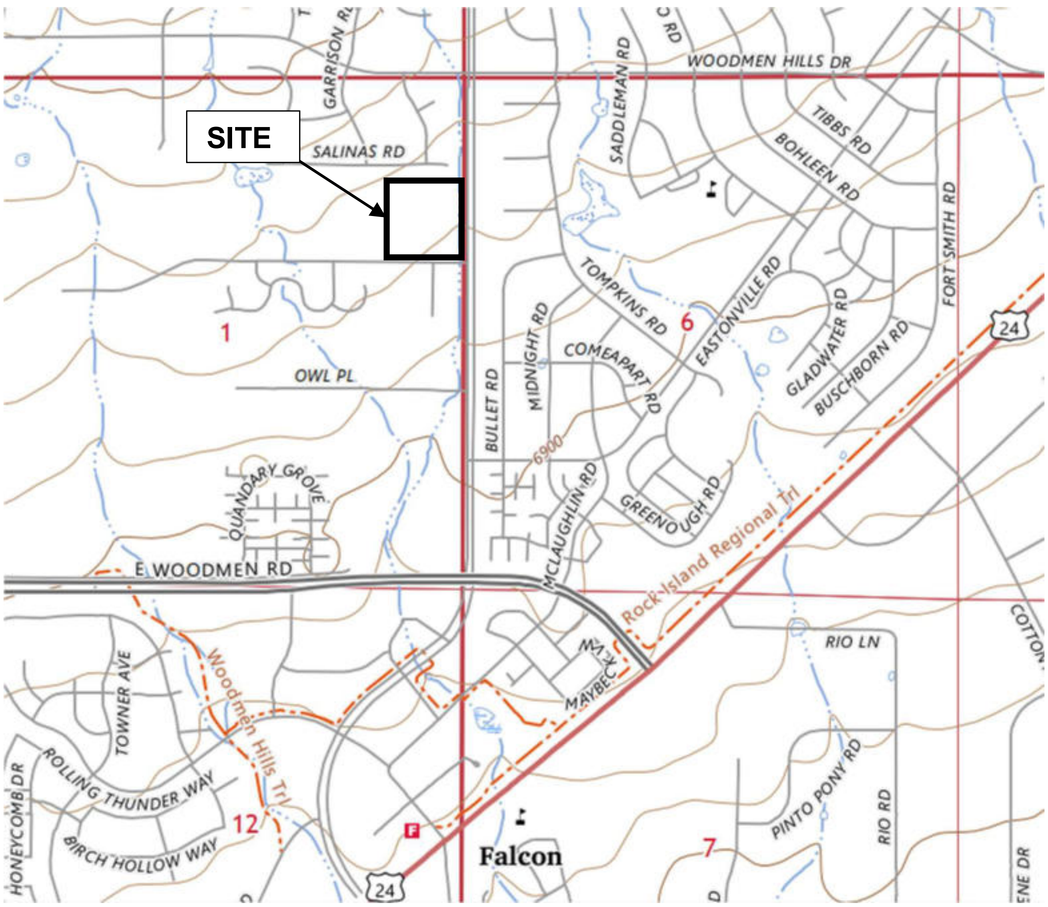
2 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The topography of the site is generally gradually sloping to the southeast, with a minor drainage along the eastern boundary of the site that flows in a southerly direction. The drainage was dry at the time of our site observations. The site boundaries are indicated in the USGS Map (Exhibit 1). Previous land uses have included undeveloped agricultural pastureland. Vegetation observed on the site includes field grasses, and weeds. Site photographs are included in Appendix A.

The site development consists of a 39,338 square foot church building with associated site improvements for the 6.8-acre parcel. The proposed development plan and grading is shown in the Site and Exploration Plan (Figure 2). Grading plans indicated filling proposed for the building pad, and minimal cuts/fill for the construction of the proposed detention pond.

Exhibit 1: USGS Topographic Map

Falcon Quadrangle



3 SCOPE OF THE REPORT

The scope of this report includes a general geologic analysis utilizing published geologic data. Detailed site-specific mapping was conducted to obtain general information with respect to major geographic and geologic features, geologic descriptions, and their effects on the development of the property in accordance with the El Paso Land Development Code.

4 FIELD INVESTIGATION

Our field investigation consisted of the preparation of a geologic map of any bedrock features and significant surficial deposits. The site was also evaluated using the Web Soil Survey from the Natural Resource Conservation Service (NRCS), formerly known as the Soil Conservation Service (SCS). The position of mappable units within the subject property is shown on the Geologic Map. Our mapping procedures involved both field reconnaissance and measurements and air photo reconnaissance and interpretation. The same mapping procedures have also been utilized to produce the Geology/Engineering Geology Map, which identified pertinent geologic conditions affecting development. The field mapping was performed by personnel of Entech on July 7, 2026. Site photographs are included in Appendix A.

Entech previously completed a *Geotechnical and Pavement Design Report* for the site dated November 11, 2024 (Reference 1). This report was used in preparing the Soils and Geology Study for the site and is included in Appendix B. Subsurface conditions at the project site were explored by eight test borings, designated TB-1 through TB-8, drilled on October 16 and 17, 2024 at the approximate locations shown on the Site and Exploration Plan (Figure 2). Five borings were drilled in the proposed building footprint and three additional borings were drilled in the parking lot and drive lanes to provide pavement design recommendations. The borings drilled in the building footprint were drilled to depths of 20 feet below the ground surface (bgs), and the borings drilled in the parking and drive areas were drilled to depths of 10 feet bgs.

The locations of the test borings are indicated on the Site and Exploration Plan (Figure 2). The Test Boring Logs and Laboratory Test Results are included in Appendix B. The results of the testing will be discussed later in this report.

Laboratory testing was performed to classify and determine the engineering characteristics of the soils. Laboratory tests included moisture content testing (ASTM D2216), grain-size analysis (ASTM D6913), and Atterberg Limits testing (ASTM D4318). Results of the laboratory testing are included in Appendix C.

5 SOIL, GEOLOGY, AND ENGINEERING GEOLOGY

5.1 General Geology

The site lies in the western portion of the Great Plains Physiographic Province just north of the Palmer Divide. Approximately 12 miles to the west is a major structural feature known as the Rampart Range Fault. This fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within the southeastern edge of a large structural feature known as the Denver Basin. Bedrock in the area tends to be very gently dipping in a northeasterly direction (Reference 2). The rocks in the area of the site are sedimentary in nature and typically Upper Cretaceous in age. The bedrock underlying the site consists of the Black Squirrel Formation. Overlying this formation are unconsolidated deposits of alluvial soils of Quaternary Age. The site's stratigraphy will be discussed in more detail in Section 5.3.

5.2 Soil Conservation Survey

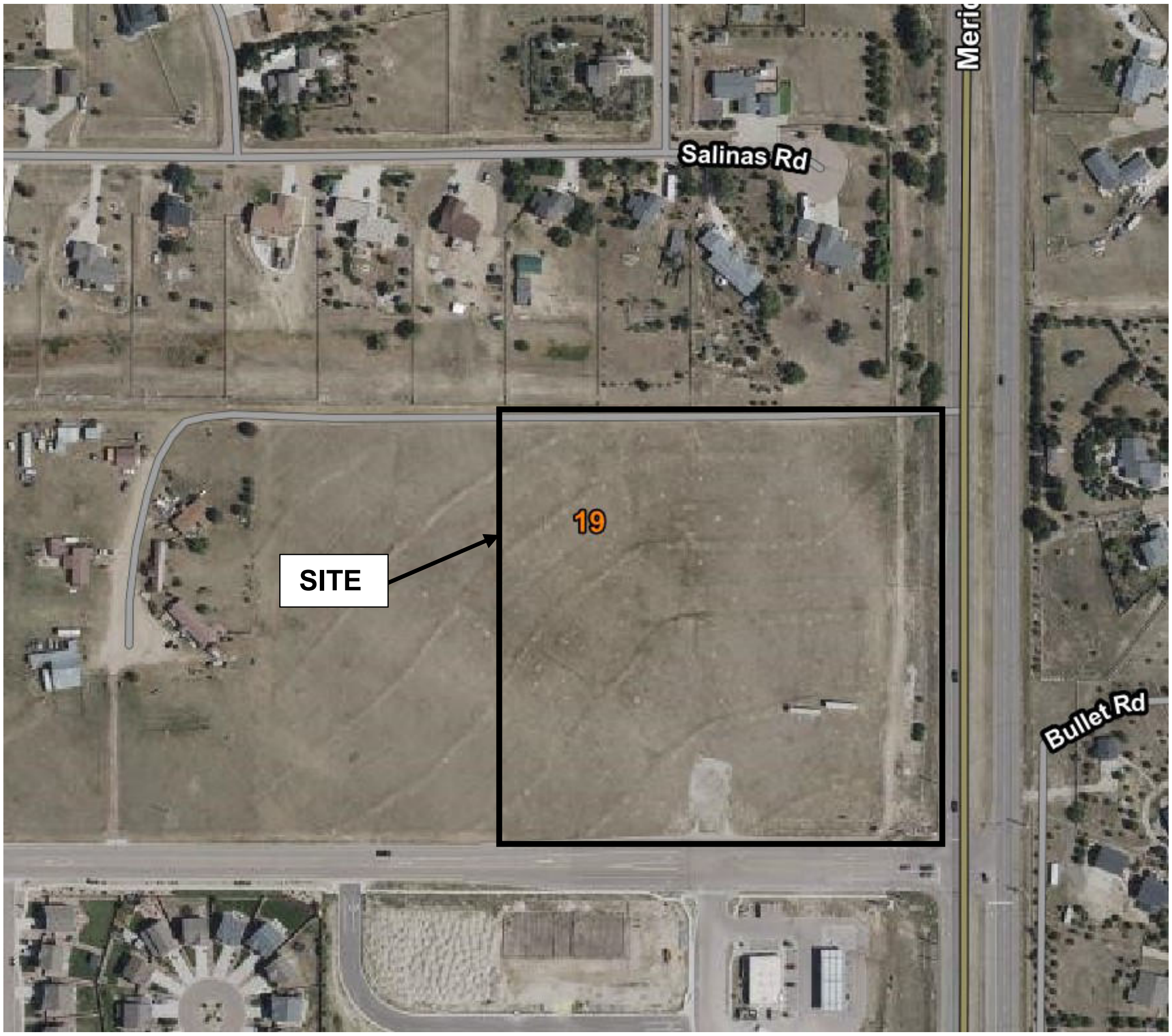
The Natural Resource Conservation Service (Reference 2), previously the Soil Conservation Service (Reference 3), has mapped one soil type on the site. In general, they consist of gravelly sandy loam and gravelly loamy sand. The soils are described in Exhibit 2, and shown in Exhibit 3.

Exhibit 2: Soil Survey Description

Type	Description
19	Columbine gravelly sandy loam, 0 to 3% slopes

Exhibit 3: USDA – Web Soil Survey

Soil Map – El Paso County Area, Colorado



Complete descriptions of each soil type are presented in Appendix C. The soils have generally been described as having moderately high to high permeabilities. Limitations on development include limited ability to support a load, shrink-swell potential, slopes, and frost action potential. Possible hazards with soil erosion are present on the site. The erosion potential can be controlled with vegetation. The soils have been described to have moderate erosion hazards.

5.3 Site Stratigraphy

The Geologic Map of the Falcon Quadrangle showing the site is presented in Exhibit 4 below (Reference 4). The Engineering Geology Map prepared for the site is presented in Figure 3. Two mappable units were identified on this site that are described as follows:

Qa_1 **Alluvium One of Holocene Age:** These materials consist of stream-deposited alluvium, typically classified as a silty to well-graded sand, brown to dark brown in color and of moderate density occurring as terrace deposits. Alluvium One can sometimes be very highly stratified containing thing layers of very silty and clayey soil. This unit correlates to the Post-Piney Creek Alluvium in the Denver area.

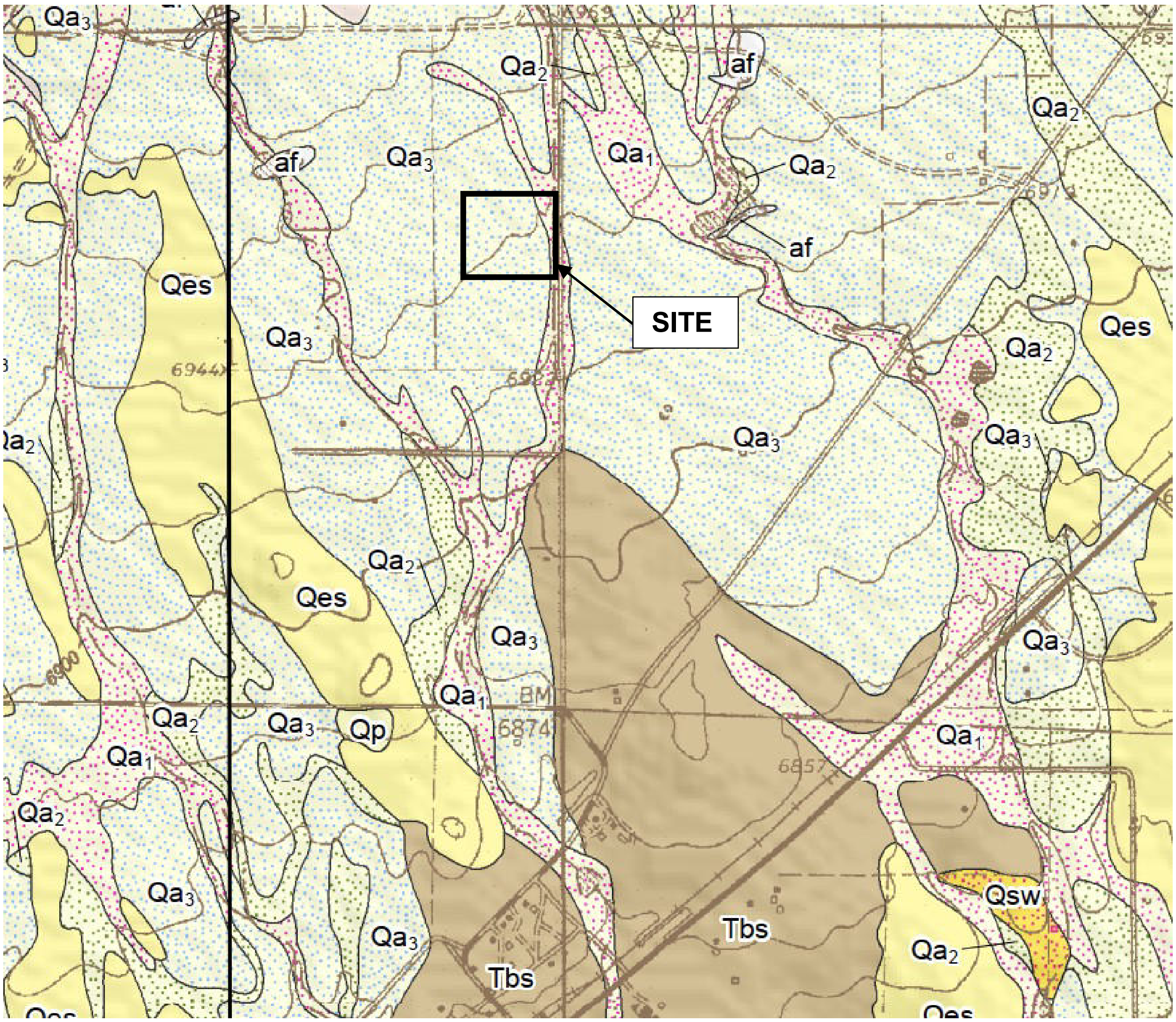
Qa_3 **Alluvium Three of Holocene Age:** lower stream terrace deposits. The Broadway Alluvium typically consists of silty to clayey gravelly sands. This deposit is usually highly stratified and may contain lenses of silt, clay or cobbles. Alluvium three can sometimes be contain dark gray clay beds that can be expansive. This unit correlates to the Broadway Alluvium in the Denver area.

The bedrock underlying the site consists of the Black Squirrel Formation of Paleocene Age. typically consist of sandstone with interbedded siltstone and claystone. The bedrock encountered in the test borings consisted of gray sandy claystone and some clayey sandstone.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Falcon Quadrangle* distributed by the Colorado Geological Survey in 2012 (Reference 5), the *Geologic Map of the Colorado Springs-Castle Rock Area*, distributed by the US Geological Survey in 1979 (Reference 6), and the *Geologic Map of the Pueblo 1^0 x 2^0 Quadrangle*, distributed by the US Geological Survey in 1978 (Reference 7). The Test Boring Logs used in evaluating the site are included in Appendix B. The Engineering Geology Map prepared for the site is presented in Figure 3.

Exhibit 4: Geologic Map of the Falcon Quadrangle

Colorado Geological Survey – OF-12-05



5.4 Soil Conditions

Two primary soil types and two bedrock types were encountered in the test borings drilled for the subsurface investigation. Each soil type was classified in accordance with the Unified Soil Classification System (USCS) and the American Association of State Highway and Transportation Officials (AASHTO) soil classification system using the laboratory testing results and the observations made during drilling.

Topsoil was encountered across the site and is generally anticipated to be on the order of 6 inches thick.

Soil Type 1 classified as clayey sand, silty sand, and sand with silt (SM, SC, SW-SM). The loose to medium-dense sands were encountered in all test borings underlying the topsoil to depths of 3 to 10 feet bgs. One-dimensional swell or collapse testing on a sample of sandy clay resulted in a volume change of -0.4% to 0.0% indicating low swell and collapse potential.

Soil Type 2 classified as native sandy clay (CL). The hard native clay was encountered in TB-1 at a depth of 8 feet bgs and extended to a depth of 12 feet bgs. One-dimensional swell or collapse testing on a sample of sandy clay resulted in a volume change of -0.1% indicating low collapse potential.

Soil Type 3 classified as sandstone bedrock of the Dawson formation, or very dense clayey sand, silty sand, and sand with clay when classified as a soil (SC, SM, SW-SC). The sandstone bedrock was encountered in all test borings except TB-6 at depths ranging from 3 to 12 feet bgs and extended to the termination depth of each boring, 20 feet bgs. The sandstone is expected to have a low potential for expansion or collapse.

Soil Type 4 classified as claystone bedrock of the Dawson formation, or hard sandy clay when classified as a soil (CL). The claystone was encountered in TB-2 underlying the Soil Type 1 and extended to 12 feet bgs. The claystone is expected to have a moderate potential for expansion or collapse.

For pavement design each soil type was classified using the AASHTO soil classifications system. Each soil type and corresponding AASHTO classification is listed below.

- Soil Type 1: A-2-4, A-1-b
- Soil Type 2: A-6
- Soil Type 3: A-2-4, A-1-b
- Soil Type 4: A-6.

The test boring logs and laboratory test results pertaining to this investigation are included in Appendix B.

5.5 Groundwater

Groundwater was encountered in borings TB-1 through TB-5 and TB-8 during our subsurface exploration program at depths ranging from 4.5 to 13 feet bgs. Groundwater was measured at depths ranging from 6.5 to 13 feet bgs within the proposed building pad. It should be noted that groundwater levels could change due to seasonal variations, changes in land runoff characteristics, and future development of nearby areas.

For the sandy materials on site, it should be noted that some groundwater conditions might be encountered due to the variability in the soil profile. Isolated sand and gravel layers within the soils, sometimes only a few feet in thickness and width, can carry water in the subsurface. Groundwater may also flow on top of the underlying bedrock or clays. Builders and planners should monitor potential occurrences of such subsurface water features during construction on-site and mitigate as necessary at the time of construction.

6 ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS

Detailed mapping has been performed on this site to produce an Engineering Geology Map (Figure 3). This map shows the location of various geologic conditions the developers should monitor during the planning, design, and construction stages of the project. No significant geologic hazards were identified on the site; however, the following constraints have been identified on the site: artificial fill, potentially expansive soils, shallow bedrock, potentially shallow seasonally groundwater areas, and the potential for elevated radon levels. These constraints and the recommended mitigation techniques are discussed below.

<u>Artificial Fill – Constraint</u>

Significant areas of artificial fill were not encountered on the site, however, several small erosion berms are located across the site. These berms are approximately 12-inches or less in height and will be mitigated by the proposed site grading. Other areas of fill may exist on the site.

> <u>Mitigation</u>: Should uncontrolled fill on this site is not located within any potential building areas. Any uncontrolled fill encountered beneath foundations will require removal and recompaction at a minimum of 95% of the Modified Procter (ASTM D1557) maximum dry density.

Potentially Expansive Soils – Constraint

Expansive clays and claystone bedrock are commonly interbedded in the sandstone underlying the site. These occurrences are typically sporadic; therefore, none have been indicated on the maps. These clays, if encountered beneath foundations, can cause differential movement in the structure foundation. The sand and sandstone soils are anticipated to exhibit low expansion potentials. If expansive materials are encountered during excavation, they will require mitigation. Expansive soils were not encountered in the test borings. Expansive soils should be identified and mitigated on an individual basis.

> Mitigation: Should expansive soils be encountered beneath foundations; mitigation will be necessary. Mitigation of expansive soils will require special foundation design. Overexcavation and replacement with non-expansive soils at a minimum of 95% of the Modified Proctor (ASTM D1557) maximum dry density is a suitable mitigation, which is common in the area. Overexcavation depths of 3 to 5 feet may be necessary depending on soil conditions. Another alternative in areas of highly expansive soils is the use of drilled pier foundation systems. Typical minimum pier depths are on the order of 25 feet or more and require penetration into the bedrock material a minimum of 4 to 6 feet, depending upon building loads. Floor slabs on expansive soils should be expected to experience movement. Overexcavation and replacement have been successful in minimizing slab movements. Specific recommendations have been provided in the *Geotechnical and Pavement Design Report* (Reference 1, Appendix B).

