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SOILS AND GEOLOGY STUDY
RISING MOON – HABITAT FOR HUMANITY
PARCEL NO. 55031-01-010
PEACEFUL MEADOW STREET
EL PASO COUNTY, COLORADO

Prepared for:
Norwood Development
111 South Tejon Street, Suite 222
Colorado Springs, Colorado 80903

Attn: Bobby Ingels

March 27, 2024

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Logan L. Langford, P.G.
Sr. Geologist

Reviewed by:

COLORADO LICENSED JOSEPH COLLIN GOODE 23725 PROFESSIONAL ENGINEER

Digitally signed by Joseph C Goode Jr.
Date: 03/27/24

Joseph C. Goode Jr., P.E.
President

LLL/JG

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1 SUMMARY

Project Location

The project site is in a portion of the E½ of Section 3, Township 15 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The 9-acre site is located north of the intersection of Harvest Moon Terrace and Peaceful Meadow Street in El Paso County, Colorado.

Project Description

The Rising Moon Habitat for Humanity housing development will consist of forty-one single-family lots, detention pond, and other associated site improvements. The development will be serviced by Colorado Centre Metropolitan District.

Scope of Report

This report presents the results of our geologic evaluation and recommended treatment/mitigation of engineering geologic hazards. This report presents the results of our geologic reconnaissance, a review of available maps, aerial photographs, and our conclusions with respect to the impacts of the geologic conditions on the proposed development.

Land Use and Engineering Geology

This site was found to be suitable for the proposed development if constraints are mitigated. Geologic conditions, including expansive soils and loose/collapsible soils, will impose some constraints on development and land use.Based on the proposed development plan, it appears that these conditions/areas will impact the development. These conditions will be discussed in greater detail in the report.

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

2 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The project site is in a portion of the E½ of Section 3, Township 15 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The 9-acre parcel is located north of the intersection of Harvest Moon Terrace and Peaceful Meadow Street in El Paso County, Colorado. The location of the site is as shown on the Vicinity Map (Figure 1).

The topography of the site slopes gradually to the southwest. There were no drainages or areas of water observed on the site; however, the head of a minor drainage is located immediately west of the southwestern corner of the site that is directed into an existing storm sewer, and Jimmy Camp Creek is located ¼ mile to the east of the site. The site boundaries are indicated on the USGS Map (Figure 2). The site is undeveloped and vegetation primarily consists of field grasses, weeds, cacti, and yuccas. Site photographs taken on March 1, 2024, are included in Appendix A.

The site is currently zoned as A1 Agricultural (Reference 1). The proposed site is currently undeveloped, with existing residential development to the north, east, and south, and an undeveloped parcel to the west. A Habitat for Humanity housing development consisting of forty-one single-family lots, a detention pond, and other associated site improvements is proposed on the 9-acre site. The preliminary grading plan indicates cuts up to approximately 12 feet for the detention pond and minor cuts/fills for the proposed lots (Figures 3 and 7). The Proposed Grading Plan is presented in Figure 4.

3 SCOPE OF THE REPORT

The scope of the report includes a general geologic analysis utilizing published geologic data. Detailed site-specific mapping will be conducted to obtain general information with respect to major geographic and geologic features, geologic descriptions, and their effects on the development of the property.

4 FIELD INVESTIGATION

Our field investigation consisted of the preparation of a geologic map of any bedrock features and significant surficial deposits. The Natural Resource Conservation Service (NRCS), previously the Soil Conservation Service (SCS), survey was also reviewed to evaluate the site. 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

Engineering Geology Map which identified pertinent geologic conditions affecting development. The field mapping was performed by personnel of Entech Engineering, Inc. (Entech) on March 1, 2024.

Nine test borings, designated TB-1 through TB-9, were drilled on February 29 through March 4, 2024, as part of the investigation to determine general soil and bedrock characteristics. The borings were drilled to depths of 20 to 50 feet below ground surface (bgs). TB-1 was placed in the proposed detention pond in the southern portion of the site, and TB-2 through TB-9 were placed in anticipated building locations across the site. The locations of the test borings are indicated on the Site and Exploration Plan (Figure 3). Laboratory testing was also performed on some of the soils to classify and determine the engineering characteristics of the soils. Laboratory tests included grain-size analysis ASTM D422, Atterberg Limits ASTM D4318, and volume change testing using the Swell/Consolidation test. Sulfate testing was performed on select samples to evaluate the potential for below-grade concrete degradation due to sulfate attack. The Test Boring Logs and Laboratory Testing Results are presented in Appendices B and C. Results of this testing will be discussed later in this report.

5 SOIL, GEOLOGY, AND ENGINEERING GEOLOGY

5.1 General Geology

The site lies in the western portion of the Great Plains Physiographic Province. Approximately 11 miles to the west is a major structural feature known as the Ute Pass 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 Pierre Shale Formation. Overlying this formation are unconsolidated deposits of alluvial deposits consisting of floodplain and stream terrace landforms. 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 3), previously the Soil Conservation Service (Reference 4), has mapped one soil type on the site (Figure 4). In general, the soil

classifies as stratified loamy soils that are associated with floodplain and stream terrace landforms. The soils are described as follows:

Soil Type	Description
101	Ustic Torrifluvents, loamy

Complete descriptions of each soil type are presented in Appendix D. The soils have generally been described to have moderate permeabilities. Possible hazards with soil erosion are present on the site. The erosion potential can be controlled with vegetation. The soils have been described as having moderate erosion hazards.

5.3 Site Stratigraphy

The Geologic Map of the Elsmere Quadrangle showing the site location is presented in Figure 6 (Reference 5). The Geology Map prepared for the site is presented in Figure 7. These mappable units were identified on this site which are described as follows:

Qay_2 **Young Alluvium Two of late and middle? Holocene Age:** These are dark gray-brown to very dark gray-brown alluvial deposits that blanket the low broad valleys in the area consisting of floodplain and stream terrace deposits. These materials typically consist of sandy to silty clays with some shale and ironstone clasts derived from the weathering of the nearby Pierre Shale alluvial deposits consisting of sandy to silty clays, and clayey to silty sands.

The bedrock underlying the site consists of the Pierre Shale Formation of Upper Cretaceous Age. The Pierre Shale Formation typically consists of claystone and shale. Overlying this formation are alluvial deposits consisting of sandy to silty clays and clayey to silty sands. These soils consisted of sandy to silty to clay with underlying claystone and shale. Bedrock was not encountered in the borings which were drilled to depths of 20 to 50 feet.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Elsmere Quadrangle* distributed by the Colorado Geological Survey in 2002 (Reference 5), the *Reconnaissance Geologic Map of Colorado Springs and Vicinity*, distributed by the USGS in 1973 (Reference 6), the *Geologic Map of the Colorado Springs-Castle Rock Area, Front Range Urban Corridor,* distributed by the USGS in 1979 (Reference 67), and the *Geologic Map of the Pueblo 1^0 x 2^0 Quadrangle*, distributed by the US Geological Survey in 1978 (Reference 4). The test

borings were also used in evaluating the site and are included in Appendices B and C. The Geology/Engineering Geology Map prepared for the site is presented in Figure 6.

5.4 Soil Conditions

The soils encountered in the test borings can be grouped into two general soil types. The soils were classified using the Unified Soil Classification System (USCS).

Soil Type 1 classified as soft to stiff clay with varying amounts of sand (CL). The clay was encountered in all the borings at the existing ground surface and extended to depths of 16 to 23 feet bgs or to the termination of the boring (20 feet). Swell/Consolidation testing on the clay resulted in volume changes of 0.1 to 2.2%, which indicates a low to moderate potential for expansion potential.

Soil Type 2 classified as very loose to medium dense sand with silt and silty sand. The sand was encountered in three of the test borings (TB-1 at 16 to 22 feet bgs) and extended to the termination depths of the borings (20 to 50 feet).

The Test Boring Logs are presented in Appendix B. The Test Boring Logs and Laboratory Testing Results are presented in Appendices B and C.

5.5 Groundwater

Groundwater was encountered in two of the test borings at 22 to 23 feet. The remaining borings were dry. Fluctuation in groundwater conditions may occur due to variations in rainfall and other factors not readily apparent at this time. It should be noted that in the sandy materials on-site, 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. Builders and planners should be cognizant of the potential for the occurrence of such subsurface water features during construction on-site and deal with individual conditions 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 7). This map shows the location of various geologic conditions the developers should

consider during the planning, design, and construction stages of the project. These constraints/hazards and the recommended mitigation techniques are as follows:

Artificial Fill – Constraint

Fill was not observed on the site; however, any uncontrolled or undocumented fill encountered beneath foundations will require mitigation.

Mitigation: Any uncontrolled fill encountered beneath foundations will require removal and recompaction at a minimum of 95% of its maximum Modified Procter Dry Density, ASTM D-1557 or penetration to native soils.

Collapsible Soils – Constraint

The soils tested did not exhibit collapsible properties; however, soft and very soft soils that will require mitigation were encountered in the test borings. If not properly mitigated, these soils could experience settling.

Mitigation: Soft to very soft soils should be overexcavated 4 to 5 feet and recompacted at 95% of their Standard Proctor Dry Density, ASTM D698. The ground surface around all permanent structures should be positively sloped away from the structure to all points, and water must not be allowed to stand or pond anywhere on the site. We recommend that the ground surface within 10 feet of the structures be sloped away with a minimum gradient of 10%. If this is not possible on the upslope side of the structures, then a well-defined swale should be created to intercept the surface water and carry it quickly and safely around and away from the structures. Roof drains should be made to discharge well away from the structures and into areas of positive drainage.