Shallow Bedrock – Constraint

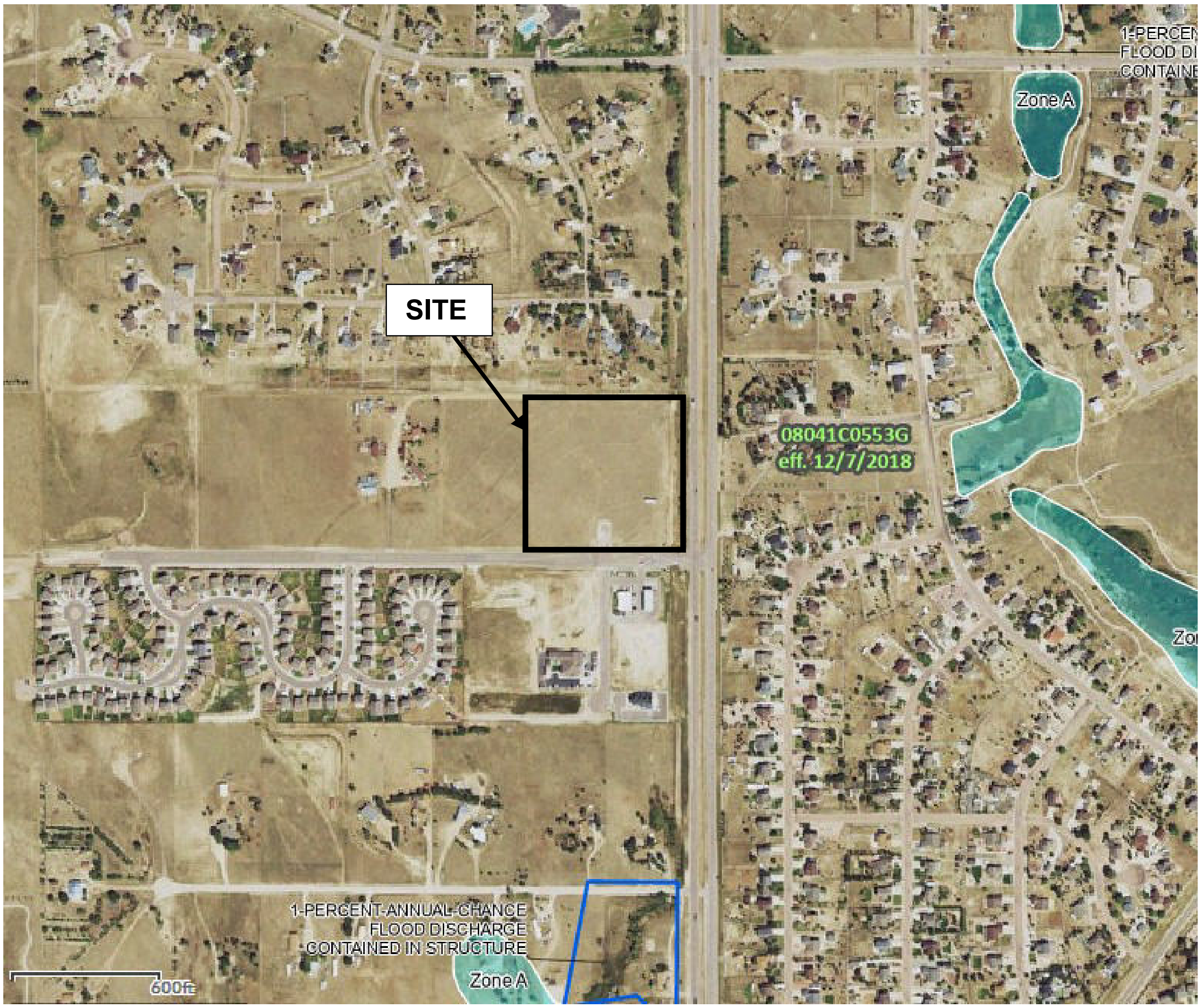
Bedrock was encountered in 7 of the test borings at depths ranging from 3 to 12 feet bgs. Shallow bedrock will be encountered across most of this site. Where claystone or sandstone are encountered, excavation/grading may be difficult requiring track-mounted excavators. Bedrock will also likely be encountered cuts for utility excavations.

Drainage and Floodplain Areas – Constraint

The site is not located within any mapped floodplains according to FEMA Map No. 08041C0285G (Figure 6, Reference 9). A minor drainage was observed along the eastern boundary of the site that flows in a southerly direction. The drainage was dry at the time of our site observations, however, the potential for seasonal shallow groundwater exists in this area. These areas are discussed further below. Specific drainage studies and floodplain locations are beyond the scope of this report.

Exhibit 5: FEMA Flood Map

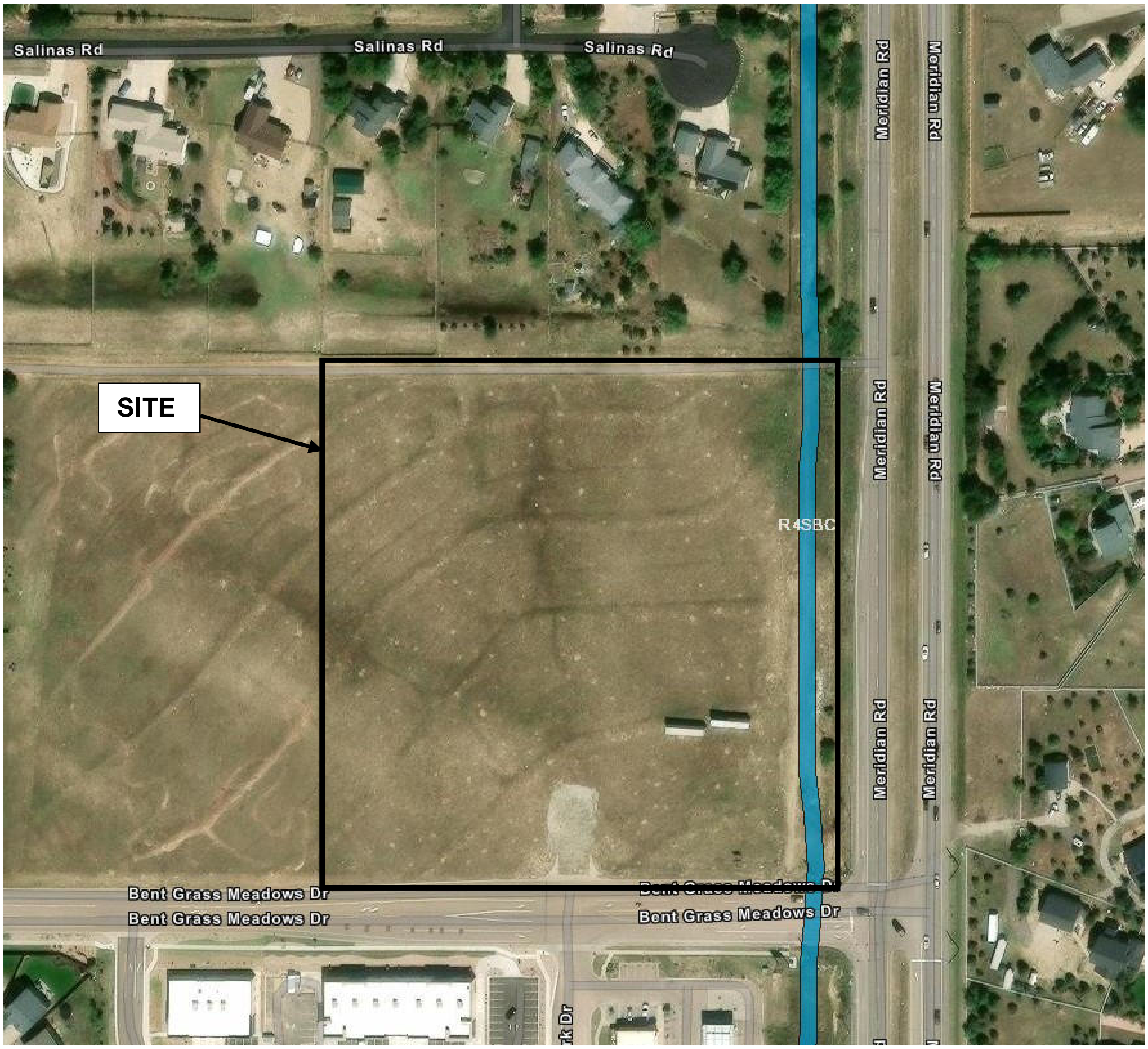
FEMA Map No. 08041C0285G, eff. 12/7/2018



The drainage along the eastern boundary of the site has been included in the National Wetland Inventory as Freshwater Emergent Wetland habitats classified as **R4SBC** (Riverine – R, Intermittent – 4, Stream Bed – SB, Seasonally Flooded – C) (Reference 10). The wetlands map is shown in Exhibit 6. This area has been identified as a potential seasonal shallow groundwater area and will be avoided with construction of the church building.

Exhibit 6: USFWS National Wetlands Inventory

Wetlands Map



<u>Potentially Seasonal Shallow Groundwater Areas – Constraint</u>

In these areas, we would anticipate periodic high subsurface moisture conditions and frost heave potential on a seasonal basis. Groundwater was not observed in the drainage at the time of our site observations. Any structures in or adjacent to potentially shallow groundwater areas should follow the mitigation discussed below.

<u>Mitigation:</u> Foundations on this site must have a minimum 30-inch depth for frost protection. Buildings should typically be set a minimum of 3 feet above groundwater levels

if possible. Subsurface perimeter drains are recommended for any usable below-grade. If groundwater is encountered within 3 feet of foundation grade, additional drains that may include but are not limited to interceptor drains, underslab drains (capillary break) may be required. Typical drain details are presented in Figures 4 through 6. Any grading in these areas should be done to direct surface flows around structures to avoid areas of ponded water. Structures should not block drainages. All organic material should be completely removed prior to any fill placement.

Slope Stability and Landslide Susceptibility – Hazard

The slopes on the site are gradually sloping and do not exhibit any signs of past or potential unstable slopes or landslides. Any future site grading should be no steeper than 3:1 unless specifically analyzed.

Debris Flow Susceptibility – Hazard

The site is not located within an area of debris flow susceptibility according to the *Debris Flow Susceptibility Map of El Paso County, Colorado* by McCoy et al. in 2018 (Reference 11).

Radon – Hazard

Radon is a colorless, tasteless radioactive gas with a United States Environmental Protection Agency (EPA) specified action level of 4.0 picocuries per liter (pCi/L) of air. Radon gas has a very short half-life of 3.8 days. Radon levels for the area have been reported by the Colorado Geologic Survey in the open file, Report No. 91-4 (Reference 12). The average radon level for the 80908 zip code is 3.40 pCi/l. The average radon levels are presented in Exhibit 2 below.

Exhibit 7: Average Radon Levels

Average Radon Levels for the 80908 Zip Code	
0 < 4 pCi/L	50.00%
4 < 10 pCi/L	50.00%
10 < 20 pCi/L	0.00%
> 20 pCi/L	0.00%

Mitigation: The potential for high radon levels is present for the site. Build-up of radon gas can usually be mitigated by providing increased ventilation of basement and crawlspace and sealing joints. **Specific requirements for mitigation should be based on site specific testing.**

6.1 Relevance of Geologic Conditions to Land Use Planning

We understand that the development consists of a 39,338 square foot church building with associated site improvements for the 6.8-acre parcel. The proposed structure may be supported with shallow spread footing foundations with slab on grade floors placed on native silty sand, recompacted on-site granular material, or sandstone. We recommend that shallow foundations be founded a minimum of 3 feet above groundwater (maximum depth of 3.5 feet bgs). Depending on the conditions observed during the excavation, additional drains such as interceptor drains or a slab underdrain may be recommended.

It is our opinion that the existing geologic and engineering geologic conditions will impose some minor constraints on the proposed development. The most significant constraints will be those associated with the potentially expansive soils, shallow bedrock, potentially seasonal shallow groundwater, and the potential for elevated radon levels. The constraints/hazards on the site may be satisfactorily mitigated through proper engineering design and construction practices or avoidance.

The granular soils were generally encountered at medium dense to very dense states. The granular soils encountered in the upper soil profiles of the test boring should provide good support for shallow foundations. Foundations anticipated for the site are standard spread footings on the medium dense granular soils or sandstone bedrock.

Expansive layers may also be encountered in the soil and bedrock on this site. Areas of expansive soils on site are expected to be sporadic; therefore, none have been indicated on the maps. Expansive soils, if encountered, will require special foundation design and/or overexcavation. These soils will not prohibit development. Overexcavation and replacement with non-expansive soils is a suitable mitigation. Specific recommendations have been provided in the *Geotechnical and Pavement Design Report* (Reference 1, Appendix B).

In summary, development of the site can be achieved if the items mentioned above are mitigated. These items can be mitigated through proper design and construction or through avoidance. Investigation of the individual lots and building sites is required prior to construction.

7 ECONOMIC MINERAL RESOURCES

Some of the sandy materials on site could be considered a low-grade sand resource. According to the *El Paso County Aggregate Resource Evaluation Map* (Reference 13), the site is mapped and the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 14), site is mapped in an alluvial fan deposit with the potential as a fine aggregate resource. According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 15), the area of the site has been mapped as “Fair” for industrial minerals. It is possible that sand materials on site could be an aggregate resource. However, considering the silty nature of much of these materials and abundance of similar materials through the region and the close proximity to developed land, they would be considered to have little significance as an economic resource.

According to the *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands* (Reference 15), the site is mapped within the Denver Basin Coal Region. However, the area of the site has been mapped as “Poor” for coal resources. No active or inactive mines have been mapped near the site. No metallic mineral resources have been mapped on the site (Reference 15).

The site has been mapped as “Fair” for oil and gas resources (Reference 15). No oil or gas fields have been discovered near the site. The sedimentary rocks in the area may lack the geologic structure for trapping oil or gas; therefore, they may not be considered a significant resource. Hydraulic fracturing is a new method used to extract oil and gas from rocks. It utilizes pressurized fluid to extract oil and gas from rocks that would not normally be productive. The area of the site has not been explored to determine if the rocks underlying the site would be commercially viable utilizing hydraulic fracturing. The practice of hydraulic fracturing has come under review due to concerns about environmental impacts, health, and safety.

8 EROSION CONTROL

The soil types observed on the site are mildly to highly susceptible to wind erosion and moderately to highly susceptible to water erosion. A minor wind erosion and dust problem may be created for a short time during and immediately after construction. Should the problem be considered severe enough during this time, watering of the cut areas or the use of chemical palliative may be required to control dust. However, once construction has been completed and vegetation re-established, the potential for wind erosion should be considerably reduced.

Regarding water erosion, loosely compacted soils will be the most susceptible to water erosion; residually weathered soils and weathered bedrock materials become increasingly less susceptible to water erosion. For the typical soils observed on site, allowable velocities or unvegetated and unlined earth channels would be on the order of 3 to 4 feet/second, depending upon the sediment load carried by the water. Permissible velocities may be increased through the use of vegetation to something on the order of 4 to 7 feet/second, depending upon the type of vegetation established. Should the anticipated velocities exceed these values, some form of channel lining material may be required to reduce erosion potential. These might consist of synthetic channel lining materials available on the market or conventional riprap. In cases where ditch-lining materials are still insufficient to control erosion, small check dams or sediment traps may be required. The check dams will serve to reduce flow velocities as well as provide small traps for containing sediment. The determination of the amount, location, and placement of ditch linings, check dams, and special erosion control features should be performed by or in conjunction with the drainage engineer who is more familiar with the flow quantities and velocities.

Cut and fill slope areas will be subjected primarily to sheetwash and rill erosion. Unchecked rill erosion can eventually lead to concentrated flows of water and gully erosion. The best means to combat this type of erosion is, where possible, the adequate re-vegetation of cut and fill slopes. Cut and fill slopes having gradients more than three (3) horizontal to one (1) vertical become increasingly more difficult to revegetate successfully. Therefore, recommendations pertaining to the vegetation of the cut and fill slopes may require input from a qualified landscape architect and/or the Soil Conservation Service.

9 ROADWAY and EMBANKMENT CONSTRUCTION RECOMMENDATIONS

In general, the site soils are suitable for the proposed roadways and embankments. The proposed detention pond at the southeast portion of the site can be constructed with site materials. Groundwater may be encountered in deeper cuts and along drainages and low-lying areas. Groundwater was not encountered within 10 feet (TB-7) in the area of the detention pond. Special mitigation for groundwater in the pond is not expected to be necessary. Additional investigation of these areas may be recommended as plans are completed. If excavations encroach on the groundwater level unstable soil conditions may be encountered. Excavation of saturated soils will be difficult with rubber-tired equipment. Stabilization using shot rock or geogrids may be necessary.

The site soils encountered in the test boring are suitable for the proposed embankments, and parking lot. Any areas to receive fill should have all topsoil, organic material, or debris removed. Prior to fill placement, Entech should observe the subgrade. Fill must be properly benched and compacted to minimize potentially unstable conditions in slope areas. Fill slopes should be 3:1 or flatter unless specifically analyzed. The subgrade should be scarified and moisture conditioned to within 2% of optimum moisture content and compacted to a minimum of 95% of the Modified Proctor (ASTM D1557) maximum dry density prior to placing new fill. Areas receiving fill may require stabilization with rock or fabric if shallow groundwater conditions are encountered.

New fill should be placed in thin lifts not to exceed 6 inches after compaction while maintaining at least 95% of the Modified Proctor (ASTM D1557) maximum dry density. These materials should be placed at a moisture content conducive to compaction, usually 0 to +/-2% of the Proctor optimum moisture content. The placement and compaction of fill should be observed and tested by Entech during construction. Entech should approve any imported materials prior to placing or hauling them to the site. Additional investigation will be required for roadway improvements.

10 CLOSURE

It is our opinion that the existing geologic engineering and geologic conditions will impose some minor constraints on the proposed development and construction. The site conditions can be mitigated through proper engineering design and construction practices. The proposed development and use are consistent with anticipated geologic and engineering geologic conditions.

It should be pointed out that because of the nature of data obtained by random sampling of such variable and non-homogeneous materials as soil and rock, it is important that we be informed of any differences observed between surface and subsurface conditions encountered in construction and those assumed in the body of this report. Construction and design personnel should be made familiar with the contents of this report.

This report has been prepared for FAL Realty LLC for application to the proposed project in accordance with generally accepted geologic soil and engineering practices. No other warranty, expressed or implied, is made.

We trust that this report has provided you with all the information that you require. Should you require additional information, please do not hesitate to contact Entech Engineering, Inc.

11 REFERENCES

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FIGURES

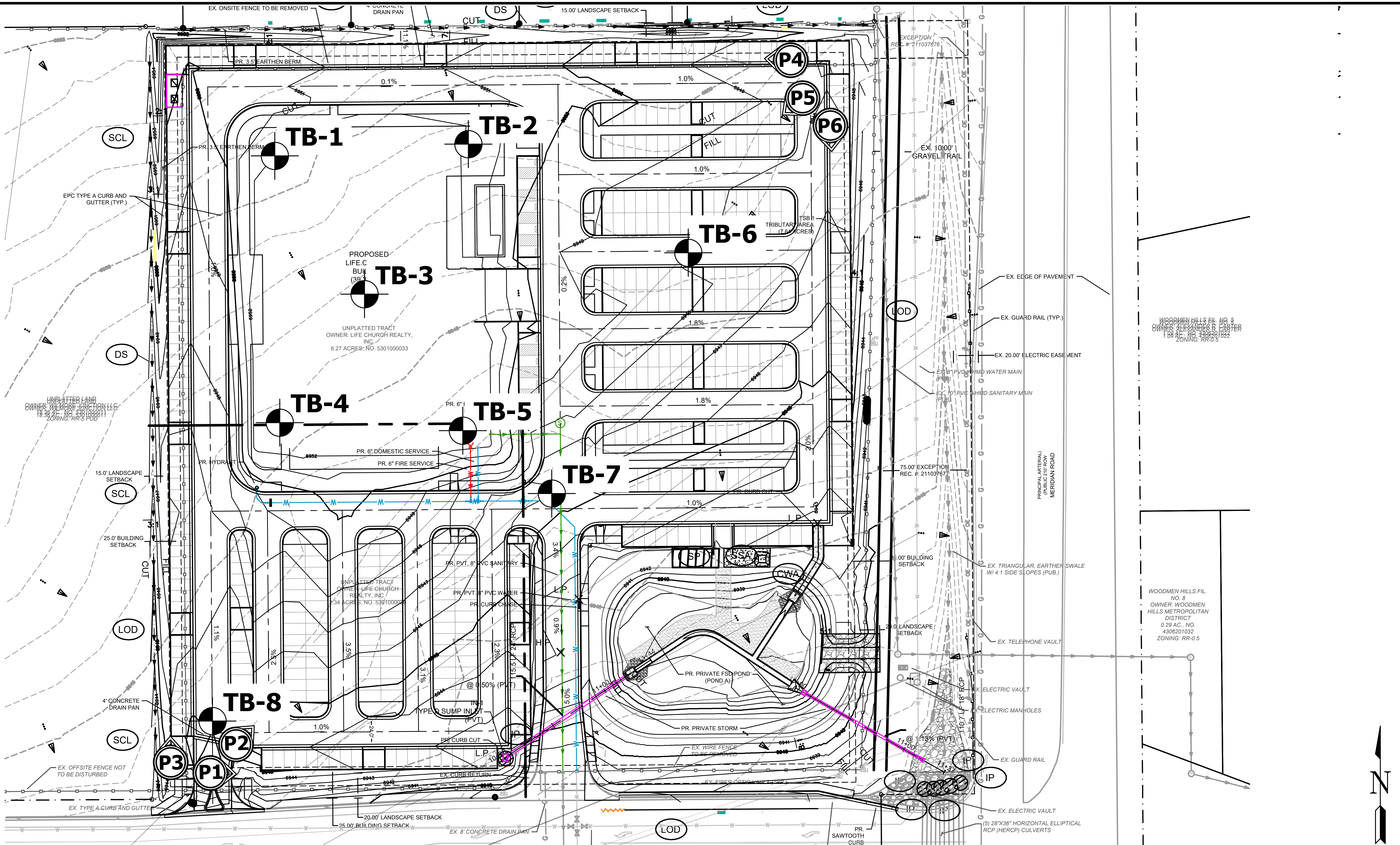
ENTECH ENGINEERING, INC.

VICINITY MAP

LIFE CHURCH AT BENTGRASS NORTH
FAL REALTY LLC

JOB NO.
241719

FIG. 1



TB- APPROXIMATE TEST BORING LOCATION AND NUMBER

P1 - APPROXIMATE PHOTOGRAPH LOCATION AND NUMBER

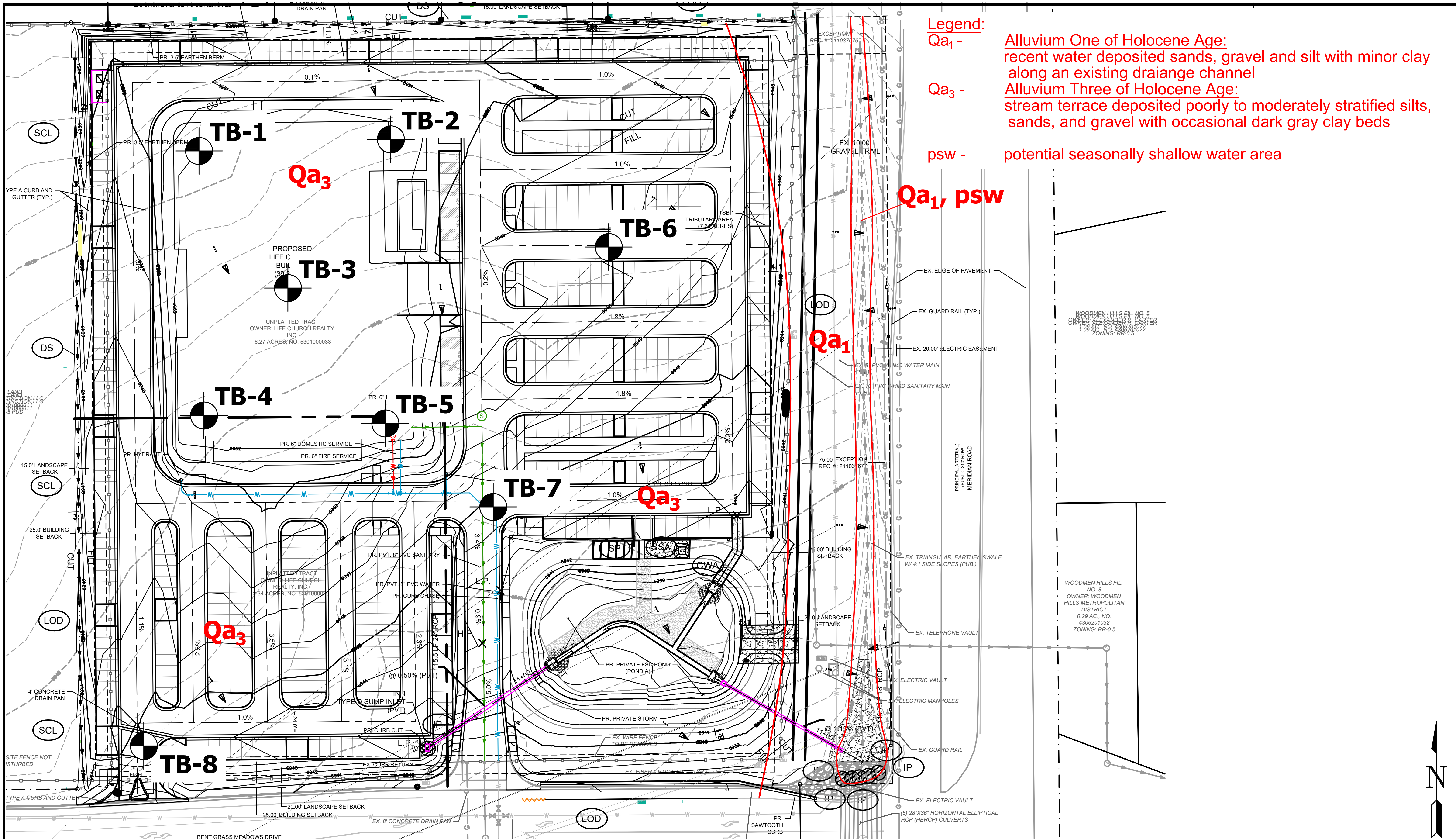
ENTECH ENGINEERING, INC.

SITE AND EXPLORATION PLAN

LIFE CHURCH AT BENT GRASS NORTH
FAL REALTY LLC

JOB NO.
241719

FIG. 2



TB- APPROXIMATE TEST BORING LOCATION AND NUMBER

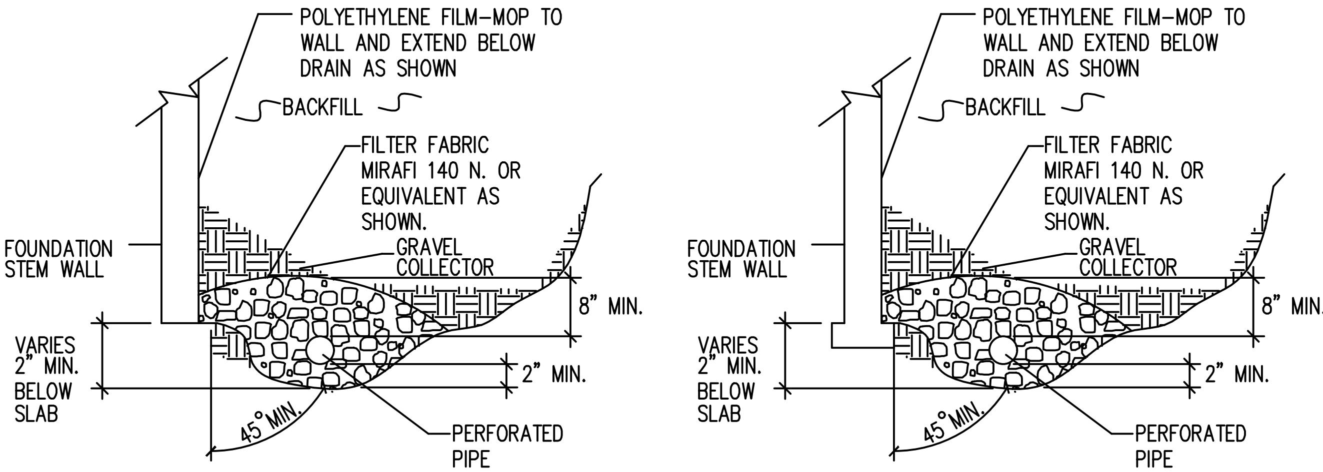
ENTECH ENGINEERING, INC.

ENGINEERING GEOLOGY MAP

LIFE CHURCH AT BENT GRASS NORTH
FAL REALTY LLC

JOB NO. 241719

FIG. 3



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.

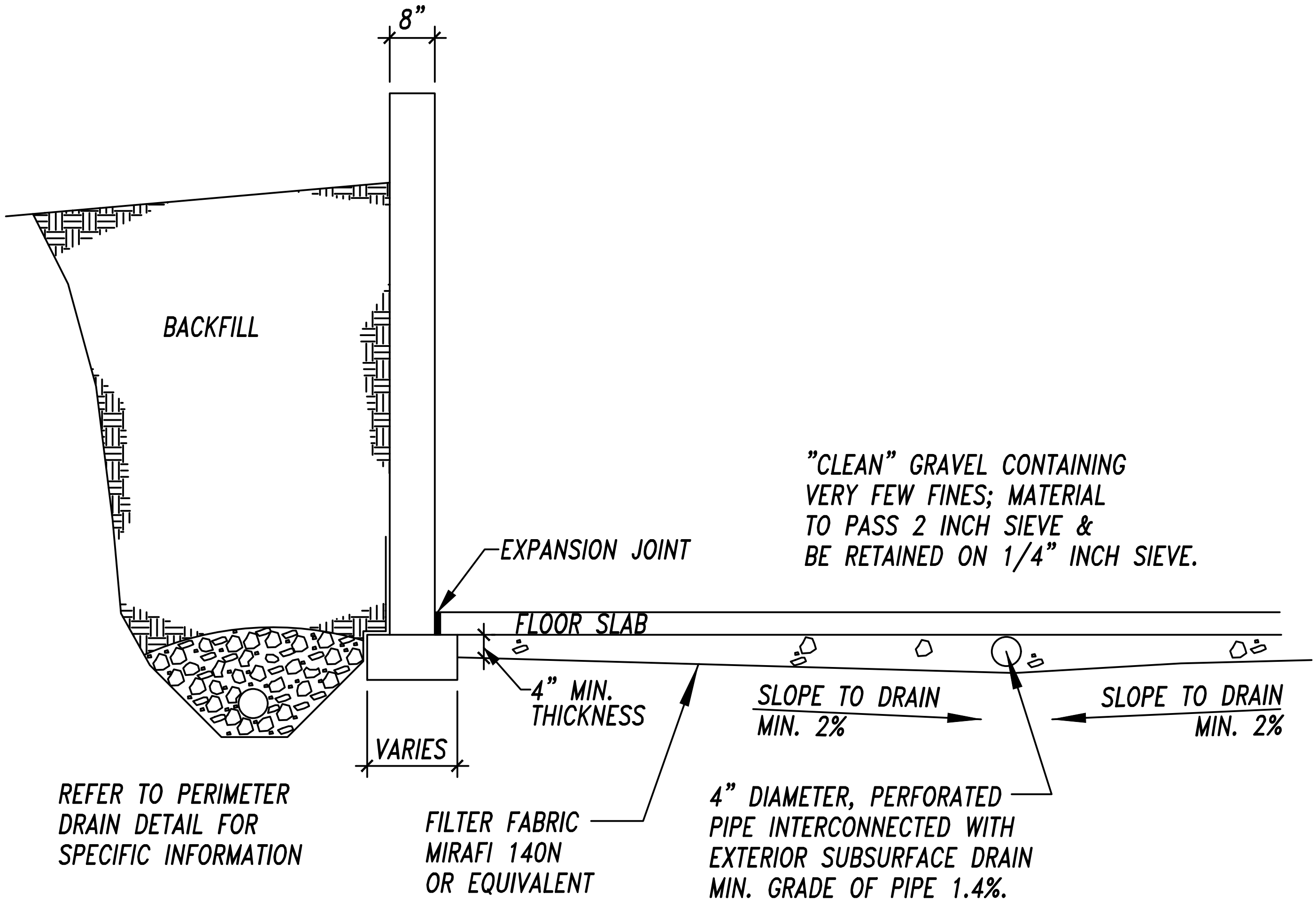
–ALL PIPE SHALL BE PERFORATED PLASTIC. THE DISCHARGE PORTION OF THE PIPE SHOULD BE NON–PERFORATED PIPE.

–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.	**PERIMETER DRAIN DETAIL** LIFE CHURCH AT BENT GRASS NORTH FAL REALTY LLC	JOB NO. 241719 **FIG. 4**



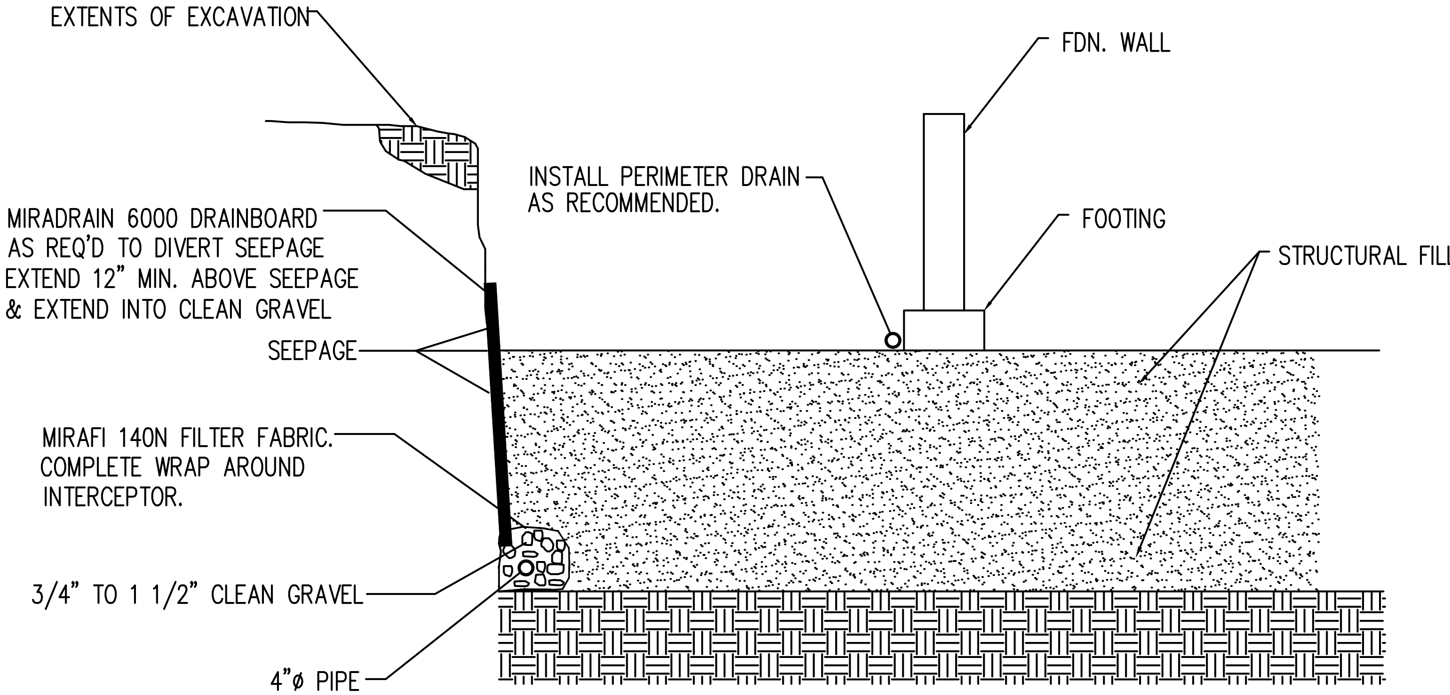
ENTECH ENGINEERING, INC.

UNDERSLAB DRAIN DETAIL

LIFE CHURCH AT BENT GRASS NORTH
FAL REALTY LLC

JOB NO.
241719

FIG. 5



NOTE:
EXTEND INTERCEPTOR DRAIN TO UNDERDRAIN OR TO SUMP.
BENCH DRAIN INTO NATIVE SOILS 12 INCHES MINIMUM.

INTERCEPTOR DRAIN DETAIL

N.T.S.

ENTECH ENGINEERING, INC.	**INTERCEPTOR DRAIN DETAIL** LIFE CHURCH AT BENT GRASS NORTH FAL REALTY LLC	JOB NO. 241719 **FIG. 6**

APPENDIX A: Site Photographs

1

Looking east from the southwest side of the site.

July 7, 2026

2

Looking northeast from the southwest side of the site.

July 7, 2026

3

Looking north from the southwest side of the site.

July 7, 2026

4

Looking west from the northeastern side of the site.

July 7, 2026

5

Looking southwest from the northeastern side of the site.

July 7, 2026

6

Looking south from the northeastern side of the site.

July 7, 2026

ENTECH
ENGINEERING, INC.

APPENDIX B: Entech Engineering, Inc., Geotechnical and Pavement Design Report, Life Church at Bent Grass North, Entech Job No. 241719

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505 ELKTON DRIVE
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GEOTECHNICAL AND PAVEMENT DESIGN REPORT
LIFE CHURCH AT BENT GRASS NORTH
PARCEL NOS. 53010-00-026 & 53010-00-033
FALCON, COLORADO

Prepared for:

Seed Development Services, LLC
8th Floor, Two Leadership Square
211 N. Robinson Ave,
Oklahoma City, OK 73102

Attn: Brett Harrington

November 11, 2024

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Zachary C. Gutierrez

Zachary C. Gutierrez, E.I.T.
Geotechnical Engineering Staff

Reviewed by:

COLORADO LICENSED
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52381
PROFESSIONAL ENGINEER

Joseph C. Goode III, P.E.
Sr. Engineer

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Figures

List of Appendices

1 Introduction

Entech Engineering Inc. (Entech) completed this geotechnical and pavement design for a new church and associated site improvements in Falcon, Colorado. This report describes the subsurface exploration program conducted for the planned commercial building and provides recommendations for foundation design, pavement sections, and construction considerations. Our services were completed for Seed Development Services, LLC in accordance with our geotechnical services and pavement design service agreement dated September 25, 2024. The contents of this report, including the geotechnical evaluation and recommendations, are subject to the limitations and assumptions presented in Section 8.

2 Project and Site Description

The project will consist of the construction of a new church and associated site improvements to be located northwest of Meridian Road and Bent Grass Meadows Drive in Falcon, Colorado. The location of the project site is shown on the Vicinity Map (Figure 1).

At the time of drilling, the property was a relatively flat vacant lot. Vegetation consisted of field grasses and weeds. Undeveloped land is located to the west with residential neighborhoods to the north and east and commercial property to the south of the proposed site. Building loads are expected to be light to moderate.

3 Subsurface Explorations and Laboratory Testing

3.1 Subsurface Exploration Program

Subsurface conditions at the project site were explored by eight test borings, designated TB-1 through TB-8, drilled on October 16 and 17, 2024 at the approximate locations shown on the Site and Exploration Plan (Figure 2). Five borings were drilled in the proposed building footprint and three additional borings were drilled in the parking lot and drive lanes to provide pavement design recommendations. The borings drilled in the building footprint were drilled to depths of 20 feet below the ground surface (bgs), and the borings drilled in the parking and drive areas were drilled to depths of 10 feet bgs. The drilling was performed using a truck-mounted, continuous-flight auger drill rig supplied and operated by Entech. Descriptive boring logs providing the lithologies of the subsurface conditions encountered during drilling are presented in Appendix A. Soil and bedrock samples were obtained from the borings utilizing the Standard Penetration Test (ASTM

D1586) using a split-barrel 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 type. The soil and bedrock type numbers are included on the boring logs. It should be understood that soil and bedrock descriptions shown on the boring logs may vary between boring location and sample depths. It should also be noted that the lines of stratigraphic separation shown on the boring logs represent approximate boundaries between soil and bedrock types, and the actual stratigraphic transitions may be more gradual or variable with location.

3.2 Laboratory Testing

Water content testing (ASTM D2216) was performed on the samples recovered from the borings, and the results are shown on the boring logs. Grain-Size Analysis (ASTM D422) and Atterberg Limits testing (ASTM D4318) were performed on selected samples to assist in classifying the materials encountered in the borings. One-dimensional swell/collapse testing (ASTM D4546) was performed to evaluate the expansive characteristics and collapse potential characteristics. Soluble sulfate testing was performed on select soil samples to evaluate the potential for below-grade degradation of concrete due to sulfate attack.

For pavement design, a Standard Proctor (ASTM D698) and California Bearing Ratio (CBR) test (ASTM D1883) were completed on a bulk sample from the roadway subgrade. The Laboratory Testing Results are presented in Appendix B and summarized in Table B-1.

4 Subsurface Conditions

Two primary soil types and two bedrock types were encountered in the test borings drilled for the subsurface investigation. Each soil type was classified in accordance with the Unified Soil Classification System (USCS) and the American Association of State Highway and Transportation Officials (AASHTO) soil classification system using the laboratory testing results and the observations made during drilling.

4.1 Soil and Bedrock

Topsoil was encountered across the site and is generally anticipated to be on the order of 6 inches thick.

Soil Type 1 classified as clayey sand, silty sand, and sand with silt (SM, SC, SW-SM). The loose to medium-dense sands were encountered in all test borings underlying the topsoil to depths of 3 to 10 feet bgs. One-dimensional swell or collapse testing on a sample of sandy clay resulted in a volume change of -0.4% to 0.0% indicating low swell and collapse potential.

Soil Type 2 classified as native sandy clay (CL). The hard native clay was encountered in TB-1 at a depth of 8 feet bgs and extended to a depth of 12 feet bgs. One-dimensional swell or collapse testing on a sample of sandy clay resulted in a volume change of -0.1% indicating low collapse potential.

Soil Type 3 classified as sandstone bedrock of the Dawson formation, or very dense clayey sand, silty sand, and sand with clay when classified as a soil (SC, SM, SW-SC). The sandstone bedrock was encountered in all test borings except TB-6 at depths ranging from 3 to 12 feet bgs and extended to the termination depth of each boring, 20 feet bgs. The sandstone is expected to have a low potential for expansion or collapse.