Expansive Soils – Constraints

Expansive soils were encountered in the test borings drilled on-site and have been indicated on the Geology/Engineering Geology Map (Figure 7). The clays encountered can cause differential movement in structures if not properly mitigated.

Mitigation Expansive soils will require mitigation. Mitigation of expansive soils will require special foundation design. Overexcavation on the order of 4 to 5 feet and replacement with non-expansive soils at 95% of Modified Proctor Dry Density, ASTM D1557 is a suitable mitigation. Overexcavation, thorough moisture conditioning, and recompaction of the clay soils at 95% of Standard Modified Proctor Dry Density, ASTM D-698 may also be an alternative. Additional testing is recommended if the moisture conditioning is used. Floor slabs on expansive soils should be expected to experience movement. Overexcavation and replacement have been successful in minimizing slab movements. The use of structural floors should be considered for basement

construction on highly expansive clays. Final recommendations should be determined after additional investigation of each building site.

Groundwater and Floodplain Areas

The site is not mapped within floodplain zones according to the FEMA Map No. 08041CO769G, (Figure 8, Reference 9). No drainages or areas of water were observed on the site; however, the head of a minor drainage that is connected to an existing storm sewer is located immediately west of the southwest corner of the site, and Jimmy Camp Creek is located approximately ¼ of a mile east of the site. Groundwater was encountered in two of the test borings at 22 to 23 feet. The remaining borings were dry. Groundwater is not expected to affect the construction of the shallow foundations or excavation of the detention pond. It should be noted that some groundwater conditions might be encountered during development 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. Perimeter drains are recommended for any structures with usable space below grade. Typical drain details that may be used are shown in Figures 8 through 11.

Faults

The closest fault is the Ute Pass Fault located approximately 11 miles to the west. No faults are mapped on the site itself. Previously Colorado was mapped entirely within Seismic Zone 1, a very low seismic risk. According to a report by the Colorado Geological Survey by Robert M. Kirkman and William P. Rogers, Bulletin 43 (1981) (Reference 10), this area should be designated for Zone 2 due to more recent data on the potential for movement in this area and any resultant earthquakes.

Radon – Hazard

Radon levels for the area have been reported by the Colorado Geologic Survey in the open file, Report No. 91-4 (Reference 11). Average Radon levels for the 80925 zip code were not available; however, the levels for nearby surrounding zip codes are presented in the table below:

Nearby Zip Codes	Average Radon Levels
80817 (south)	3.88 pCi/l
80911 (west)	2.57 pCi/l
80916 (north)	3.82 pCi/l

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, 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 will consist of a Habitat for Humanity housing development consisting of forty-one single-family lots, detention pond, and other associated site improvements. It is our opinion that the existing geologic and engineering geologic conditions will impose some constraints on the proposed development and construction. The most significant problems affecting development will be those associated with the expansive soils and loose/collapsible soils that can be satisfactorily mitigated through proper engineering design and construction practices.

Subsurface soil conditions encountered in the test borings drilled for the planned development consisted of clay with varying amounts of sand overlying sand with silt and silty sand. Bedrock was not encountered in the borings which were drilled to depths of 20 to 50 feet. The clays were encountered at very soft to stiff consistencies and the sand at very loose to medium dense states. Expansive clays or soft soils encountered beneath foundations will require mitigation which may include overexcavation. Overexcavation on the order of 4 to 5 feet and replacement with non-expansive soils at 95% of Modified Proctor Dry Density, ASTM D1557 is a suitable mitigation. Overexcavation, moisture conditioning, and recompaction of the clay soils at 95% of Standard Modified Proctor Dry Density, ASTM D-698 can also be considered to mitigate the clay. Floor slabs on expansive soils should be expected to experience movement. Overexcavation and replacement have been successful in minimizing slab movements. The use of structural floors should be considered for basement construction on highly expansive clays. **Final recommendations should be determined after additional investigation of each building site.**

No drainages or areas of water were observed on the site, however, the head of a minor drainage that is connected to an existing storm sewer is located immediately west of the southwest corner of the site, and Jimmy Camp Creek is located approximately ¼ of a mile east of the site. Groundwater was encountered in two of the test borings at 22 to 23 feet. The remaining borings were dry. Groundwater is not expected to affect the construction of the shallow foundations or excavation of the detention pond. It should be noted that shallow 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. Perimeter drains are recommended for any structure with usable below-grade space. Typical drain details are shown in Figures 8 through 11.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 on each lot is recommended prior to construction.

7 ECONOMIC MINERAL RESOURCES

According to the *El Paso County Aggregate Resource Evaluation Map* (Reference 12), the area is not mapped with any aggregate deposits. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 13), areas of the site are not mapped with any resources. According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 14), the area of the site has been mapped as “Good” for industrial minerals. However, considering the clayey silty nature of the soils, 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 14), 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 in the area of the site. No metallic mineral resources have been mapped on-site (Reference 14).

The site has been mapped as “Fair” for oil and gas resources (Reference 14). No oil or gas fields have been discovered in the area of the site. The sedimentary rocks in the area may lack the geologic structure for trapping oil or gas; therefore, it may not be considered a significant resource. Hydraulic fracturing is a new method that is being 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.

With regard to water erosion, loosely compacted soils will be the most susceptible to water erosion whereas residually weathered soils 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 some of the synthetic channel lining materials 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 of 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 the adequate re-vegetation of cut and fill slopes wherever possible. 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, EMBANKMENT, AND STORMWATER FACILITY CONSTRUCTION RECOMMENDATIONS

In general, the site soils are suitable for the proposed roadways and embankments. Groundwater is not expected to be encountered on the site based on the preliminary grading plan. 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.

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. The subgrade should be scarified and moisture conditioned to 0 to +4% of its optimum moisture content, compacted to a minimum of 95% of its maximum Standard Proctor Dry Density, ASTM D698 (cohesive soils) and within 2% of optimum moisture content, and compacted to a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557 (non-cohesive soils) 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 its maximum Standard Proctor Dry Density, ASTM D698 (cohesive soils) or at least 95% of its maximum Modified Proctor Dry Density, ASTM D-1557 (non-cohesive). These materials should be placed at a moisture content conducive to compaction, usually 0 to ±2% of Proctor optimum moisture content. The placement and compaction of fill should be observed and tested by Entech during construction. Entech should approve any import materials prior to placing or hauling them to the site. Additional investigation will be required for pavement designs once roadway grading is completed and utilities are installed.

10 CLOSURE

It is our opinion that the existing geologic engineering and geologic conditions will impose some constraints on development and construction of the site. The majority of these 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 Entech be informed of any differences observed between surface and subsurface conditions encountered in construction and those assumed in the body of this report. Additional investigations are required for the building sites prior to construction to determine foundation recommendations and mitigations required. Construction and design personnel should be made familiar with the contents of this report. Reporting such discrepancies to Entech Engineering, Inc. soon after they are discovered would be greatly appreciated and could possibly help avoid construction and development problems.

This report has been prepared for Norwood Development 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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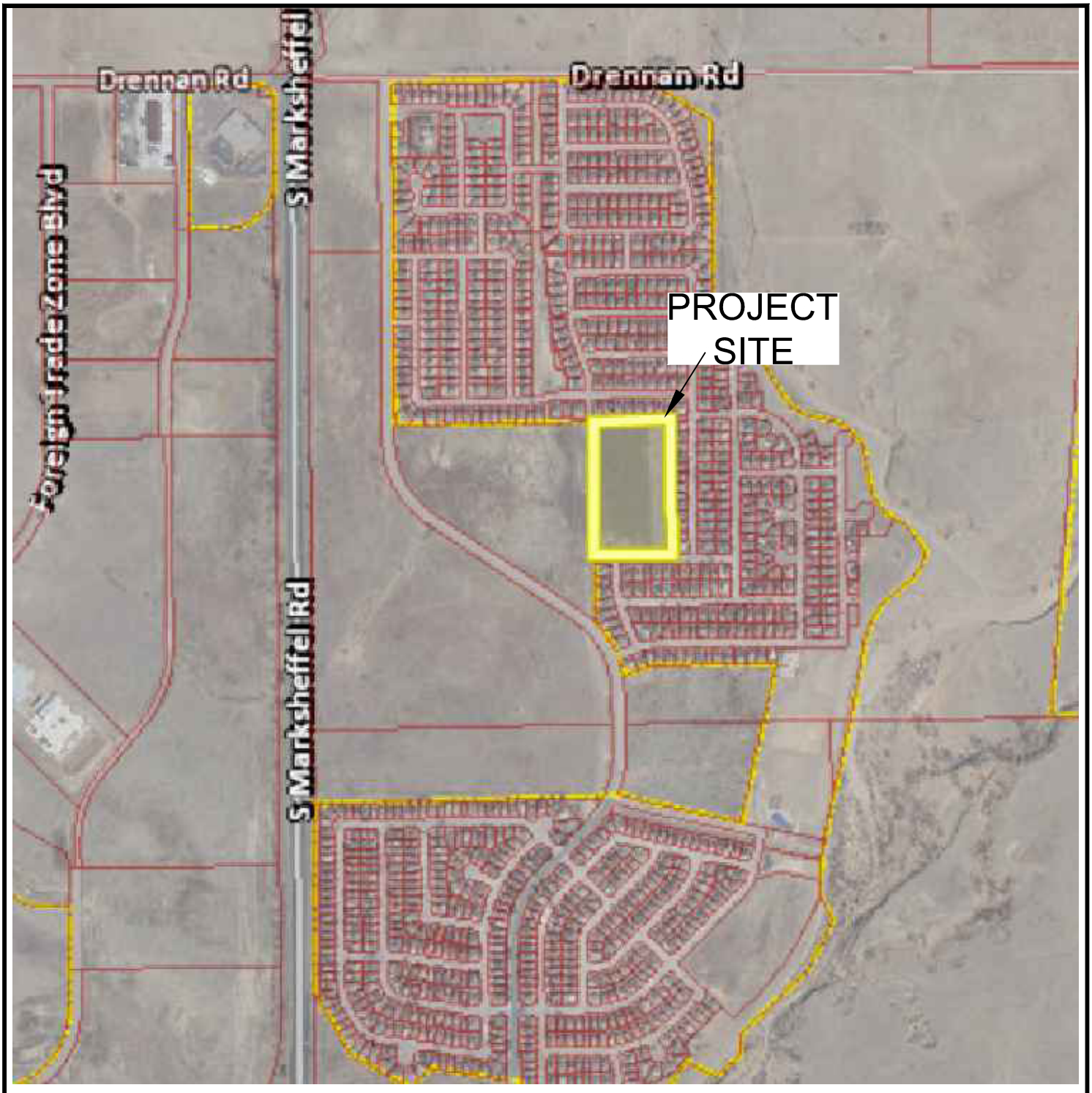
FIGURES