Soil Type 4 classified as claystone bedrock of the Dawson formation, or hard sandy clay when classified as a soil (CL). The claystone was encountered in TB-2 underlying the Soil Type 1 and extended to 12 feet bgs. The claystone is expected to have a moderate potential for expansion or collapse.

For pavement design each soil type was classified using the AASHTO soil classifications system. Each soil type and corresponding AASHTO classification is listed below.

- Soil Type 1: A-2-4, A-1-b
- Soil Type 2: A-6
- Soil Type 3: A-2-4, A-1-b
- Soil Type 4: A-6

4.2 Groundwater

Groundwater was encountered in borings TB-1 through TB-5 and TB-8 during our subsurface exploration program at depths ranging from 4.5 to 13 feet bgs. Shallow groundwater encountered on-site will need to be addressed as discussed in Sections 5.1, 5.4, and 7.1.2. Groundwater was measured at depths ranging from 6.5 to 13 feet bgs within the proposed building pad. 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 Geotechnical Evaluation and Recommendations

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

As discussed in Section 2, we understand that the site will be developed with a new church and associated site improvements. The proposed structure is expected to be supported on a shallow foundation system. Anticipated subsurface conditions will consist of native or recompacted silty sand.

5.1 Shallow Foundations

The proposed structure may be supported with shallow spread footing foundations placed on native silty sand, recompacted on-site granular material, or sandstone. We recommend that shallow foundations be founded a minimum of 3 feet above groundwater (maximum depth of 3.5 feet bgs). Depending on the conditions observed during the excavation, additional drains such as interceptor drains or a slab underdrain may be recommended.

The Dawson formation bedrock commonly includes interbedded expansive claystone layers. Cohesive soils and interbedded claystone may be encountered during subgrade preparation and, if encountered, should be overexcavated and prepared as discussed in Section 7.1.1.

Refer to Exhibit 1 below for recommended allowable bearing capacity values by subgrade type. Shallow foundations shall not be placed on uncontrolled fill or expansive soils or bedrock; refer to Section 7.1.1 for further discussion.

A spread footing (16”) stemwall foundation system is anticipated for this site. Subgrades should be prepared as discussed in Section 7.1.1. Refer to Exhibit 1 for the recommended allowable bearing capacity values. Shallow foundations shall not be placed on differential bearing capacities, loose granular soil, cohesive soil, or uncontrolled fill. Actual bearing capacities will be verified at the time of the open excavation observation (Section 7.9).

Foundation walls should be designed to resist lateral pressures generated by the soils used for wall backfill. Recommended active equivalent fluid density parameters for the on-site granular soils are provided in Exhibit 1. Clay/silt soils (more than 50% passing the No. 200 sieve) are not recommended for backfill against the walls. It should be noted that this value applies 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. Exterior footings should extend a minimum of 30 inches below the adjacent exterior site grade for frost protection.

Exhibit 1: Foundation Design Parameters

Design Parameter	Value
Allowable Bearing Capacity [1, 2]	
Sandstone Bedrock	3,000 psf
Medium-Dense Silty Sand or Recompacted Granular Fill	2,400 psf
Lateral Earth Pressure Equivalent Fluid Density [3]	
Active Conditions - Granular Backfill	40 pcf

pcf = pounds per cubic foot; psf = pounds per square foot

Notes:

1. Assumes a minimum embedment of 30 inches for frost protection.
2. Up to 1 inch of total settlement and ½ inch of differential settlement is anticipated for the bearing capacity value provided, assuming subgrades are prepared in accordance with Section 7.
3. Assumes level backfill conditions.

5.2 On-Grade Floor Slabs

On-grade floor slabs for the planned structures should be supported on compacted site or imported granular soils prepared in accordance with Section 7.1.1, and any loose soils or uncontrolled fill encountered will require removal.

Grade-supported floor slabs should be separated from other building structural components and utility penetrations to allow for possible future vertical movement. Interior partition walls should be constructed in such a manner so as not to transfer slab movement into the overlying floor(s) and/or roof members, should slab movement occur. Control joints in grade-supported slabs are recommended at 10- to 15-foot perpendicular spacings to control cracking. If slab movement cannot be tolerated, a structural floor system should be used.

5.3 Seismic Site Classification

Based on the subsurface conditions encountered at the site, and in accordance with Section 1613 of the 2021 *International Building Code* (IBC), the site meets the conditions of a Site Class D.

5.4 Surface and Subsurface Drainage

Positive surface drainage is recommended around the building's perimeter to minimize infiltration of surface water into the supporting foundation soils. A minimum ground surface slope of 5% 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% 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. 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.

Perimeter drains are recommended for usable space below grade (areas where the interior slab or bottom of the crawl space is below the exterior grade). A typical perimeter drain detail is shown in Figure 3. Additional drains, such as interceptor drains or a slab underdrain may be recommended if groundwater is encountered within 3.5 feet of the bottom of foundation components.

6 Pavement Design Recommendations

Pavement design recommendations were made in accordance with the *El Paso County Engineering Criteria Manual.*

6.1 Pavement Subgrade Conditions

Three test borings (TB-6, TB-7, and TB-8) were drilled to depths of approximately 10 feet below the existing subgrade surface in the parking lot and drive lanes. The soils at the roadway subgrade depth consisted of silty sand to sand with silt. The native sands, classified as A-2-4 using the

AASHTO classification system, were considered for pavement subgrades based on the laboratory testing.

California Bearing Ratio (CBR) testing was performed on a representative bulk sample of the silty sand (Soil Type 1) from TB-8 to determine the support characteristics of the subgrade soils for the pavement sections. The results of the CBR testing are presented in Appendix B and summarized in Exhibit 2.

Exhibit 2: Pavement Subgrade Laboratory Summary

Design Parameter	Value
Soil Type	1-Silty Sand
CBR at 95%	21.0
Design CBR	10
Liquid Limit	NV
Plasticity Index	NP
Percent Passing 200	17.8
AASHTO Classification	A-2-4
Group Index	0
Unified Soils Classification	SM

6.2 Swell Mitigation

El Paso County recommendations require swell mitigation of expansive soils criteria for roadway subgrade with swell testing results greater than 2% under a 150 pounds per square foot (psf) surcharge. Based on the classification of the soils, mitigation for expansive soils is not expected to be required on this site. However, due to shallow Dawson formation bedrock encountered, on-site cohesive soils or claystone may be encountered and swell mitigation may be required.

6.3 Traffic Loading

Traffic data is not available for the parking lot and access road. Based on the Colorado Asphalt Pavement Association (CAPA) *Guideline for the Design and Construction of Asphalt Parking Lots in Colorado* (2006), an 18-kip equivalent single axle loading (ESAL) of 100,000 is appropriate for moderate traffic level which includes passenger cars and light trucks.

6.4 Pavement Designs

The recommended flexible pavement sections were determined utilizing the *El Paso County Engineering Criteria Manual*, the CBR testing, and design ESAL value. Design parameters used in the pavement analysis are presented in Exhibit 3.

Exhibit 3: Pavement Design Parameters

Design Parameter	Value
Reliability	80%
Standard Deviation	0.45
Serviceability Loss (Δ psi)	2.0
Design CBR	10
Resilient Modulus	15,000 psi
Standard Deviation	0.44
Structural Coefficients	
Hot Bituminous Pavement	0.44
Aggregate Base Course	0.11
Recycled Concrete Base	0.11

Pavement sections are presented below in Exhibit 4. Any additional grading may result in subgrade soils with different support characteristics. The following pavement sections should be re-evaluated if additional grading is performed.

Exhibit 4: Recommended Pavement Sections

Pavement Area	Design ESAL	Alternative[1]
Parking Areas and Drive Lanes	100,000	1. 4.0 inches HMA over 4.0 inches ABC/RCB

ABC = Aggregate Base Course; ESAL = equivalent single axle loads; HMA = Hot Mix Asphalt; RCB = Recycled Concrete Base

Notes:

1. The pavement alternatives meet the minimum sections required per the *El Paso County Engineering Criteria Manual.*

7 Construction Recommendations

7.1 Earthwork Recommendations for Structures

7.1.1 Subgrade Preparation

If loose materials are encountered during subgrade preparation, they should be overexcavated to suitable, dense underlying soils and recompacted in place or replaced with granular fill (Section 7.1.4 and 7.1.5). All soil beneath the foundation and slabs should be free of organics, debris, and cobbles larger than 3 inches in diameter. Shallow groundwater, if encountered, should be addressed as discussed in 7.1.2.

The foundation should be supported by soils with a similar bearing capacity (i.e., entirely on sand or entirely on sandstone bedrock). If the majority of the foundation is supported by sandstone and a relatively small portion supported by sand, the sand should be stepped down in order for the foundation to bear on sandstone, or the sand can be overexcavated and recompacted to a minimum of 95% of the Modified Proctor (ASTM D1557) maximum dry density. Similarly, if the foundation subgrade is primarily medium-dense sand, any sandstone encountered should be overexcavated a minimum of 2 feet and replaced with recompacted site granular material.

Prior to site earthwork, any ponded water should be drained and surface runoff should be directed away from earthwork areas. If water is allowed to sit, pond, or infiltrate into the foundation subgrade, it will likely create unstable subgrade conditions.

7.1.2 Shallow Groundwater

If shallow groundwater is encountered during subgrade preparation, we recommend overexcavating 6 to 12 inches below the base of foundation elements, pushing 2- to 4-inch shot rock into the subgrade for stabilization, as required, followed by a layer of Tensar BX1200 geogrid (or equivalent). The stabilization should extend a minimum of 2 feet beyond footings. We then recommend placing compacted granular fill in accordance with Section 7.1.4 and 7.1.5. After placement of backfill, the subgrade should be proof-rolled and evaluated to ensure that subgrade is not pumping. Based on the groundwater conditions encountered at the time of excavation, dewatering methods may be required. This could include diversion ditches, pumping, or capillary drains. Additional subsurface drains, such as interceptor drains or a slab underdrain, may be recommended, and should be determined at the time of our construction observation.

7.1.3 Swell Mitigation

Expansive cohesive soils were not encountered on-site, however, expansive claystone is commonly interbedded in sandstone bedrock. An exploratory boring or test pit should be completed from the final subgrade elevation and slab-on-grade elevation to a depth of 4 feet. Expansive soils or bedrock must be penetrated or removed and replaced with recompacted granular fill (Section 7.1.4 and 7.1.5) if encountered during subgrade preparation or on-grade floor slab elevation. An overexcavation depth of 4 feet is anticipated where expansive soils are encountered, however the depth of overexcavation, if needed, should be determined at the time of the excavation observation on each lot.

If required, overexcavations should extend laterally beyond planned footings a minimum distance equal to the depth below planned footings (e.g. a 4-foot overexcavation should extend 4 feet beyond the edge of the foundation). The final overexcavation subgrade should be scarified a minimum of 8 inches, moisture conditioned 0 to +3% and be compacted to a minimum of 95% of the Standard Proctor (ASTM D698) for cohesive soils or bedrock or Modified Proctor (ASTM D1557) maximum dry density for cohesionless materials, respectively.

7.1.4 Granular Fill

Granular fill placed beneath foundation components and floor slabs shall consist of nonexpansive, granular soil free of organic matter, unsuitable materials, debris, and cobbles greater than 3 inches in diameter. On-site granular soils or properly processed sandstone may be used as granular fill. Entech should approve any imported granular or structural fill to be used within the foundation area prior to delivery to the site.

7.1.5 Fill Placement and Compaction

All granular fill placed within the foundation area should be compacted to a minimum of 95% of the Modified Proctor (ASTM D1557) maximum dry density at +/- 2% of optimum moisture content. Fill material should be placed in horizontal lifts such that each finished lift has a compacted thickness of 6 inches or less as determined by ASTM D1557. Mechanical methods can be used for placement and compaction of fill; however, heavy equipment should be kept at a 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.

Fill placement and compaction beneath and around foundations should be observed and tested by Entech during construction. Density tests should be performed frequently to verify compaction with the first density test performed at the overexcavated subgrade elevation and with additional testing once each 12 to 18 inches of granular fill has been placed.

7.2 Pavements

Pavement design recommendations provided herein are contingent on good construction practices, and poor construction techniques may result in poor performance. Our analyses assumed that this project will be constructed according to the *El Paso County Engineering Criteria Manual* and the *Pike Peak Regional Asphalt Paving Specifications*.

7.2.1 Pavement Subgrade Preparation

Proper subgrade preparation is required for adequate pavement performance. Paving areas should be cleared of all deleterious materials including but not limited to: existing pavements, utility poles, and fence poles. Surface vegetation should be removed by stripping, with the depth to be field determined.

The final subgrade surface should be scarified to a depth of 8 inches, a minimum of 95% of the Modified Proctor (ASTM D1557) maximum dry density at +/-2% of optimum moisture content. The compacted surface below pavements should be proof-rolled with a fully loaded, tandem-axle, 10-yard dump truck or equivalent. Any areas that are delineated to be soft, loose, or yielding during proof-rolling should be removed and reconditioned or replaced.

7.2.2 Aggregate Base Course and Recycled Concrete Base

ABC or RCB materials shall conform to the *El Paso County Standard Specifications Manual*, Section 300 Aggregate Base Course. ABC or RCB materials should be compacted to a minimum of 95% of the Modified Proctor (ASTM D1557) maximum dry density within +/-2% of optimum moisture content.

7.3 Excavation Potential

Excavation of the upper granular soils should be feasible with rubber-tired equipment.

7.4 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).

7.5 Utility Trench Backfill

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.

Fill placement and compaction in utility trenches should be observed and tested by Entech during construction. Fill should be placed in horizontal lifts having a compacted thickness of 6 inches or less and at a water content conducive to adequate compaction, within +/-2% of optimum water content. No water flooding techniques of any type should be used for compaction or placement of utility trench fill.

7.6 General Backfill

Any areas to receive general grading fill 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, a minimum of 95% of the Modified Proctor (ASTM D1557) maximum dry density at +/-2% of optimum moisture content or the Standard Proctor (ASTM D698) for cohesive soils before the addition of new fill. Fill should be placed in thin lifts not to exceed 6 inches in thickness. Fill material should be free of vegetation and other unsuitable material and should not contain cobbles or fragments larger 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, or beneath roadways or other structural features of the project should be observed and tested by Entech during construction.

7.7 Concrete Degradation Due to Sulfate Attack

Sulfate solubility testing was conducted on several samples recovered from the test borings to evaluate the potential for sulfate attack on concrete placed below surface grade. The test results indicated less than 0.01 and 0.00% soluble sulfate (by weight). 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 1L or Type II cement is recommended for concrete on the 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.

7.8 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 the burial of snow, ice, or frozen material within the planned construction area.

7.9 Foundation Excavation and Construction Observation

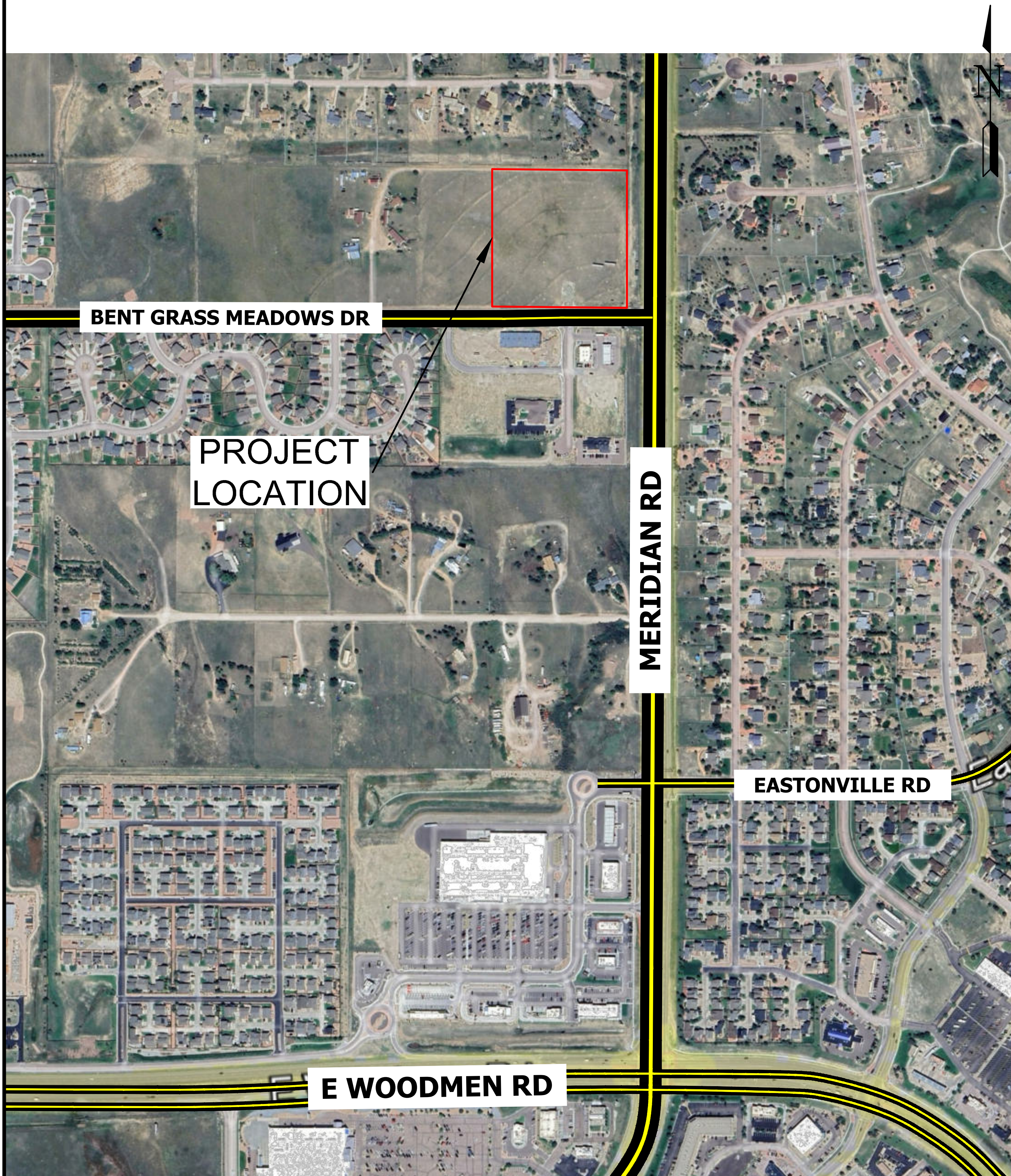
Subgrade preparation for building foundations should be observed by Entech prior to construction of the footings and floor slabs in order to verify that (1) no anomalies are present, (2) materials similar to those described in this report have been encountered or placed, and (3) no soft spots, expansive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

In addition, Entech should observe and document placement and compaction of utility bedding and trench backfill.

8 Closure

The subsurface investigation, geotechnical evaluation, and recommendations presented in this report are intended for use by Seed Development Services, LLC with application to the planned new construction of a church located in Falcon, 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 the 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 to 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.



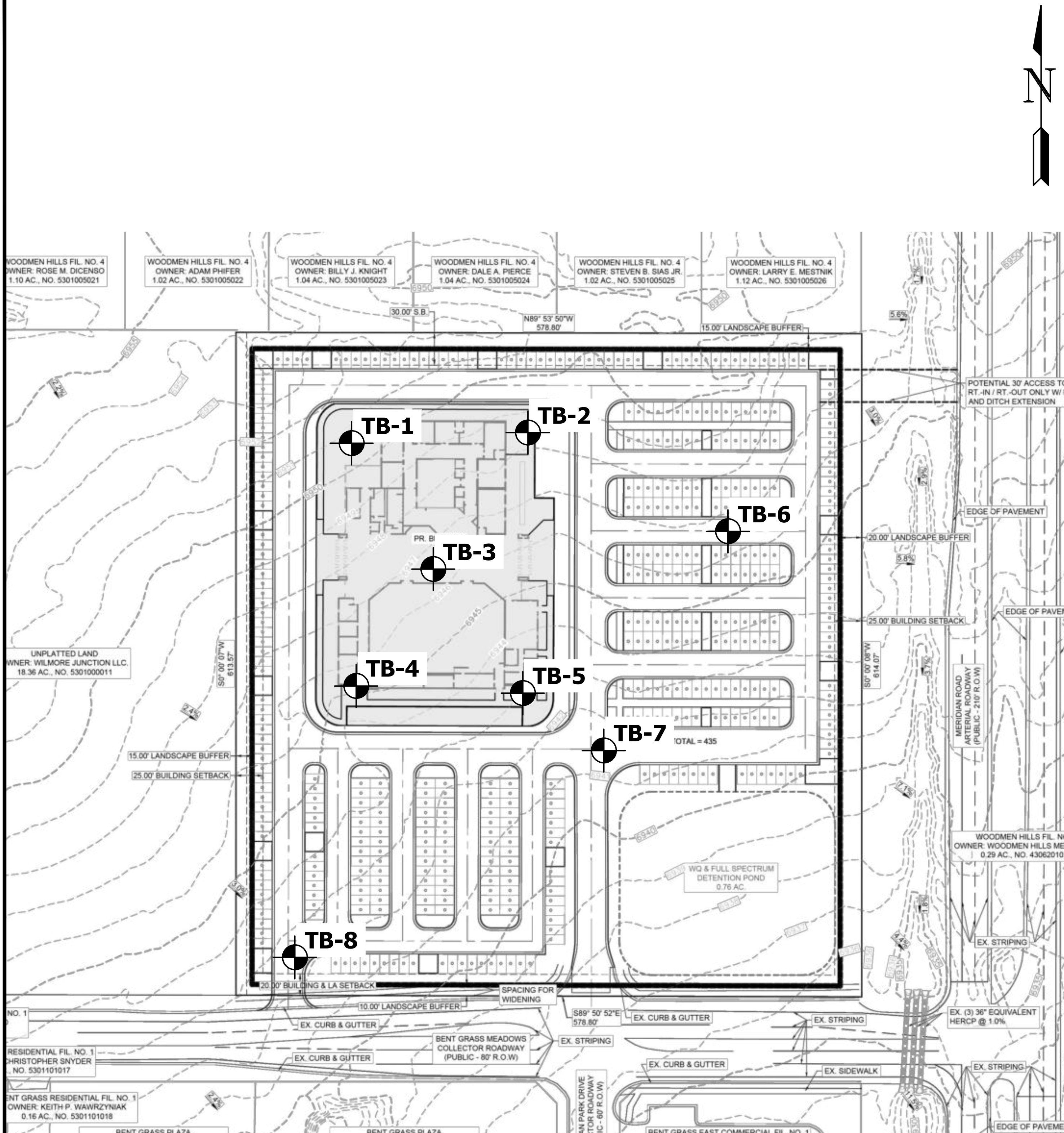
ENTECH ENGINEERING, INC.

VICINITY MAP

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

JOB NO. 241719

FIG. 1



TB- APPROXIMATE TEST BORING LOCATION AND NUMBER

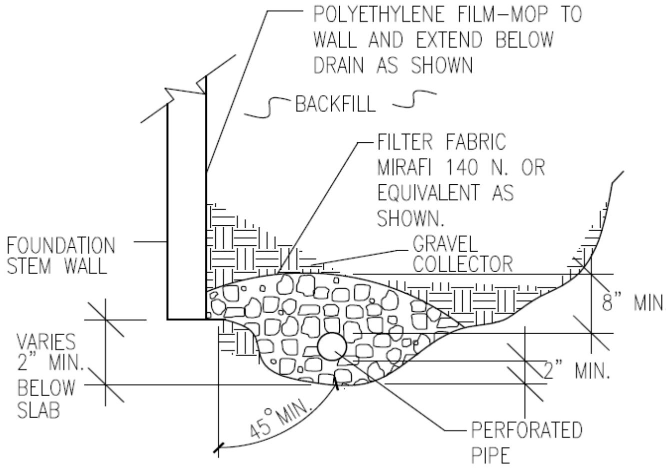
ENTECH ENGINEERING, INC.

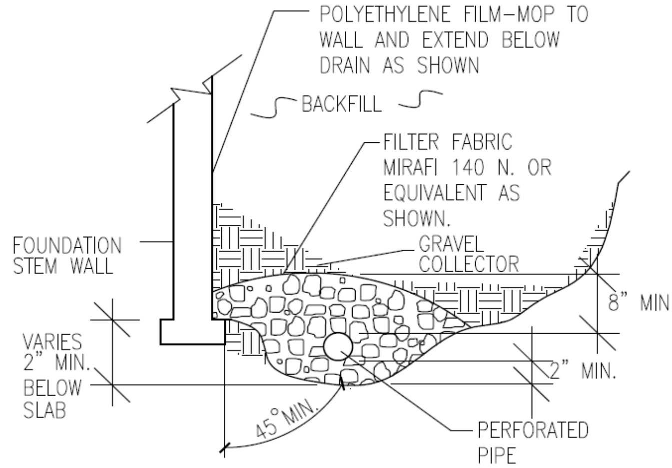
SITE AND EXPLORATION MAP

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

JOB NO.
241719

FIG. 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.	**PERIMETER DRAIN DETAIL** LIFE CHURCH AT BENT GRASS NORTH SEED DEVELOPMENT SERVICES	JOB NO. 241719 **FIG. 3**

ENTECH
ENGINEERING, INC.

APPENDIX A: Test Boring Logs

TEST BORING 1
DATE DRILLED 10/16/2024
REMARKS

WATER @ 13', 10/31/24

Description	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
6" TOPSOIL SAND, WITH SILT, TAN to LIGHT BROWN, MEDIUM DENSE, DRY to MOIST				24	1.6	1
	5			26	5.9	1
CLAY, SANDY, LIGHT BROWN, HARD, MOIST (CLAYSTONE, VERY WEAK, HIGHLY WEATHERED)	10			41	12.3	2
SANDSTONE, VERY WEAK, GRAY, HIGHLY WEATHERED (SAND, CLAYEY, VERY DENSE, MOIST)	15			50/7"	8.4	3
	20			50/5"	9.6	3

TEST BORING 2
DATE DRILLED 10/16/2024
REMARKS

WATER @ 6.5', 10/31/24

Description	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
6" TOPSOIL SAND, SILTY, TAN, DENSE to MEDIUM DENSE, DRY to MOIST				34	1.5	1
	5			18	5.8	1
CLAYSTONE, VERY WEAK, TAN, HIGHLY WEATHERED (CLAY, SANDY, HARD, MOIST)	10			50/9"	13.4	4
SANDSTONE, WEAK, GRAY, COMPLETELY WEATHERED (SAND, SILTY, VERY DENSE, MOIST to WET)	15			50/6"	10.7	3
	20			50/6"	27.5	3

ENTECH ENGINEERING, INC.

TEST BORING LOGS

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

JOB NO. 241719

FIG. A-1

TEST BORING 3
DATE DRILLED 10/17/2024

REMARKS

WATER @ 7.5', 10/31/24

Description	Depth (ft)	Samples	Blows per foot	Watercontent %	Soil Type
6" TOPSOIL					
SAND, WITH SILT, TAN to BROWN, MEDIUM DENSE, DRY to MOIST		■	23	2.1	1
	5	■	19	5.4	1
SANDSTONE, VERY WEAK, BROWN to GREEN-GRAY, HIGHLY WEATHERED (SAND, SILTY, VERY DENSE, MOIST)	10	■	50/8"	13.2	3
	15	■	50/9"	8.3	3
	20	■	50/9"	11.8	3

TEST BORING 4
DATE DRILLED 10/17/2024

REMARKS

WATER @ 10', 10/31/24

Description	Depth (ft)	Samples	Blows per foot	Watercontent %	Soil Type
6" TOPSOIL					
SAND, SILTY, BROWN, MEDIUM DENSE, DRY		■	23	1.6	1
SAND, CLAYEY, GRAY, MEDIUM DENSE, MOIST	5	■	27	9.3	1
SANDSTONE, VERY WEAK, GRAY to GREEN-GRAY, HIGHLY WEATHERED (SAND, SILTY, VERY DENSE, MOIST)	10	■	50/6"	9.7	3
	15	■	50/6"	9.4	3
	20	■	50/9"	13.8	3

ENTECH ENGINEERING, INC.

TEST BORING LOGS

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

JOB NO. 241719

FIG. A-2

TEST BORING 5
DATE DRILLED 10/17/2024
REMARKS
WATER @ 8', 10/31/24

6" TOPSOIL
SAND, SILTY, BROWN, MEDIUM DENSE, DRY

SANDSTONE, VERY WEAK, GRAY, MODERATELY WEATHERED (SAND, SILTY, VERY DENSE, MOIST)

Depth (ft)	Blows per foot	Watercontent %	Soil Type
	11	1.3	1
5	18	2.2	1
10	50/11"	10.0	3
15	50/10"	12.4	3
20	50/9"	11.8	3

TEST BORING 6
DATE DRILLED 10/17/2024
REMARKS
DRY TO 10', 10/31/24

6" TOPSOIL
SAND, CLAYEY, BROWN, MEDIUM DENSE to LOOSE, MOIST

Depth (ft)	Blows per foot	Watercontent %	Soil Type
	16	6.6	1
5	27	5.6	1
10	8	24.6	1

ENTECH ENGINEERING, INC.

TEST BORING LOGS

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

JOB NO.
241719

FIG. A-3

TEST BORING	7
DATE DRILLED	10/17/2024
REMARKS	DRY TO 10', 10/31/24

Description	Depth (ft)	Samples	Blows per foot	Watercontent %	Soil Type
6" TOPSOIL					
SAND, SILTY, BROWN, MEDIUM DENSE, DRY to MOIST		X	10	1.8	1
	5	X	19	7.2	1
SANDSTONE, VERY WEAK, BROWN, HIGHLY WEATHERED (SAND, CLAYEY, VERY DENSE, MOIST)	10	X	50/7"	11.1	3
	15				
	20				

TEST BORING	8
DATE DRILLED	10/17/2024
REMARKS	WATER @ 4.5', 10/31/24

Description	Depth (ft)	Samples	Blows per foot	Watercontent %	Soil Type
6" TOPSOIL					
SAND, WITH SILT, TAN, MEDIUM DENSE, DRY		X	24	2.0	1
SANDSTONE, VERY WEAK, BROWN, COMPLETELY WEATHERED (SAND, WITH CLAY, VERY DENSE, MOIST)	5	X	50/10"	10.6	3
	10	X	50/7"	11.7	3
	15				
	20				

ENTECH ENGINEERING, INC.

TEST BORING LOGS

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

JOB NO. 241719

FIG. A-4

TABLE A-1

DEPTH TO GROUNDWATER & BEDROCK

TEST BORING	DEPTH TO GROUNDWATER (ft.)	DEPTH TO BEDROCK (ft.)
1	13	12
2	6.5	12
3	7.5	7
4	10	8
5	8	8
6	>10	>10
7	>10	7
8	4.5	3

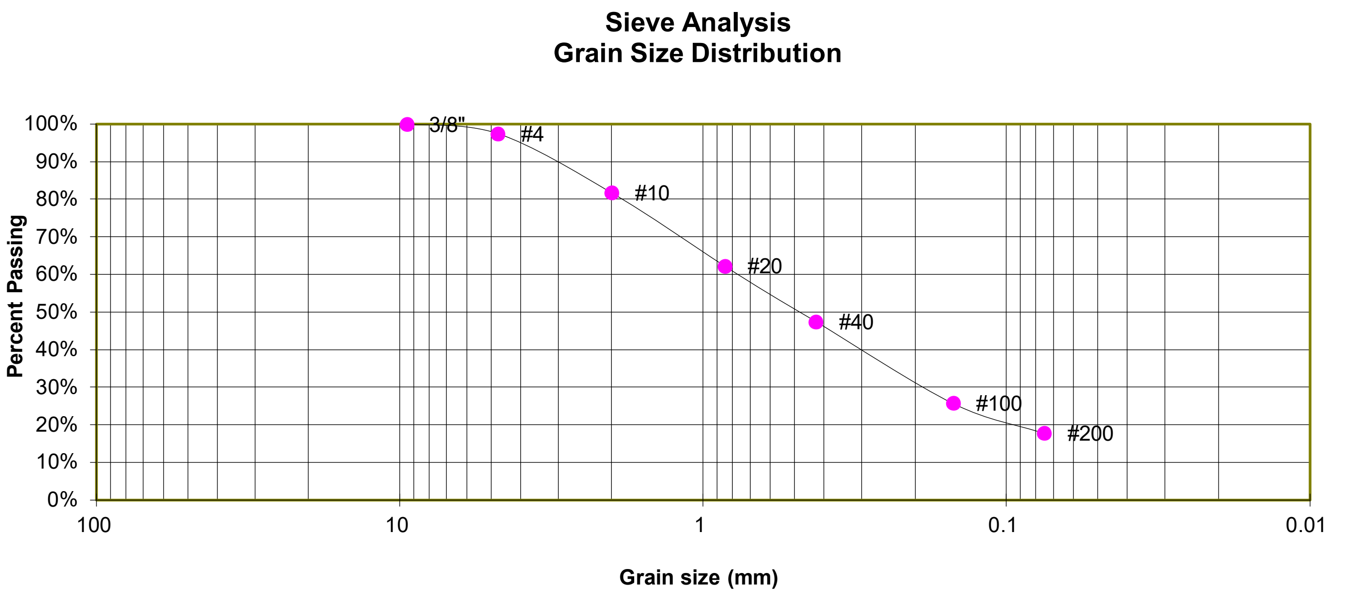
APPENDIX B: Laboratory Test Results

TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX	SULFATE (WT %)	SWELL/ COLLAPSE (%)	AASHTO CLASS. (GROUP INDEX)	USCS	SOIL DESCRIPTION
1, CBR	8	0-3	2.0		17.8	NV	NP	NP			A-2-4 (0)	SM	SAND, SILTY
1	1	2-3	1.6		7.7	NV	NP	NP	<0.01			SW-SM	SAND, WITH SILT
1	6	0-3	2.3		22.5	NV	NP	NP				SM	SAND, SILTY
1	3	5	5.4		10.9				0.00			SM	SAND, WITH SILT
1	4	5	11.1	114.5	49.4					-0.4		SC	SAND, CLAYEY
1	6	1-2	6.6		43.2	28	19	9			A-4 (1)	SC	SAND, CLAYEY
1	6	10	21.0	102.1	43.9	32	21	11	0.00	0.0	A-6 (2)	SC	SAND, CLAYEY
1	7	1-2	1.8		16.7	NV	NP	NP	<0.01		A-2-4 (0)	SM	SAND, SILTY
1	8	1-2	2.0		8.0	NV	NP	NP			A-1-b (0)	SW-SM	SAND, WITH SILT
2	1	10	13.2	117.6	58.7	36	24	12	0.00	-0.1	A-6 (5)	CL	CLAY, SANDY
3	8	5	10.6		10.8	32	23	9	<0.01		A-2-4 (0)	SW-SC	SANDSTONE (SAND, WITH CLAY)
3	5	10	10.0		23.9							SM	SANDSTONE (SAND, SILTY)
3	2	15	10.7		21.0	NV	NP	NP				SM	SANDSTONE (SAND, SILTY)
4	2	10	13.5	102.6	55.9	37	24	13	0.00			CL	CLAYSTONE (CLAY, SANDY)

Project: Life Church at Bent Grass North
Client: Seed Development
Job No: 241719

TEST BORING	8	SOIL DESCRIPTION	SAND, SILTY
DEPTH (FT)	0-3	SOIL TYPE	1, CBR



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.5%
10	81.7%
20	62.3%
40	47.4%
100	25.7%
200	17.8%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-2-4
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

JOB NO.
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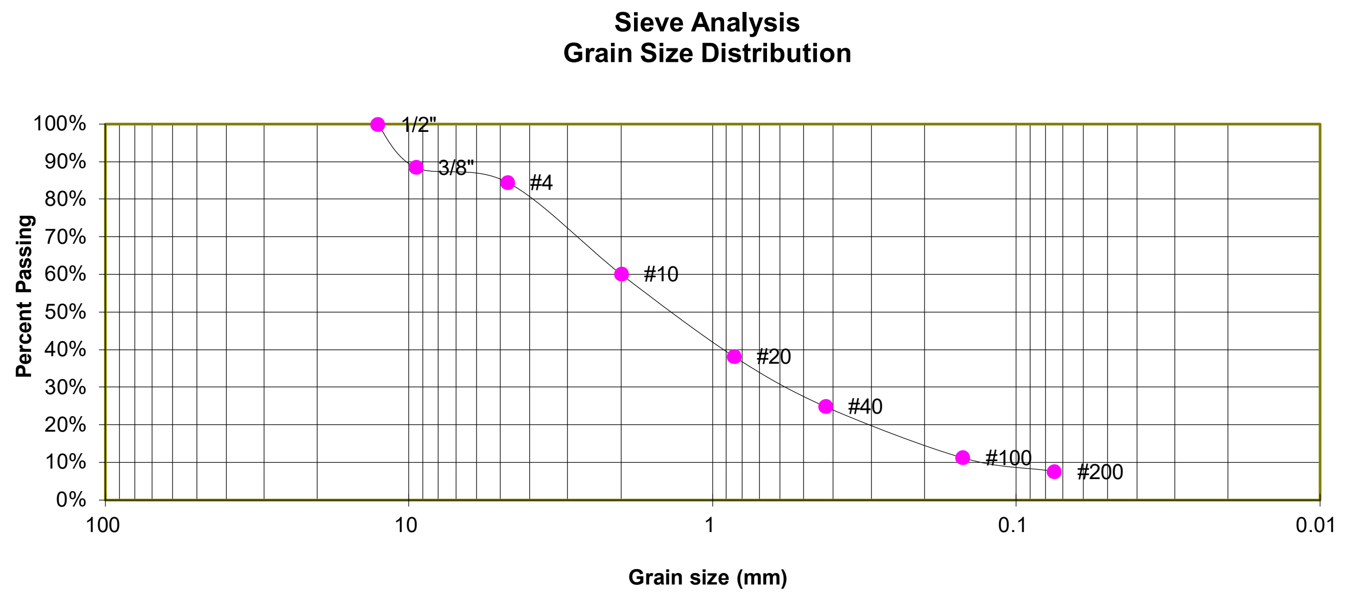
FIG. B-1

TEST BORING	1	SOIL DESCRIPTION	SAND, WITH SILT
DEPTH (FT)	2-3	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	88.5%
4	84.5%
10	60.1%
20	38.2%
40	24.9%
100	11.3%
200	7.7%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION: SW-SM

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

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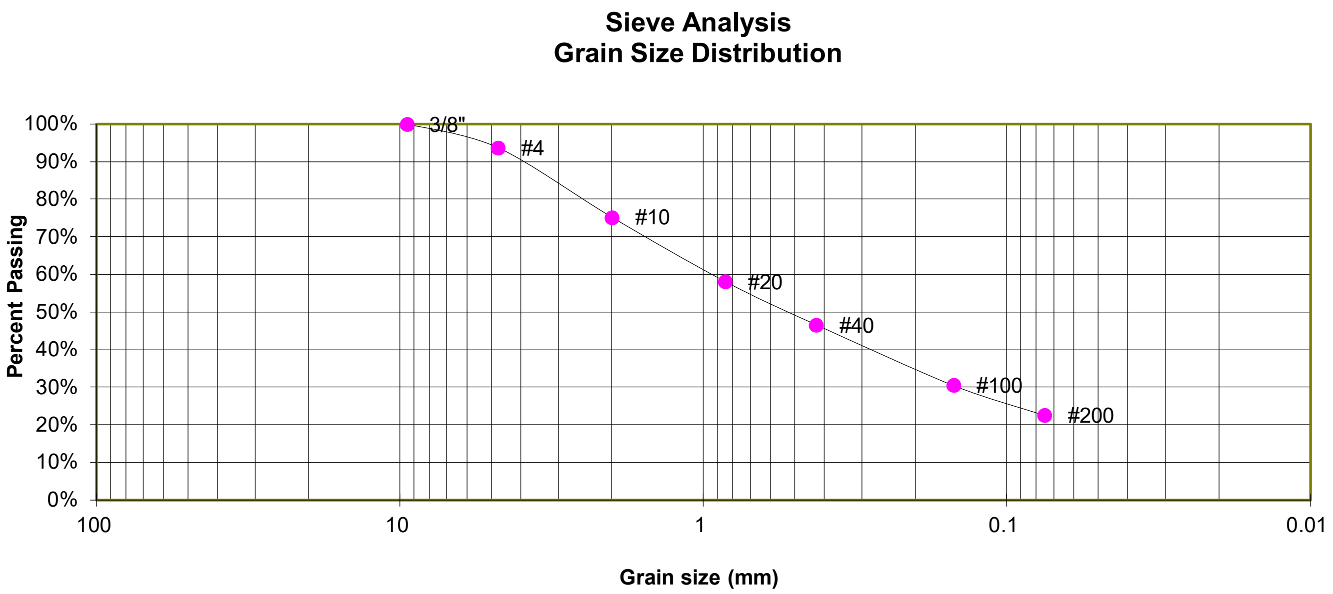
FIG. B-2

TEST BORING	6	SOIL DESCRIPTION	SAND, SILTY
DEPTH (FT)	0-3	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	93.7%
10	75.2%
20	58.2%
40	46.6%
100	30.6%
200	22.5%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-2-4
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

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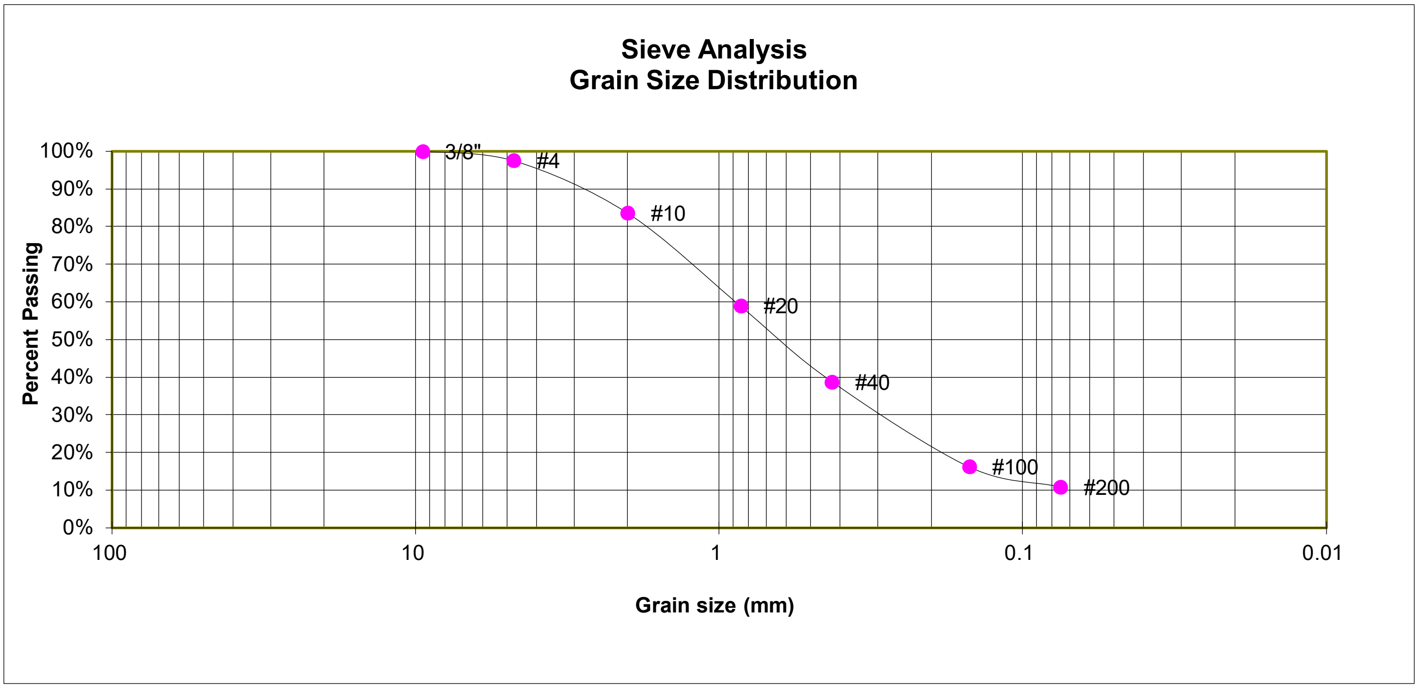
FIG. B-3