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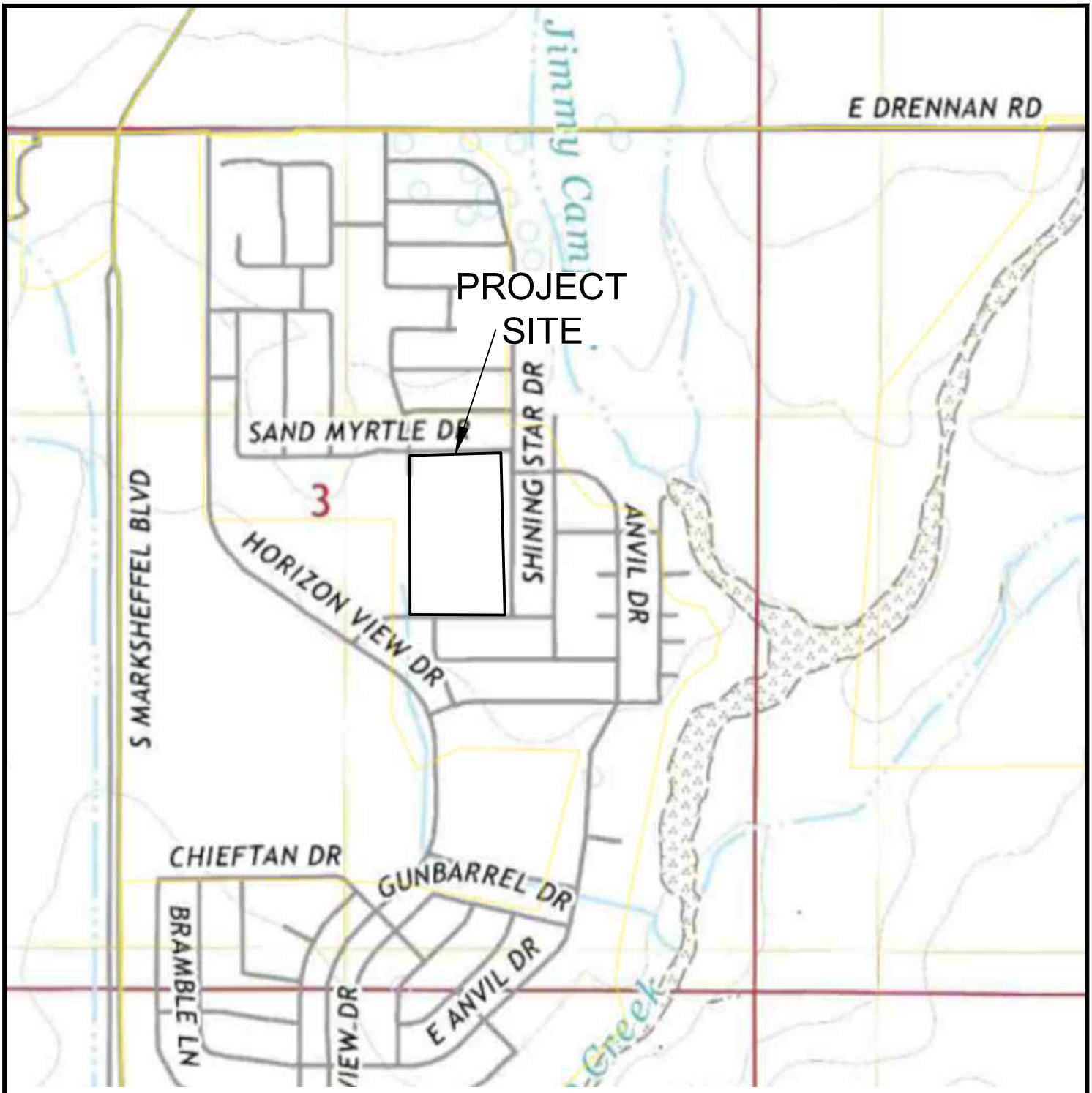
VICINITY MAP

HABITAT FOR HUMANITY - MEADOWORKS
COLORADO SPRINGS, CO
NORWOOD DEVELOPMENT

JOB NO.
240323

FIG. 1



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USGS TOPOGRAPHY MAP

HABITAT FOR HUMANITY - MEADOWORKS
COLORADO SPRINGS, CO
NORWOOD DEVELOPMENT

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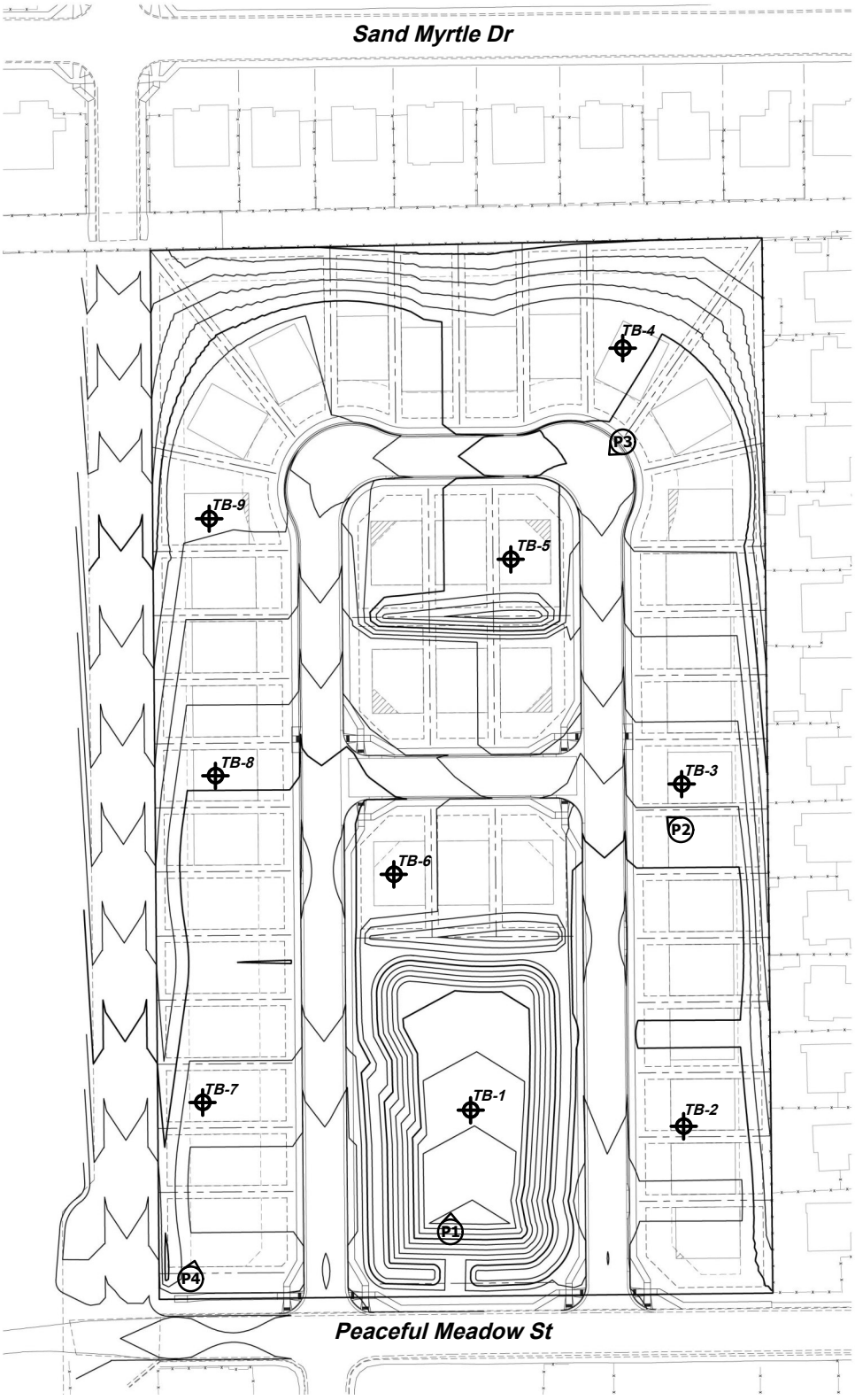
FIG. 2



TB- APPROXIMATE TEST BORING LOCATION AND NUMBER

P2 - APPROXIMATE PHOTOGRAPH LOCATION AND NUMBER

N

ENTECH ENGINEERING, INC.