TEST BORING	3	SOIL DESCRIPTION	SAND, WITH SILT
DEPTH (FT)	5	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.5%
10	83.6%
20	58.9%
40	38.8%
100	16.3%
200	10.9%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SM

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

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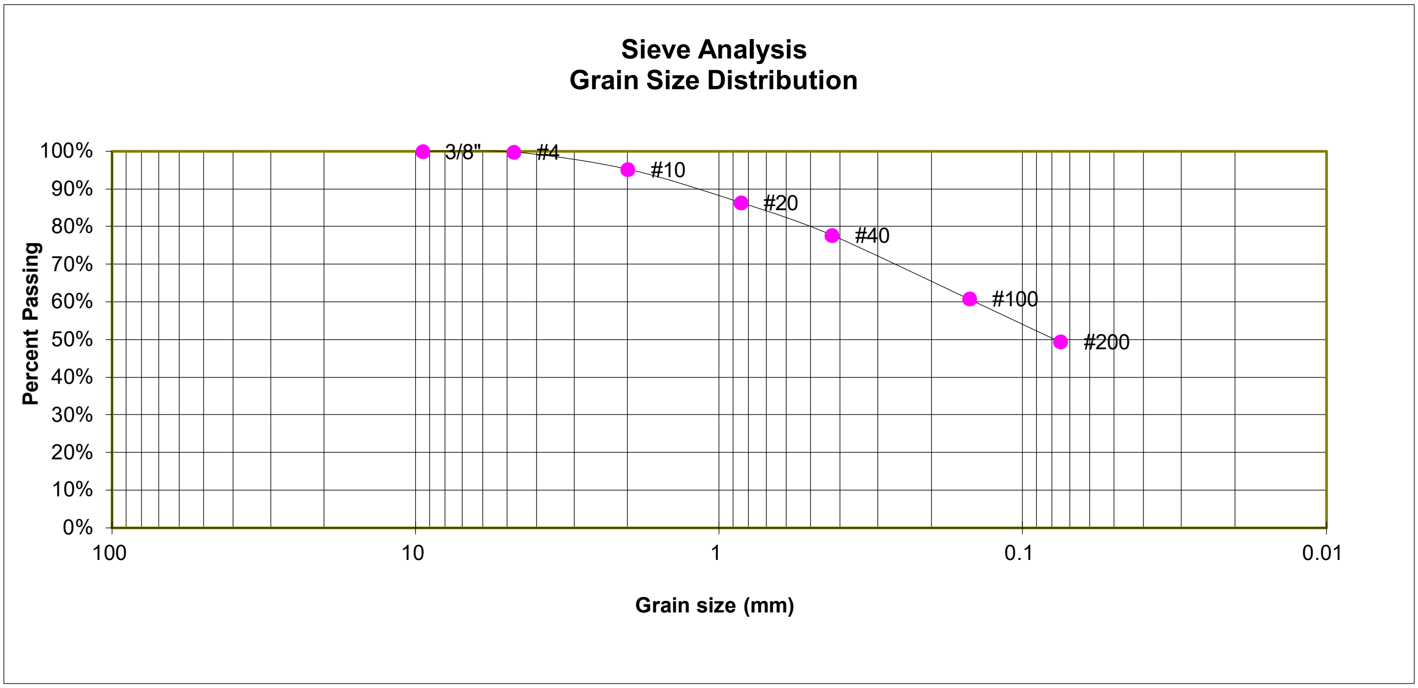
FIG. B-4

TEST BORING	4	SOIL DESCRIPTION	SAND, CLAYEY
DEPTH (FT)	5	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.8%
10	95.2%
20	86.4%
40	77.7%
100	60.8%
200	49.4%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SC

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

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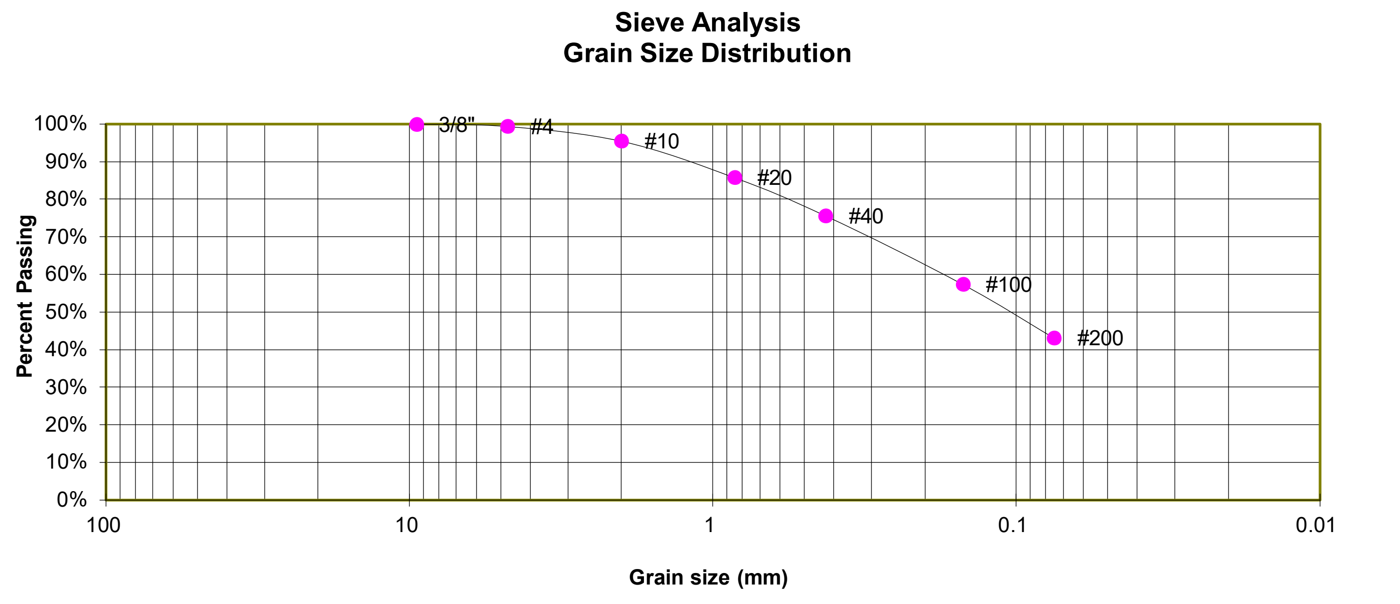
FIG. B-5

TEST BORING	6	SOIL DESCRIPTION	SAND, CLAYEY
DEPTH (FT)	1-2	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.4%
10	95.5%
20	85.8%
40	75.6%
100	57.4%
200	43.2%

ATTERBERG LIMITS

Plastic Limit	19
Liquid Limit	28
Plastic Index	9

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SC
AASHTO CLASSIFICATION:	A-4
AASHTO GROUP INDEX:	1

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

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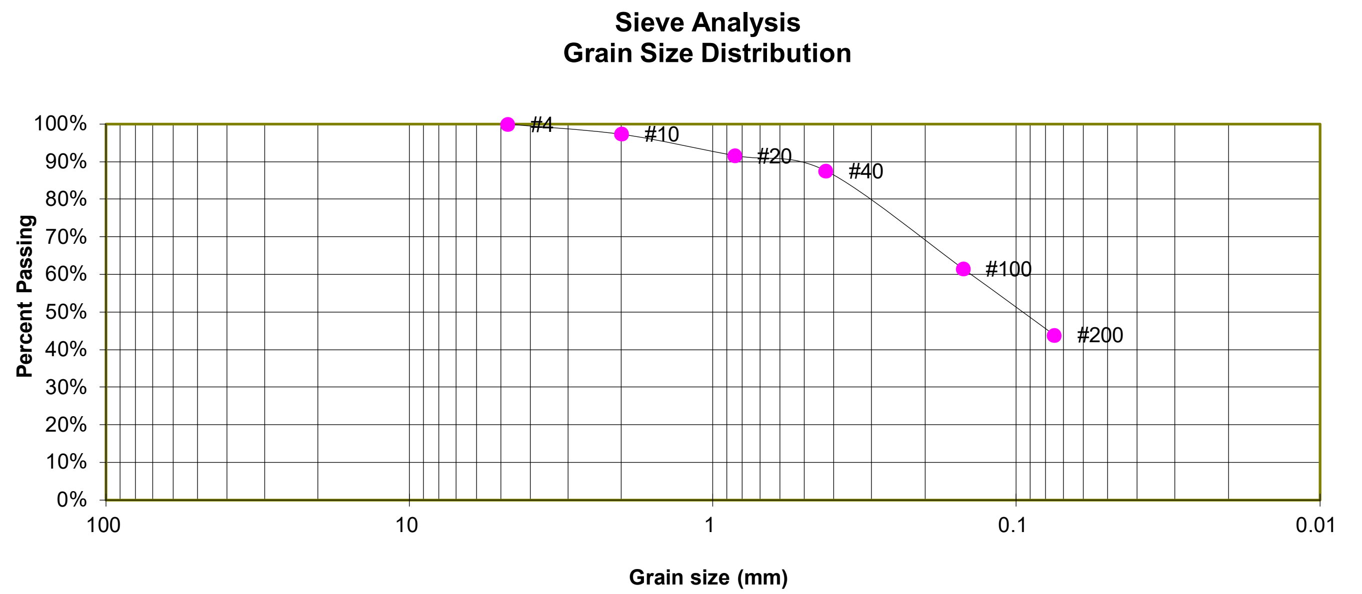
FIG. B-6

TEST BORING	6	SOIL DESCRIPTION	SAND, CLAYEY
DEPTH (FT)	10	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	97.4%
20	91.7%
40	87.6%
100	61.6%
200	43.9%

ATTERBERG LIMITS

Plastic Limit	21
Liquid Limit	32
Plastic Index	11

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SC
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	2

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

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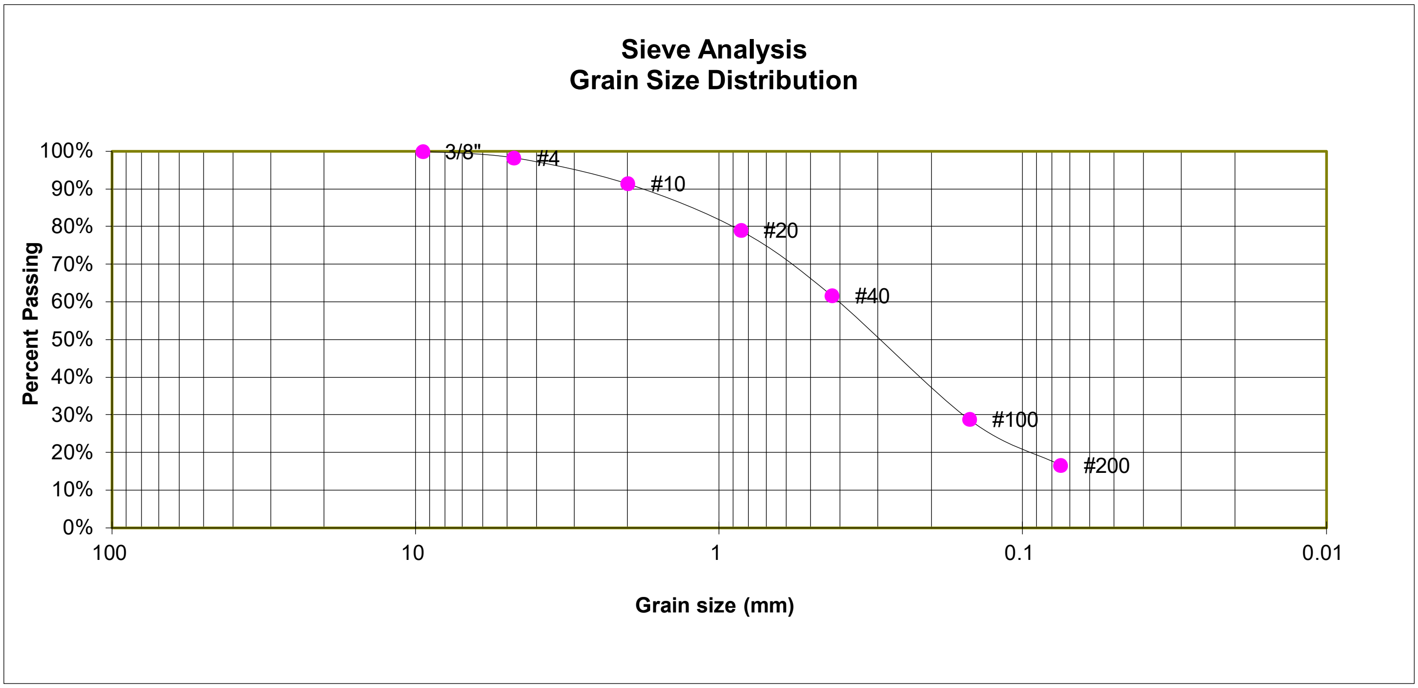
FIG. B-7

TEST BORING	7	SOIL DESCRIPTION	SAND, SILTY
DEPTH (FT)	1-2	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.3%
10	91.4%
20	79.0%
40	61.7%
100	28.8%
200	16.7%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-2-4
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

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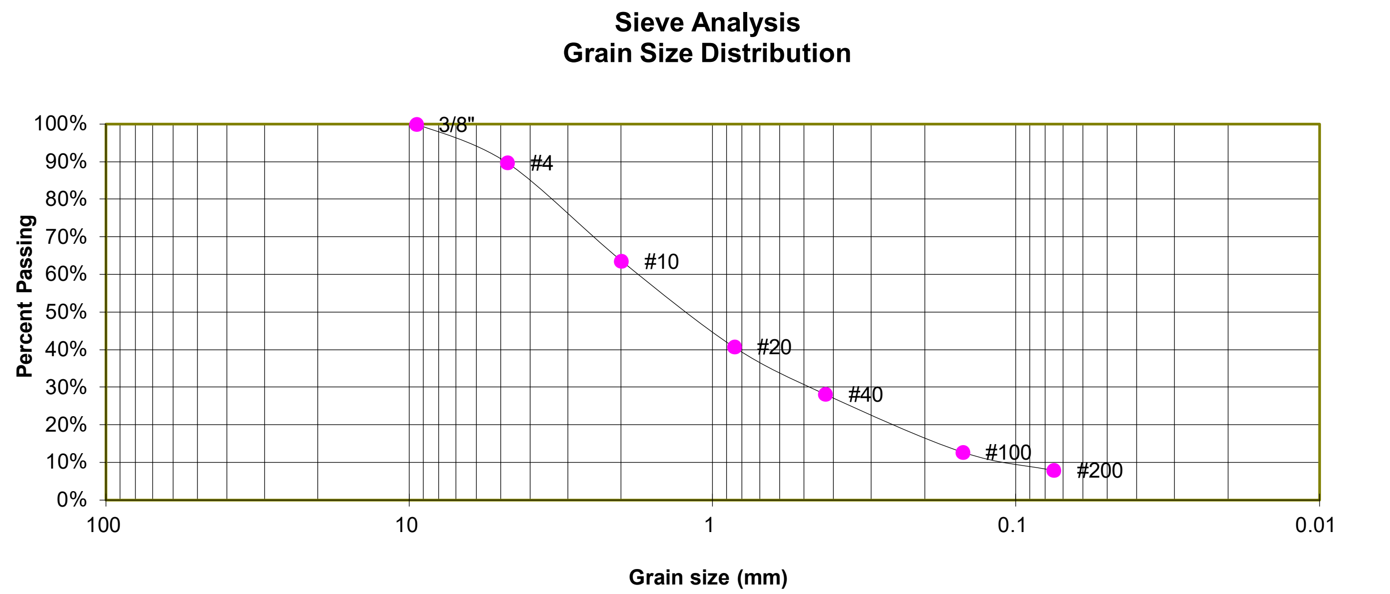
241719

FIG. B-8

TEST BORING	8	SOIL DESCRIPTION	SAND, WITH SILT
DEPTH (FT)	1-2	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	89.7%
10	63.6%
20	40.8%
40	28.1%
100	12.8%
200	8.0%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SW-SM
AASHTO CLASSIFICATION:	A-1-b
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

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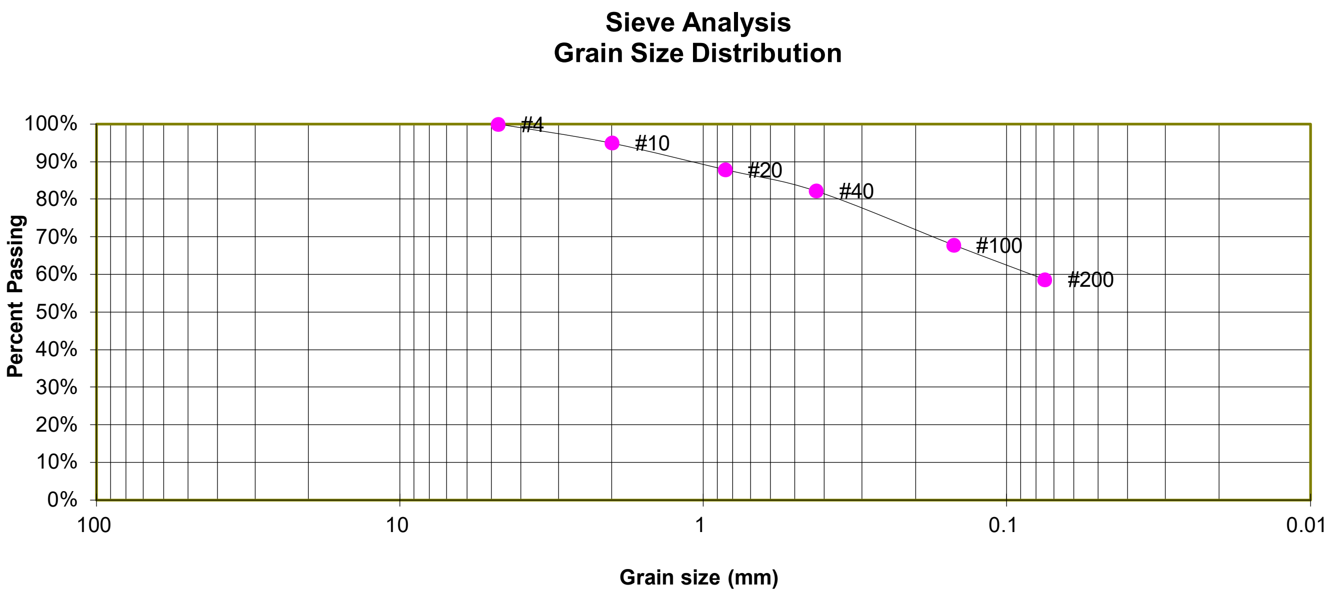
FIG. B-9

TEST BORING	1	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	10	SOIL TYPE	2



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	95.0%
20	87.9%
40	82.3%
100	67.8%
200	58.7%

ATTERBERG LIMITS

Plastic Limit	24
Liquid Limit	36
Plastic Index	12

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-6
AASHTO GROUP INDEX:	5

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

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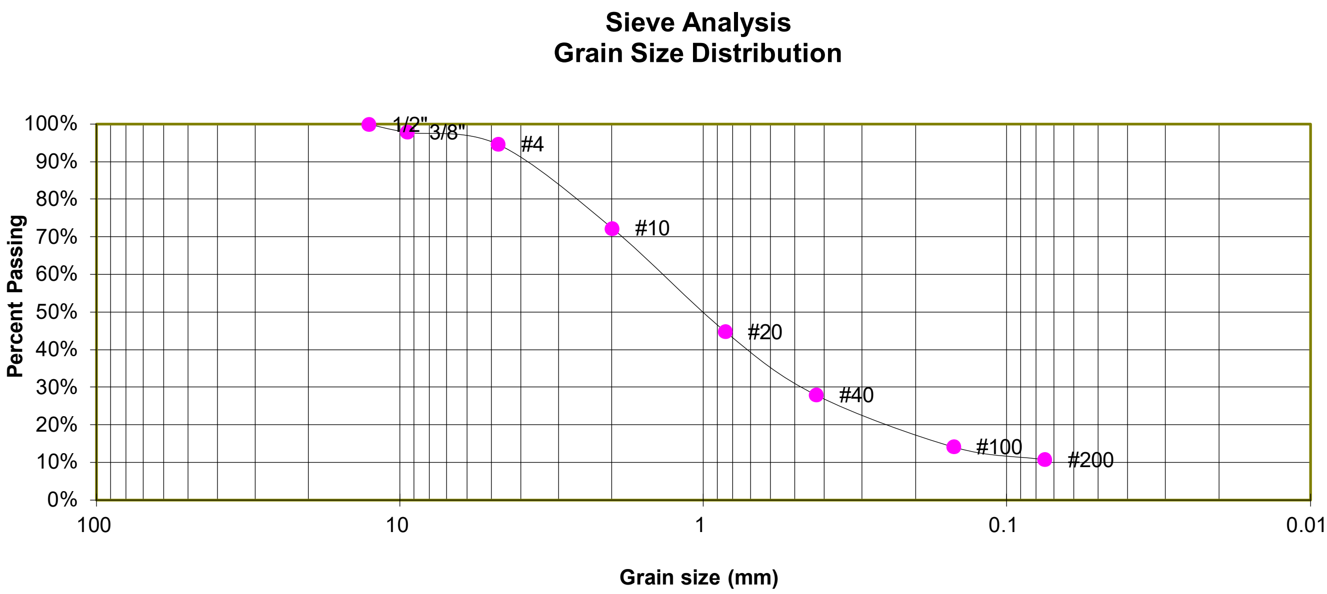
FIG. B-10

TEST BORING	8	SOIL DESCRIPTION	SANDSTONE (SAND, WITH CLAY)
DEPTH (FT)	5	SOIL TYPE	3



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.9%
4	94.6%
10	72.3%
20	44.9%
40	28.0%
100	14.2%
200	10.8%

ATTERBERG LIMITS

Plastic Limit	23
Liquid Limit	32
Plastic Index	9

SOIL CLASSIFICATION

USCS CLASSIFICATION: SW-SC
AASHTO CLASSIFICATION: A-2-4
AASHTO GROUP INDEX: 0

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

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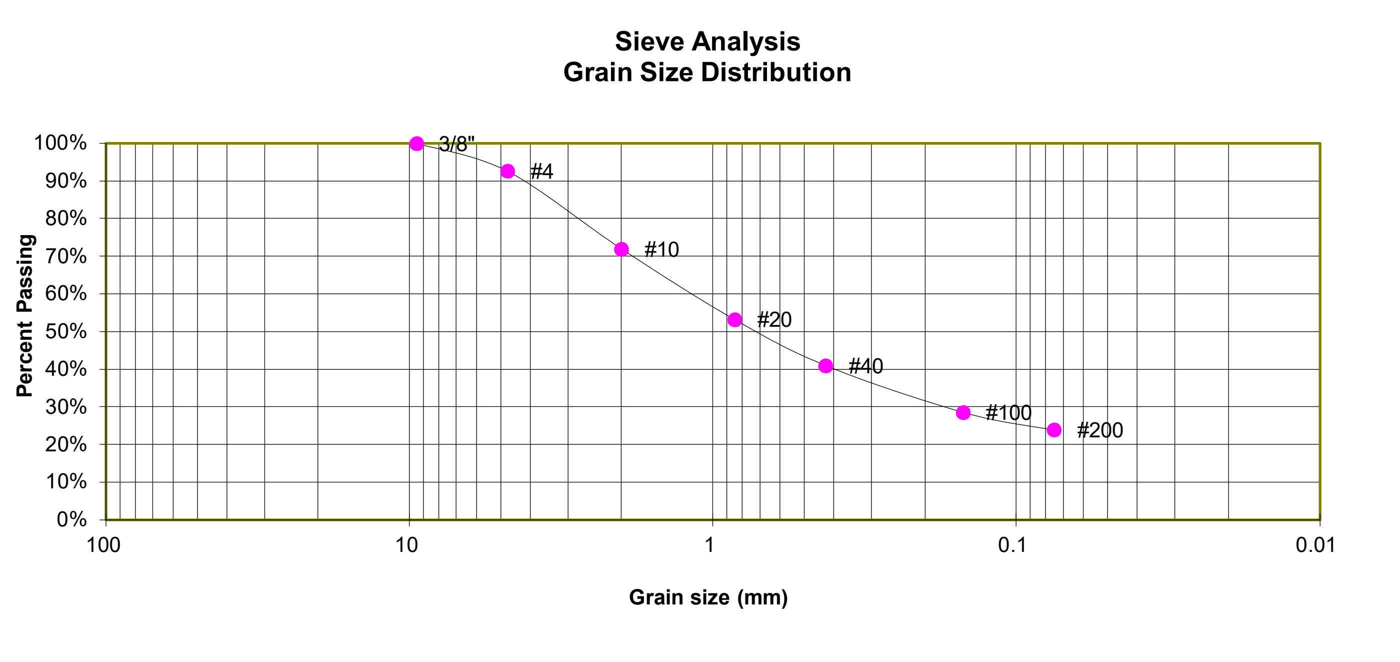
FIG. B-11

TEST BORING	5	SOIL DESCRIPTION	SANDSTONE (SAND, SILTY)
DEPTH (FT)	10	SOIL TYPE	3



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	92.7%
10	71.9%
20	53.3%
40	41.0%
100	28.6%
200	23.9%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SM

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

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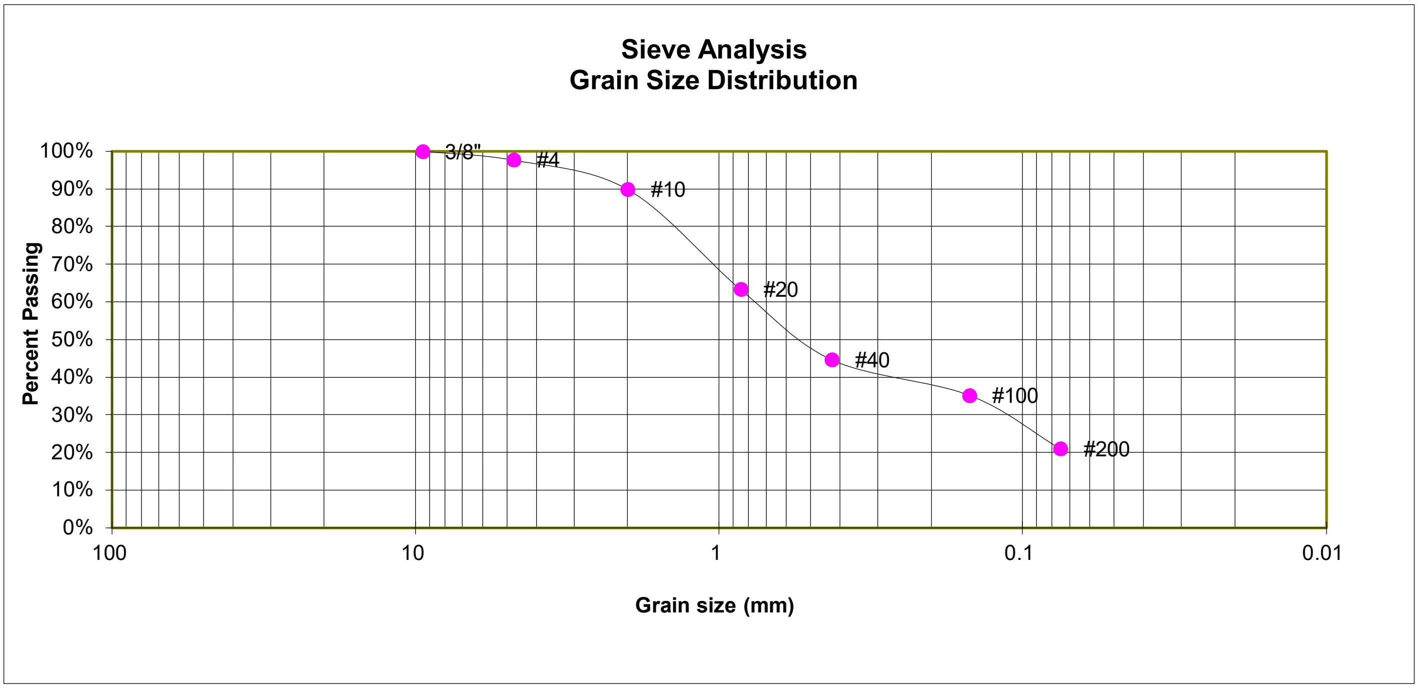
FIG. B-12

TEST BORING	2	SOIL DESCRIPTION	SANDSTONE (SAND, SILTY)
DEPTH (FT)	15	SOIL TYPE	3



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.7%
10	89.9%
20	63.3%
40	44.7%
100	35.2%
200	21.0%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION: SM

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

LIFE CHURCH AT BENT GRASS NORTH
SEED DEVELOPMENT SERVICES

JOB NO.
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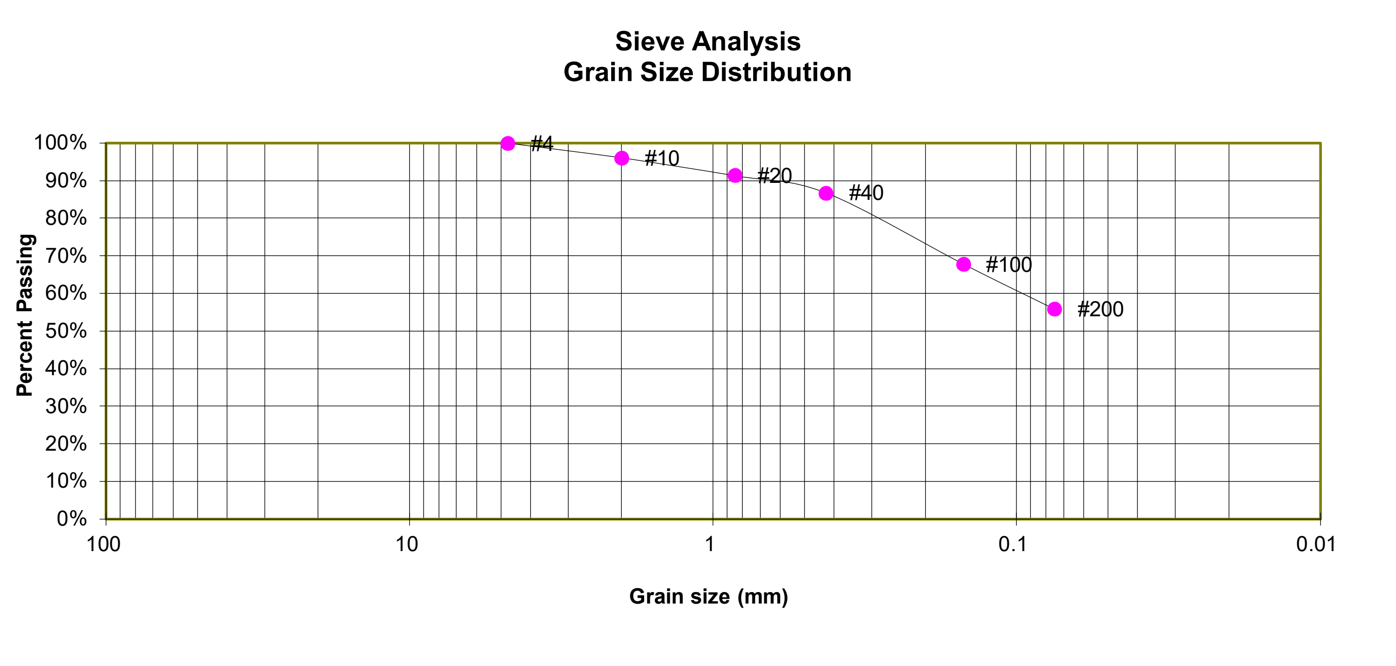
FIG. B-13

TEST BORING	2	SOIL DESCRIPTION	CLAYSTONE (CLAY, SANDY)
DEPTH (FT)	10	SOIL TYPE	4



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	96.1%
20	91.4%
40	86.8%
100	67.9%
200	55.9%

ATTERBERG LIMITS

Plastic Limit	24
Liquid Limit	37
Plastic Index	13

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

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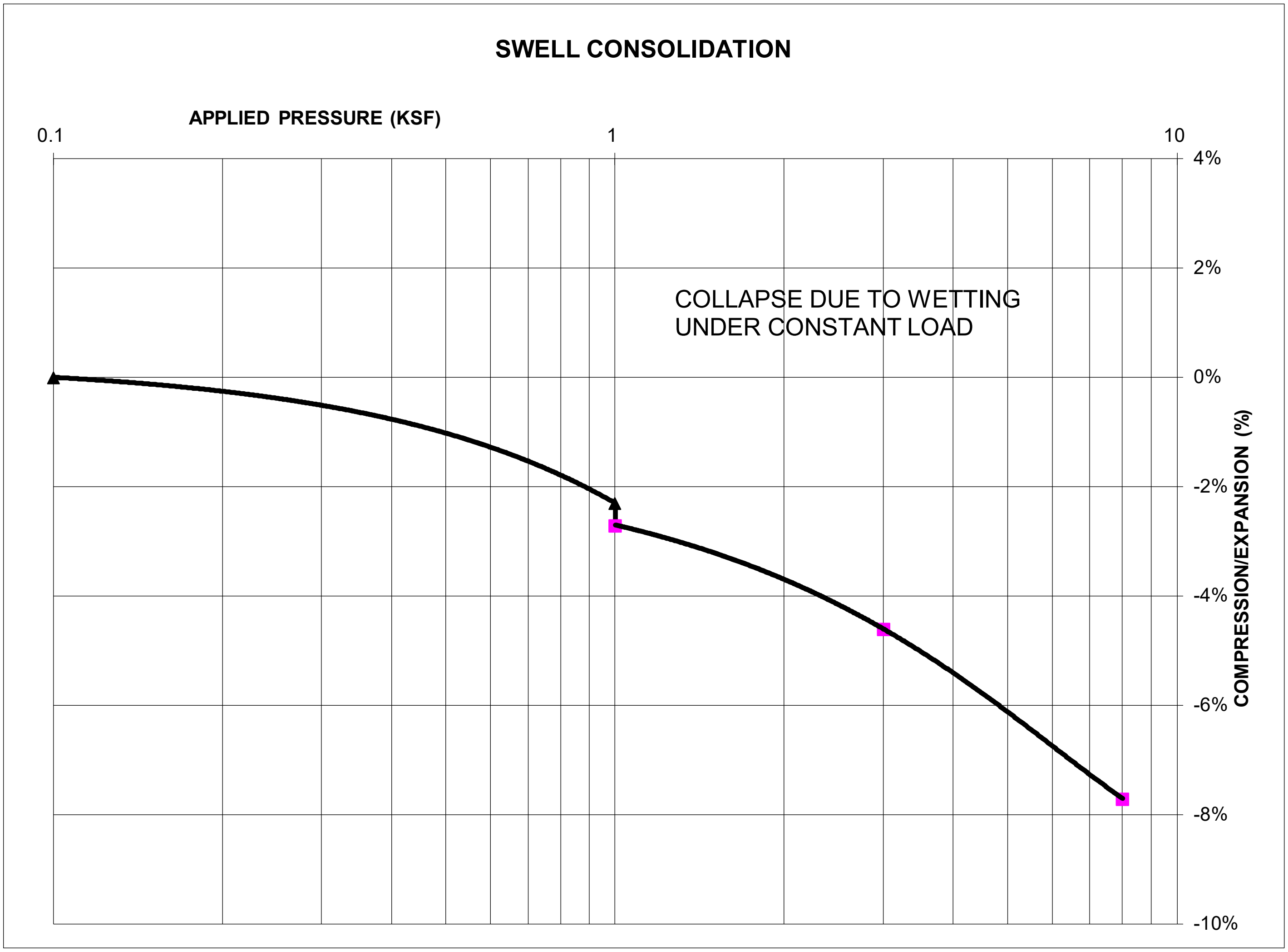
FIG. B-14

TEST BORING	4	SOIL DESCRIPTION	SAND, CLAYEY
DEPTH (FT)	5	SOIL TYPE	1



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	115
NATURAL MOISTURE CONTENT:	11.1%
SWELL/COLLAPSE (%):	-0.4%

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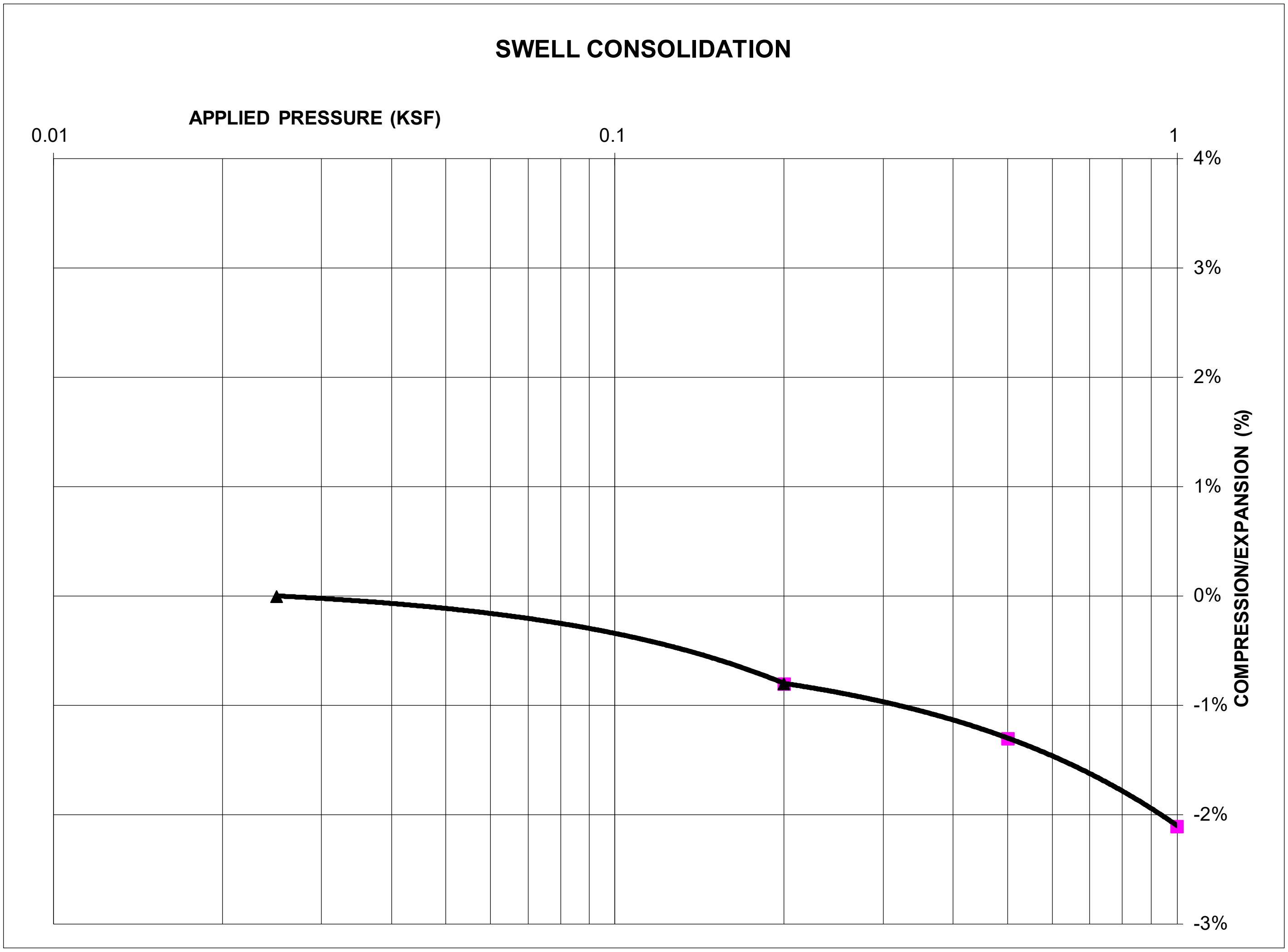
FIG. B-15

TEST BORING	6	SOIL DESCRIPTION	SAND, CLAYEY
DEPTH (FT)	10	SOIL TYPE	1



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	102
NATURAL MOISTURE CONTENT:	21.0%
SWELL/COLLAPSE (%):	0.0%