SITE AND EXPLORATION PLAN

HABITAT FOR HUMANITY - MEADOWORK
COLORADO SPRINGS, CO
NORWOOD DEVELOPMENT

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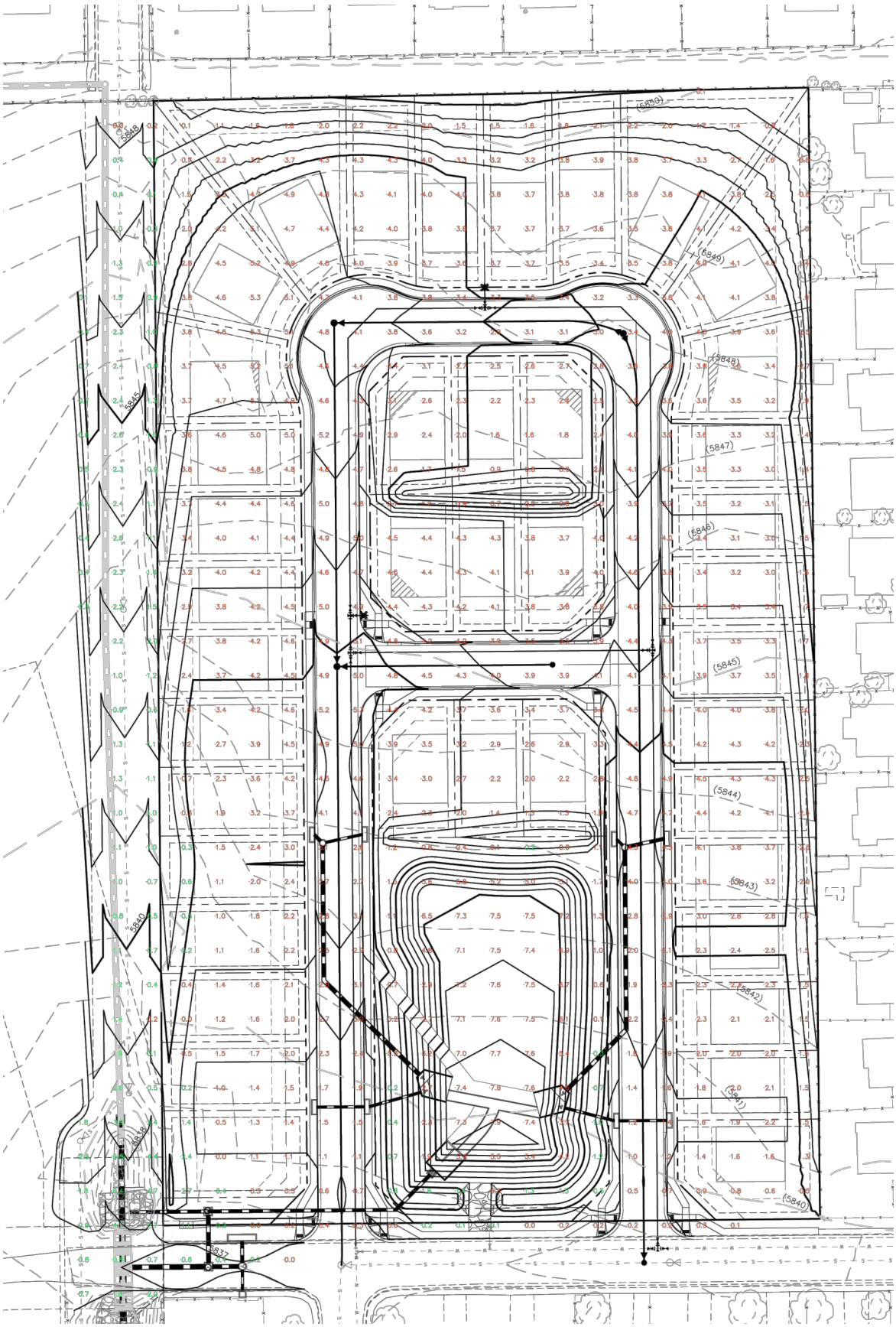
FIG. 3



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PROPOSED GRADING PLAN

HABITAT FOR HUMANITY - MEADOWORKS
COLORADO SPRINGS, CO
NORWOOD DEVELOPMENT

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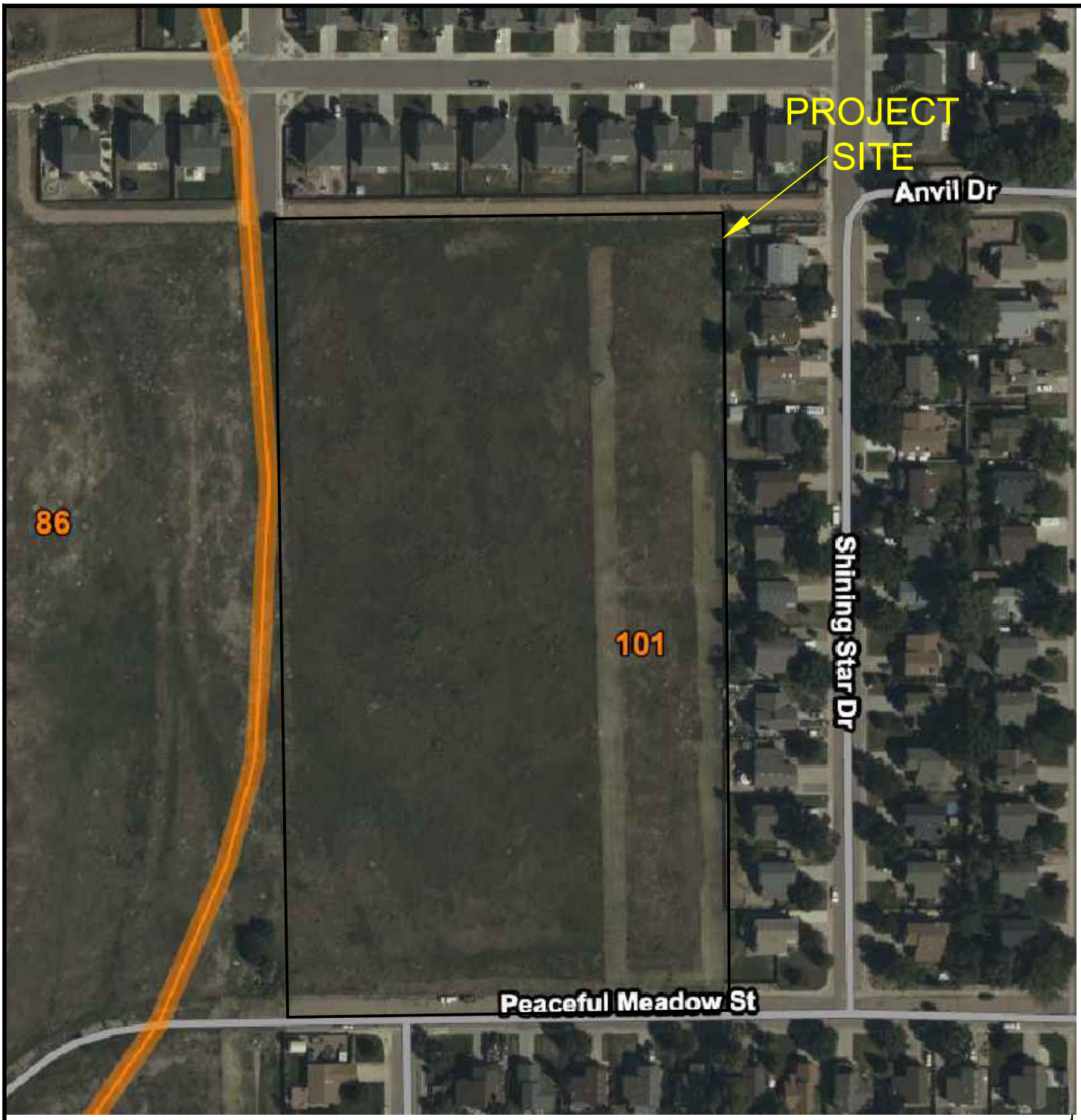
FIG. 4



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USDA SOIL SURVEY MAP

HABITAT FOR HUMANITY - MEADOWORKS
COLORADO SPRINGS, CO
NORWOOD DEVELOPMENT

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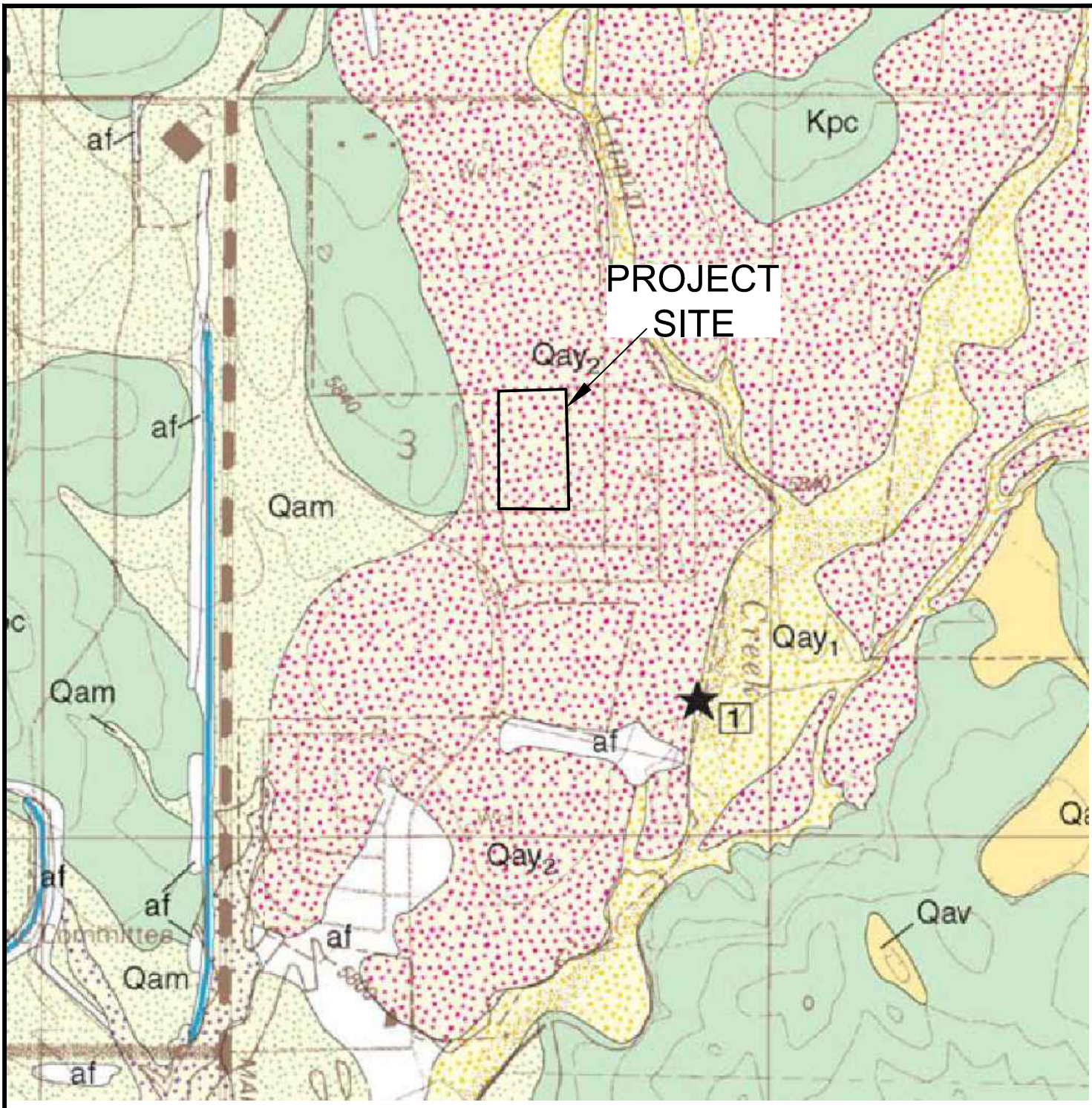
FIG. 5



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ELSMERE QUADRANGLE GEOLOGIC MAP

HABITAT FOR HUMANITY - MEADOWORKS
COLORADO SPRINGS, CO
NORWOOD DEVELOPMENT

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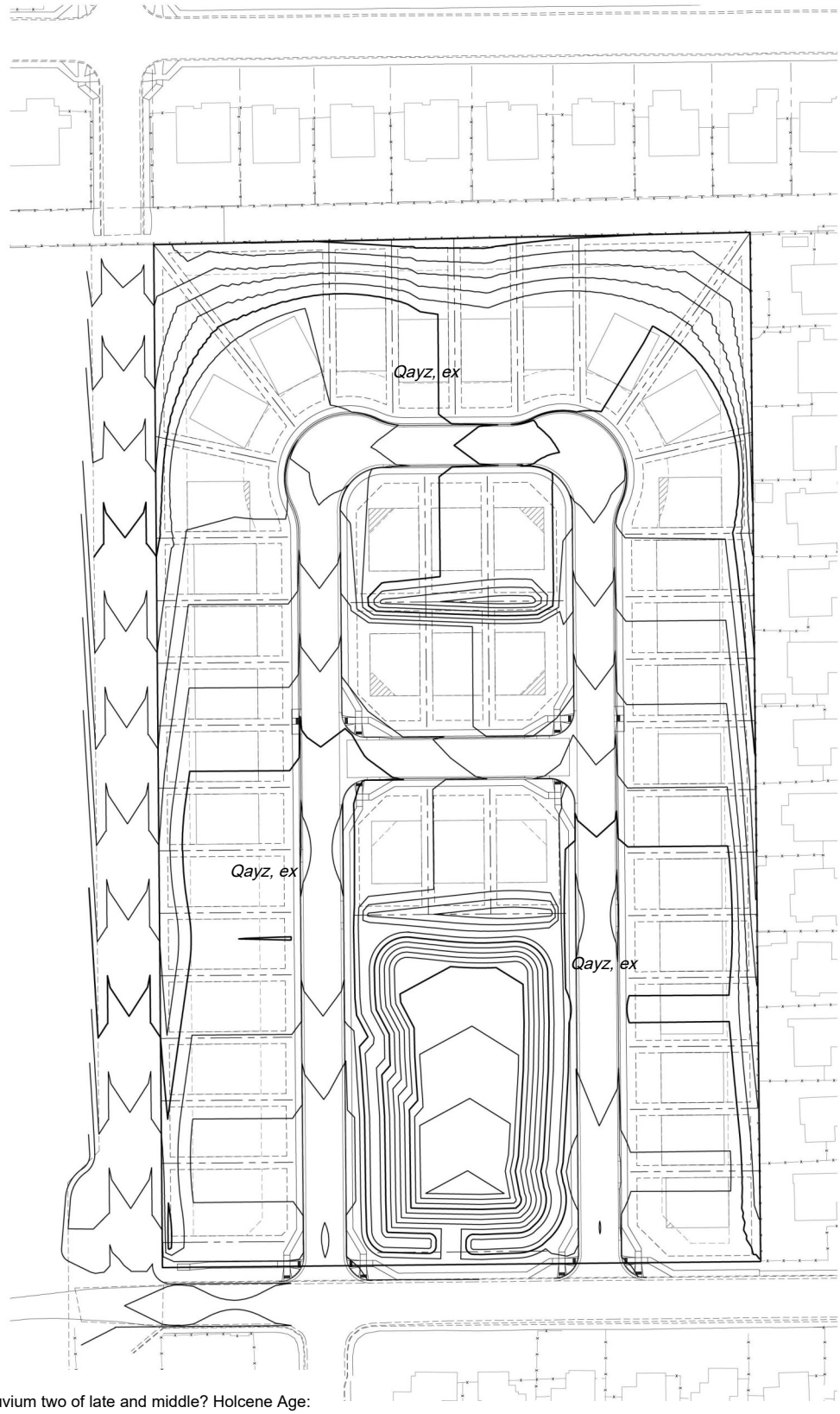
FIG. 6



Legend:

Qayz-	Young alluvium two of late and middle? Holcene Age: clayey fllodplain and stream terrace deposits
ex -	expansive soils

N

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GEOLOGY/ENGINEERING GEOLOGY MAP

HABITAT FOR HUMANITY - MEADOWORKS
COLORADO SPRINGS, CO
NORWOOD DEVELOPMENT

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FIG. 7

ENTECH ENGINEERING, INC.

FEMA FLOODPLAIN MAP

HABITAT FOR HUMANITY - MEADOWORKS
COLORADO SPRINGS, CO
NORWOOD DEVELOPMENT

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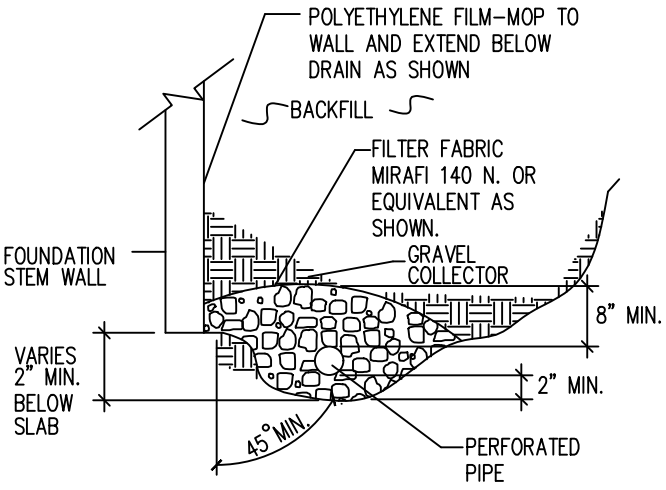
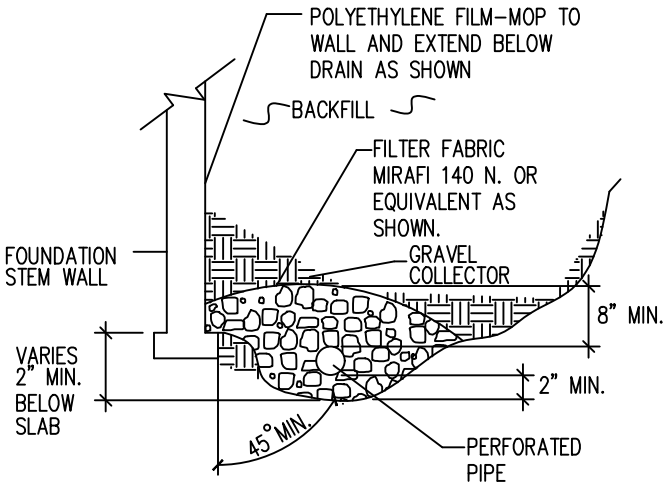
240323

FIG. 8





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.