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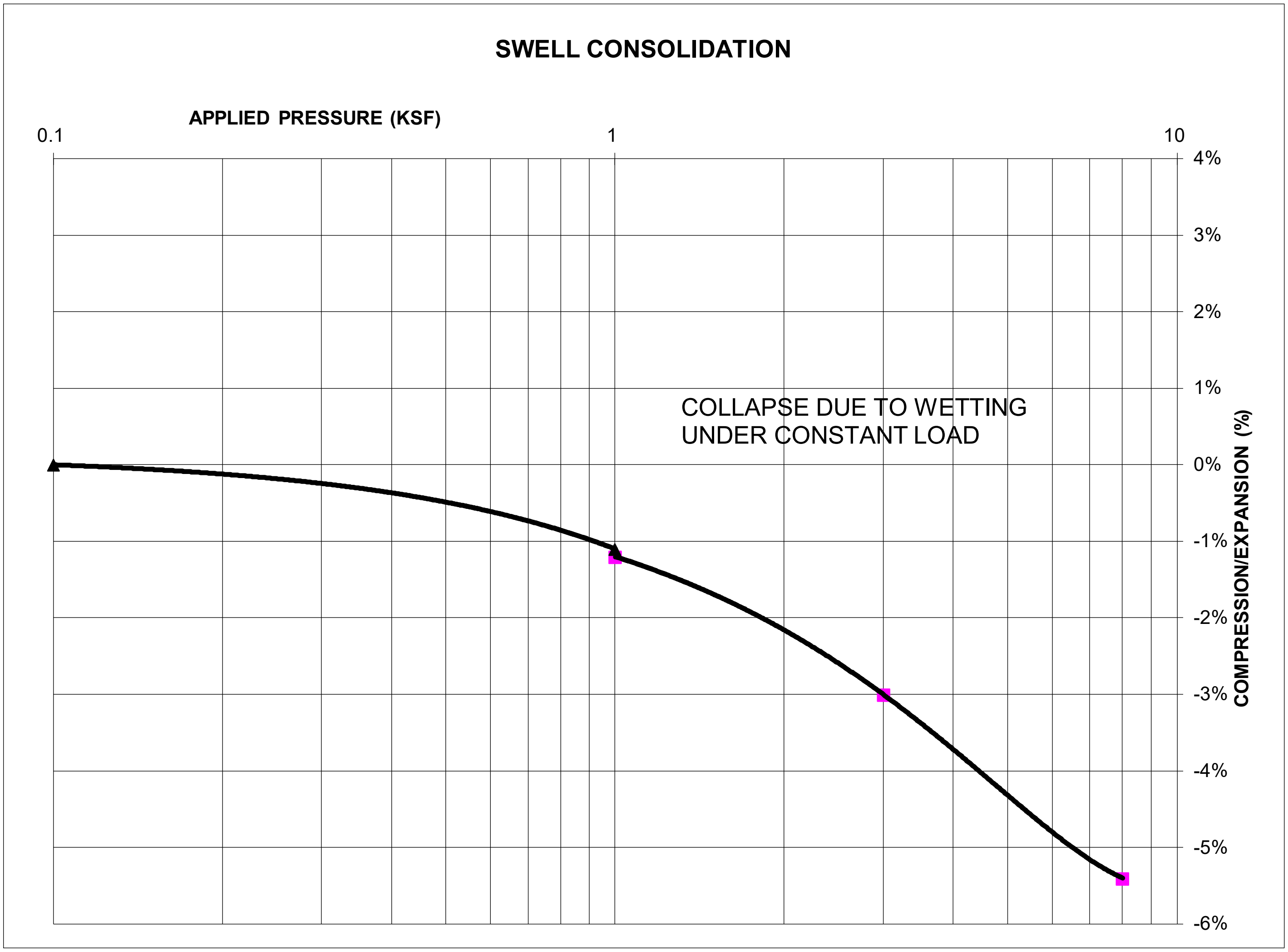
FIG. B-16

TEST BORING	1	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	10	SOIL TYPE	2



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF):	118
NATURAL MOISTURE CONTENT:	13.2%
SWELL/COLLAPSE (%):	-0.1%

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FIG. B-17

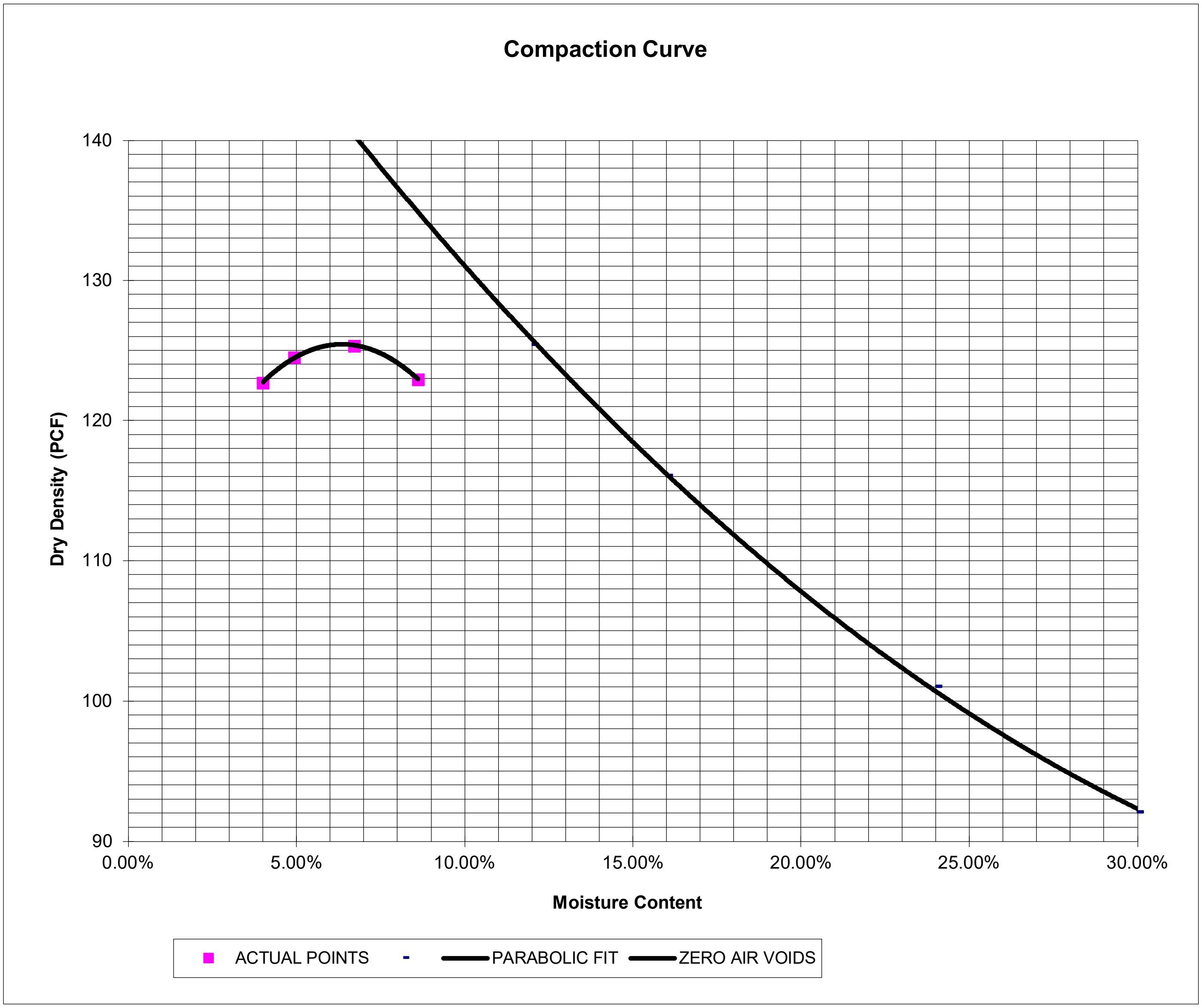
SAMPLE LOCATION TB-8 @ 0-3'

SOIL DESCRIPTION SAND, SILTY, BROWN

SOIL TYPE 1

PROCTOR DATA

IDENTIFICATION:	SM
PROCTOR TEST #:	1
TEST BY:	PH
TEST DESIGNATION:	ASTM-1557-A
MAXIMUM DRY DENSITY (PCF):	125.5
OPTIMUM MOISTURE:	6.5



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LABORATORY TEST RESULTS

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FIG. B-18

SAMPLE LOCATION TB-8 @ 0-3'	SOIL DESCRIPTION SAND, SILTY, BROWN
	SOIL TYPE 1

CBR TEST LOAD DATA

Piston Diameter (cm): 4.958
Piston Area (in^2): 2.993

Penetration Depth (inches)	10 BLOWS Mold # 1 Load (lbs)	Stress (psi)	25 BLOWS Mold # 2 Load (lbs)	Stress (psi)	56 BLOWS Mold # 3 Load (lbs)	Stress (psi)
0.000	0	0.00	0	0.00	0	0.00
0.025	61	20.38	281	93.90	327	109.27
0.050	179	59.82	399	133.33	500	167.08
0.075	286	95.57	460	153.72	613	204.84
0.100	307	102.59	537	179.45	723	241.60
0.125	351	117.29	640	213.87	881	294.40
0.150	364	121.64	766	255.97	1068	356.89
0.175	400	133.67	857	286.38	1233	412.03
0.200	440	147.03	938	313.45	1379	460.82
0.300	558	186.47	1224	409.02	2048	684.38
0.400	640	213.87	1434	479.20	2548	851.46
0.500	721	240.93	1664	556.06	3168	1058.64

MOISTURE AND DENSITY DATA

	Mold # 1	Mold # 2	Mold # 3
Can #	341	342	351
Wt. Can	8.87	8.52	8.01
Wt. Can+Wet	167.14	143.86	137.61
Wt. Can+Dry	148.87	128.44	123.65
Wt. H20	18.27	15.42	13.96
Wt. Dry Soil	140	119.92	115.64
Moisture Content	13.05%	12.86%	12.07%
Wet Density (PCF)	121.6	124.4	129.7
Dry Density (PCF)	114.2	116.8	121.7
% Compaction	91%	93%	97%
CBR	10.26	17.94	24.16

PROCTOR DATA

Maximum Dry Density (pcf)	125.5
Optimum Moisture	6.5
90% of Max. Dry Density (pcf)	113.0
95% of Max. Dry Density (pcf)	119.2

CBR at 90% of Max. Density = 6.6	~ R VALUE 14
CBR at 95% of Max. Density = 21.0	~ R VALUE 71

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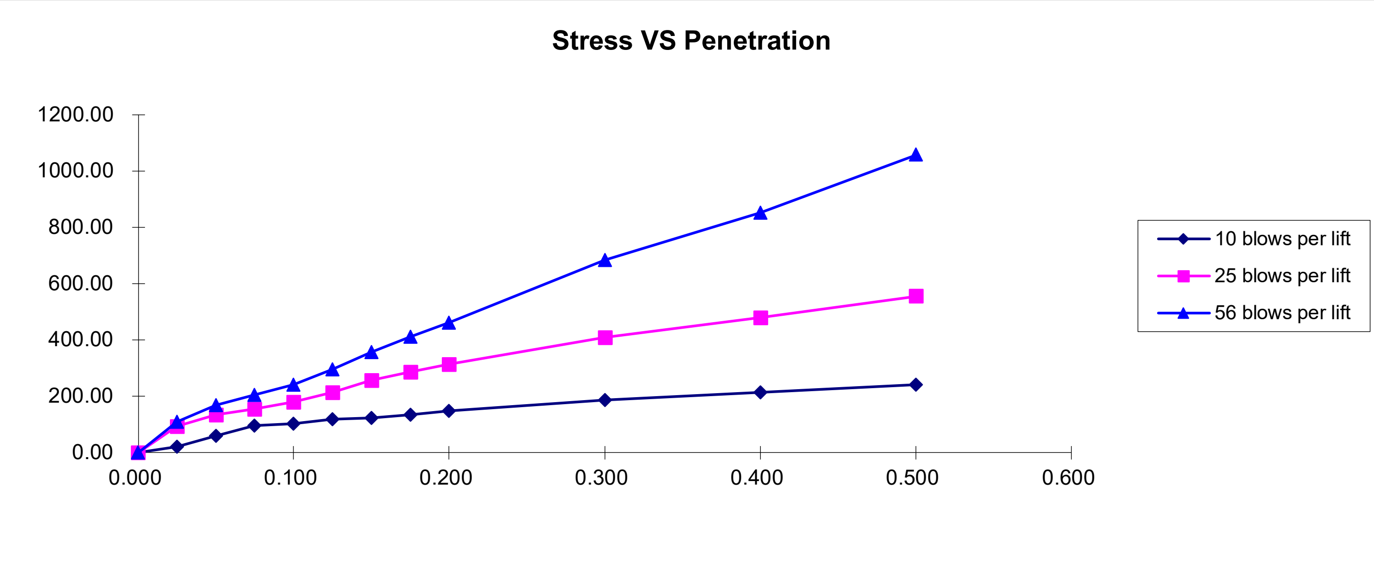
FIG. B-19

SAMPLE LOCATION TB-8 @ 0-3'
SOIL DESCRIPTION SAND, SILTY, BROWN
SOIL TYPE 1



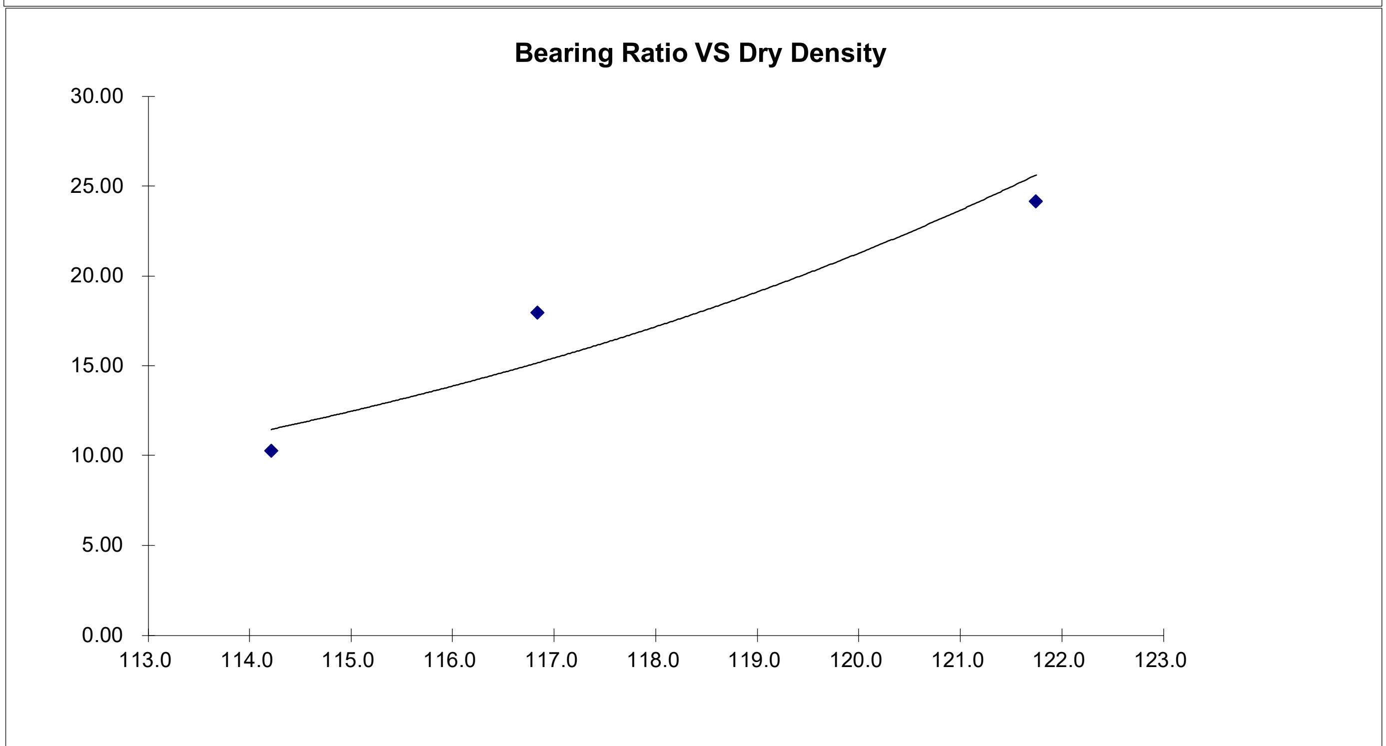


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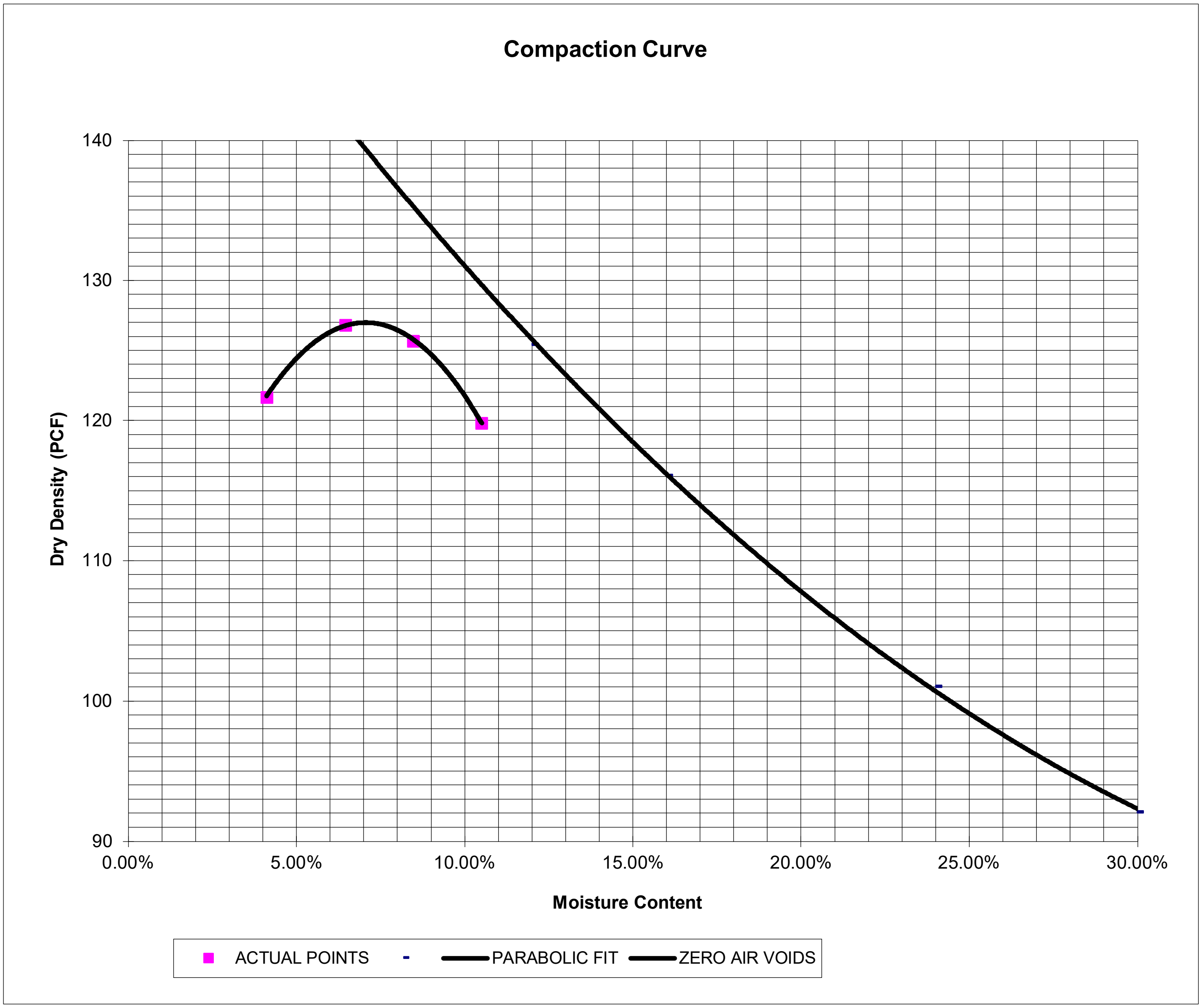
FIG. B-20

SAMPLE LOCATION TB-6 @ 0-3'	SOIL DESCRIPTION SAND, SILTY, BROWN SOIL TYPE 1

PROCTOR DATA

IDENTIFICATION:	SM
PROCTOR TEST #:	2
TEST BY:	PH
TEST DESIGNATION:	ASTM-1557-A
MAXIMUM DRY DENSITY (PCF):	127.1
OPTIMUM MOISTURE:	7



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LABORATORY TEST RESULTS

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SEED DEVELOPMENT SERVICES

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FIG. B-20

APPENDIX C: Pavement Design Calculations

FLEXIBLE PAVEMENT DESIGN

PROJECT DATA

Project Location: Life Church at Bent Grass North

Job Number: 241719

DESIGN DATA

Equivalent (18-kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	100,000
Design CBR	CBR =	10
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.0
Reliability	Reliability =	80
Reliability (z-statistic)	Z_R =	-0.84
Soil Resilient Modulus	M_R =	15,000 psi

Required Structural Number (SN): → SN = 1.66

DESIGN EQUATIONS

Resilient Modulus

If using CBR:

$M_R = (CBR) \times 1{,}500$

If using R-Value:

$M_R = 10^{[(S_1 + 18.72) / 6.24]}$ where $S_1 = [(\text{R-value} - 5) / 11.29] + 3$

Required Structural Number

$$\log_{10} W_{18} = Z_R * S_O + 9.36 * \log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2 - 1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32 * \log_{10} M_R - 8.07$$

Pavement Section Thickness

$SN^* = C_1 D_1 + C_2 D_2$ where:

C_1 = Strength Coefficient - HMA

C_2 = Strength Coefficient - ABC/RCB

D_1 = Depth of HMA (inches)

D_2 = Depth of ABC/RCB (inches)

RECOMMENED THICKNESSES

Layer	Material	Coefficient	Thickness (D^*_i)	SN^*_i	SN
1	HMA	C_1 = 0.44	4.0 inches	1.760	-
2	ABC/RCB	C_2 = 0.11	4.0 inches	0.440	
				SN* = 2.200	1.66

Pavement SN > Required SN, Design is Acceptable

FIG. C-1

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APPENDIX C: USDA Soil Survey Descriptions

El Paso County Area, Colorado

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Columbine and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Columbine

Setting

Landform: Fans, Fan terraces, Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 14 inches: gravelly sandy loam
C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XY214CO - Gravelly Foothill
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

Percent of map unit: 1 percent

Landform: Swales
Hydric soil rating: Yes

Other soils
Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant
Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 23, Aug 29, 2025