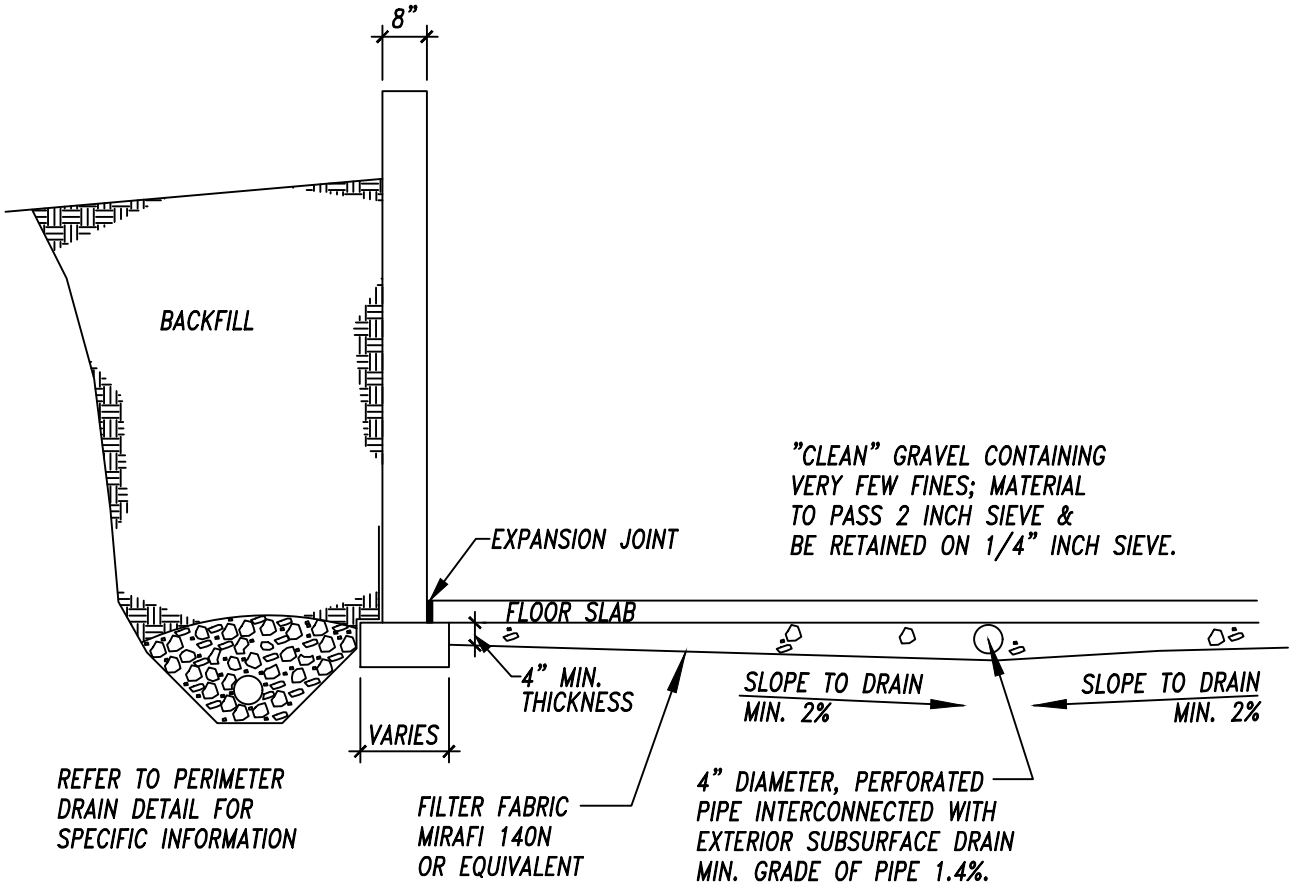
ENTECH ENGINEERING, INC.

PERIMETER DRAIN DETAIL

HABITAT FOR HUMANITY - MEADOWORKS
COLORADO SPRINGS, CO
NORWOOD DEVELOPMENT

JOB NO. 240323

FIG. 9



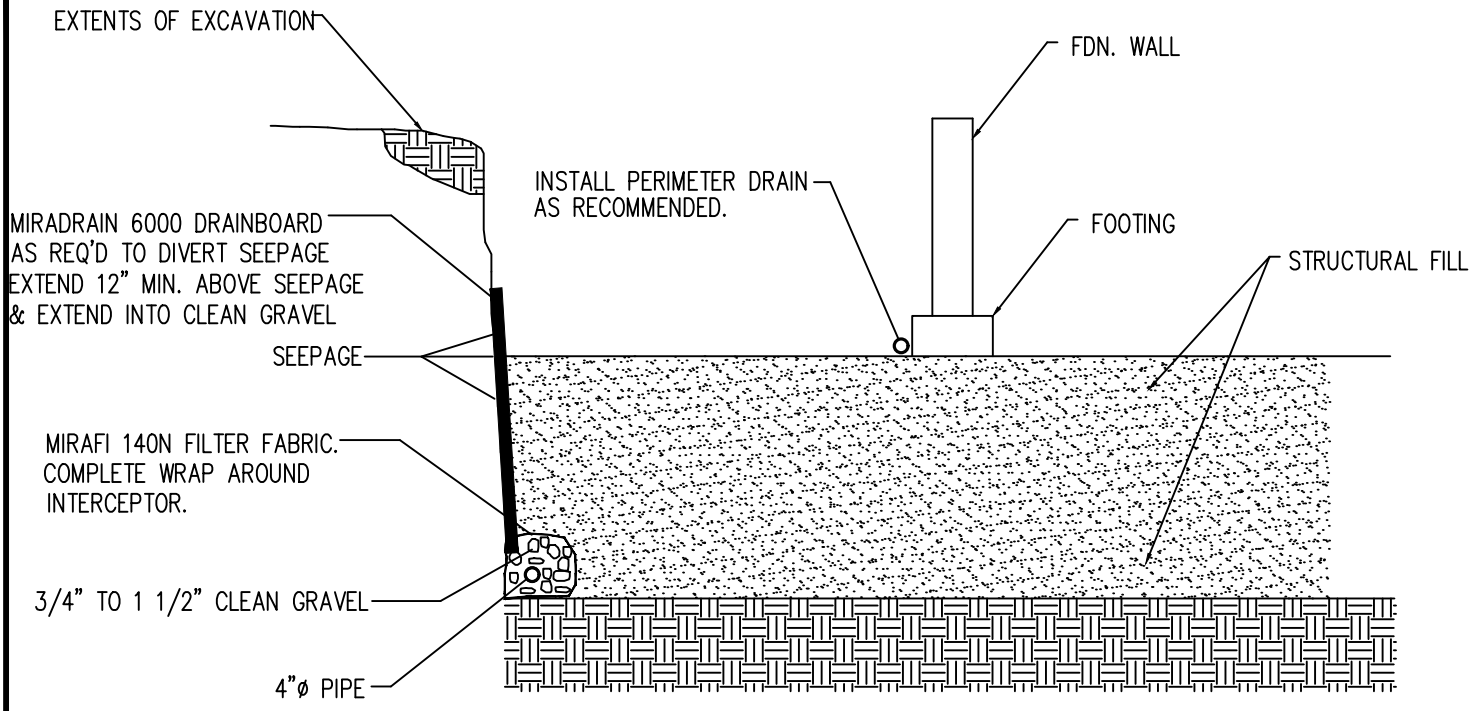
ENTECH ENGINEERING, INC.

TYP. UNDERSLAB DRAINAGE LAYER (CAPILLARY BREAK)

HABITAT FOR HUMANITY - MEADOWORKS
COLORADO SPRINGS, CO
NORWOOD DEVELOPMENT

JOB NO.
240323

FIG. 10



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

INTERCEPTOR DRAIN DETAIL

N.T.S.

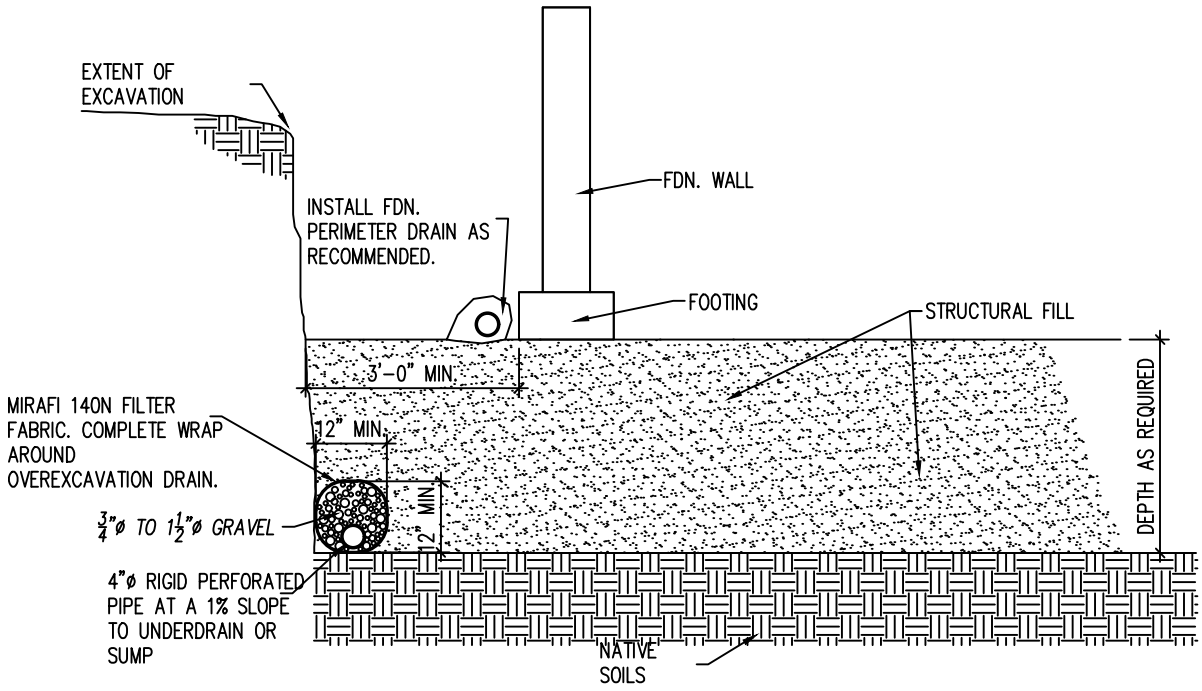
ENTECH ENGINEERING, INC.

INTERCEPTOR DRAIN DETAIL

HABITAT FOR HUMANITY - MEADOWORKS
COLORADO SPRINGS, CO
NORWOOD DEVELOPMENT

JOB NO.
240323

FIG. 11



OVEREXCAVATION DRAIN DETAIL

N.T.S.

NOTE:

EXTEND DRAIN TO SUMP AS REQ'D.

ENTECH ENGINEERING, INC.

OVEREXCAVATION DRAIN

HABITAT FOR HUMANITY - MEADOWORKS
COLORADO SPRINGS, CO
NORWOOD DEVELOPMENT

JOB NO. 240323

FIG. 12

APPENDIX A: Site Photographs

1

Looking north from the southern side of the site.

March 1, 2024

2

Looking northwest from the eastern side of the site.

March 1, 2024

Job No. 240323

3

Looking southwest from the eastern side of the site.

March 1, 2024

4

Looking north fr om the southwest side of the site.

March 1, 2024

Job No. 240323

5

Looking south from the northwestern side of the site.

December 12, 2023

6

Looking east from the northwestern side of the site.

December 12, 2023

Job No. 231855

7

Looking southeast from the northwestern side of the site.

December 12, 2023

8

Looking southeast from the southwestern side of the site.

December 12, 2023

Job No. 231855

APPENDIX B: Test Boring Logs

TEST BORING 1
DATE DRILLED 2/29/2024

REMARKS

DRY TO 20', 2/29/24

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			8	11.1	1
5			25	23.9	1
10			20	19.0	1
15			9	13.6	1
20			18	5.8	2

CLAY, WITH SAND, BROWN to TAN, STIFF to VERY STIFF, MOIST

SAND, SILTY, TAN, MEDIUM DENSE, MOIST

TEST BORING 2
DATE DRILLED 2/29/2024

REMARKS

DRY TO 20', 2/29/24

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			8	21.2	1
5			22	22.7	1
10			10	14.6	1
15			8	21.2	1
20			6	16.9	1

CLAY, SLIGHTLY SANDY, BROWN to TAN, STIFF to VERY STIFF, MOIST

ENTECH ENGINEERING, INC.

TEST BORING LOGS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

JOB NO. 240323

FIG. A-1

TEST BORING 3
DATE DRILLED 2/29/2024

REMARKS

DRY TO 20', 2/29/24

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			6	14.0	1
5			6	26.0	1
10			14	9.9	1
15			11	15.9	1
20			11	6.2	2

CLAY, SANDY, BROWN to TAN, MEDIUM STIFF to STIFF, MOIST

SAND, SILTY, TAN, MEDIUM DENSE, MOIST

TEST BORING 4
DATE DRILLED 3/1/2024

REMARKS

DRY TO 20', 3/1/24

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			6	10.5	1
5			4	9.5	1
10			7	10.5	1
15			6	20.9	1
20			7	22.4	1

CLAY, WITH SAND, BROWN to TAN, MEDIUM STIFF, MOIST

ENTECH ENGINEERING, INC.

TEST BORING LOGS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

JOB NO. 240323

FIG. A-2

TEST BORING 5
DATE DRILLED 3/1/2024

REMARKS

DRY TO 20', 3/1/24

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	CLAY, WITH SAND, BROWN to TAN, MEDIUM STIFF, MOIST		5	10.0	1
5			8	12.2	1
10			6	17.1	1
15			6	20.3	1
20			6	6.2	1

TEST BORING 6
DATE DRILLED 3/1/2024

REMARKS

DRY TO 20', 3/1/24

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	CLAY, SANDY, BROWN to TAN, MEDIUM STIFF, MOIST		4	7.7	1
5			7	13.4	1
10			7	9.1	1
15			8	30.4	1
20			9	5.6	1

ENTECH ENGINEERING, INC.

TEST BORING LOGS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

JOB NO. 240323

FIG. A-3

TEST BORING 7
DATE DRILLED 3/4/2024

REMARKS

WATER @ 23', 3/4/24

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	CLAY, SANDY, BROWN to TAN, MEDIUM STIFF to STIFF, MOIST		6	15.3	1
5			13	16.7	1
10			6	17.3	1
15			8	16.8	1
20			7	20.0	1
	SAND, WITH SILT, TAN, VERY LOOSE to MEDIUM DENSE, WET ▼				
25			<1	19.2	2

TEST BORING 7 cont.
DATE DRILLED 3/4/2024

REMARKS

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	SAND, WITH SILT, TAN, VERY LOOSE to MEDIUM DENSE, WET				
30			13	14.8	2
35			6	21.9	2
40			13	20.9	2
45			12	19.4	2
50			7	32.1	2

ENTECH ENGINEERING, INC.

TEST BORING LOGS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

JOB NO. 240323

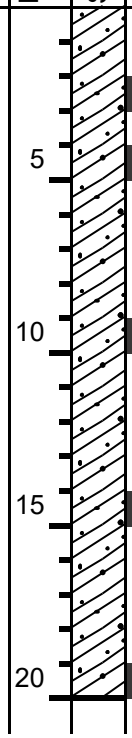
FIG. A-4

TEST BORING 8
DATE DRILLED 3/4/2024

REMARKS

DRY TO 20', 3/4/24

CLAY, SANDY, BROWN to TAN, MEDIUM STIFF to STIFF, MOIST



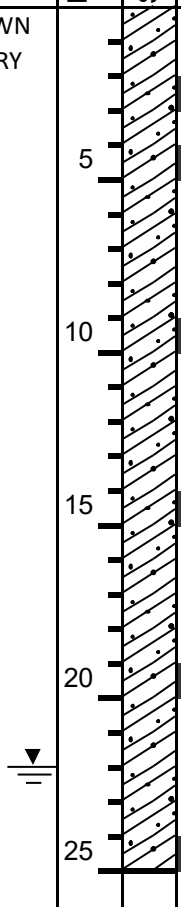
Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			5	5.7	1
5			7	15.6	1
10			12	14.5	1
15			10	12.6	1
20			8	19.9	1

TEST BORING 9
DATE DRILLED 3/4/2024

REMARKS

WATER @ 22', 3/4/24

CLAY, SLIGHTLY SANDY, BROWN to TAN, MEDIUM STIFF to VERY SOFT, MOIST



Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			4	14.5	1
5			8	8.9	1
10			7	13.4	1
15			7	22.3	1
20			5	27.1	1
25			2	25.9	1

ENTECH ENGINEERING, INC.

TEST BORING LOGS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

JOB NO. 240323

FIG. A-5

APPENDIX C: Laboratory Testing Results

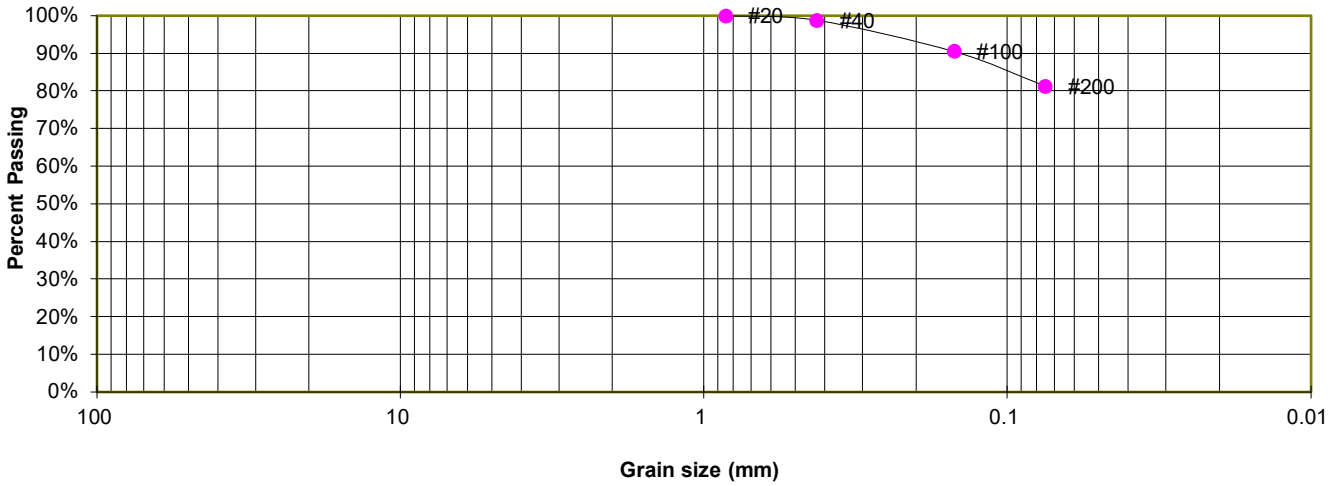
ENTECH ENGINEERING, INC.

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/ CONSOL (%)	USCS	SOIL DESCRIPTION
1	1	10	22.7	85.8	81.3	46	23	23	0.04	2.2	CL	CLAY, WITH SAND
1	2	5			95.6						CL	CLAY, SLIGHTLY SANDY
1	3	2-3			52.5						CL	CLAY, SANDY
1	3	10	13.5	89.3	57.8					0.2	CL	CLAY, SANDY
1	4	20	25.3	94.7	78.8	34	21	13	<0.01	0.1	CL	CLAY, WITH SAND
1	5	10			78.9	42	25	17	0.00		CL	CLAY, WITH SAND
1	6	5			63.5				0.00		CL	CLAY, SANDY
1	8	20			62.4						CL	CLAY, SANDY
1	9	15	20.2	101.9	94.0					0.9	CL	CLAY, SLIGHTLY SANDY
2	7	40			9.0						SW-SM	SAND, WITH SILT

Project: Meadowbrooks Habitat for Humanity
Client: Norwood Development
Job No: 240323

TEST BORING	1	SOIL DESCRIPTION	CLAY, WITH SAND
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	
10	
20	100.0%
40	98.8%
100	90.5%
200	81.3%

ATTERBERG LIMITS

Plastic Limit	23
Liquid Limit	46
Plastic Index	23

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

ENTECH ENGINEERING, INC.

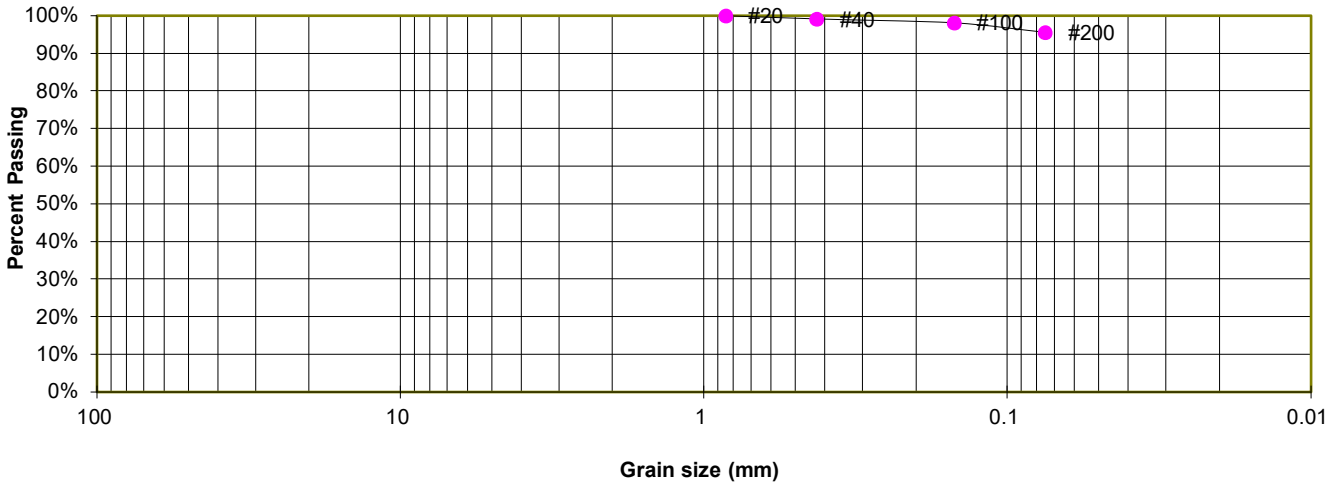
LABORATORY TEST RESULTS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

JOB NO. 240323

FIG. B-1

TEST BORING	2	SOIL DESCRIPTION	CLAY, SLIGHTLY SANDY
DEPTH (FT)	5	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	100.0%
40	99.2%
100	98.2%
200	95.6%

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

ENTECH ENGINEERING, INC.

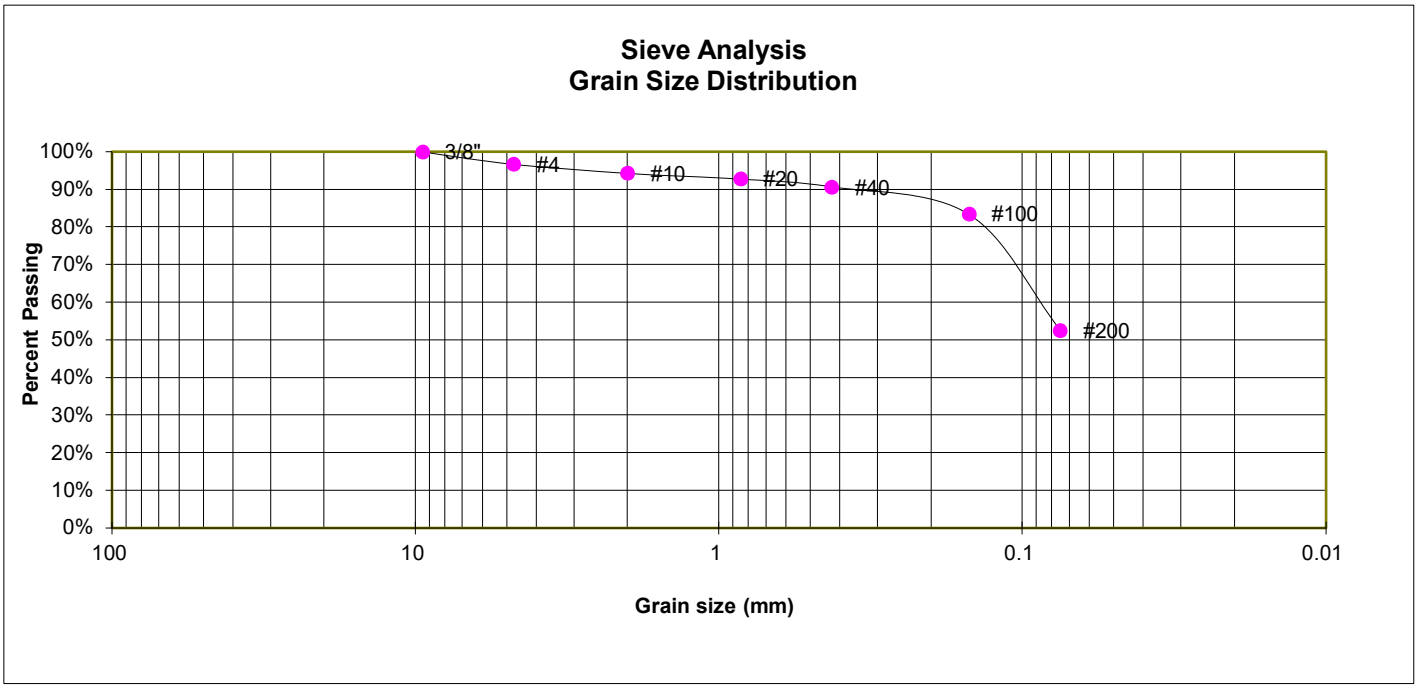
LABORATORY TEST RESULTS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

JOB NO. 240323

FIG. B-2

TEST BORING	3	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	2-3	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.7%
10	94.3%
20	92.8%
40	90.7%
100	83.4%
200	52.5%

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

ENTECH ENGINEERING, INC.

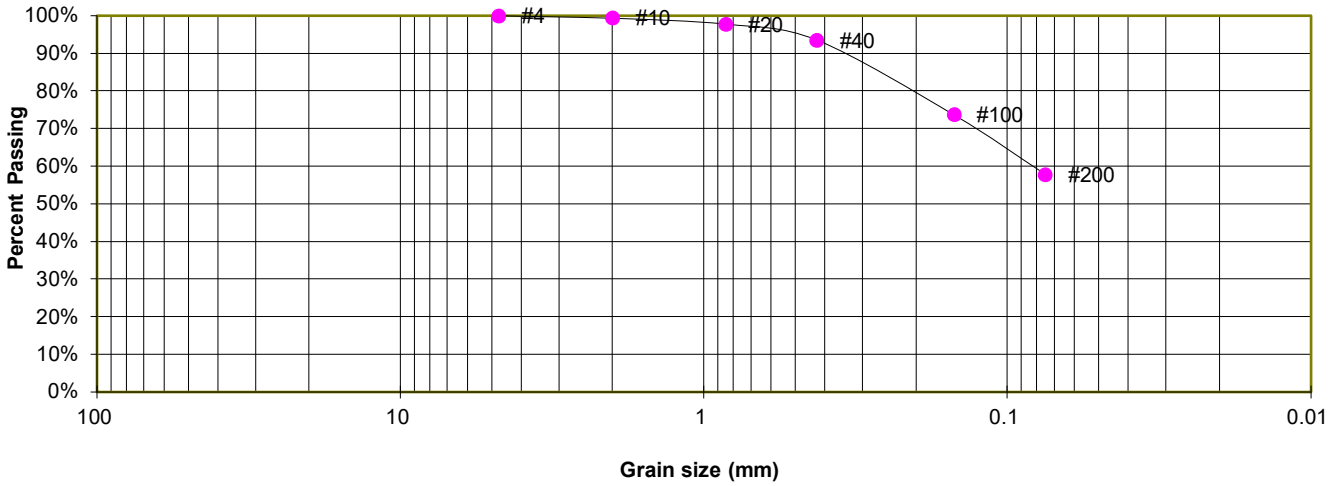
LABORATORY TEST RESULTS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

JOB NO. 240323

FIG. B-3

TEST BORING	3	SOIL DESCRIPTION	CLAY, SANDY
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	99.4%
20	97.8%
40	93.5%
100	73.8%
200	57.8%

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

ENTECH ENGINEERING, INC.

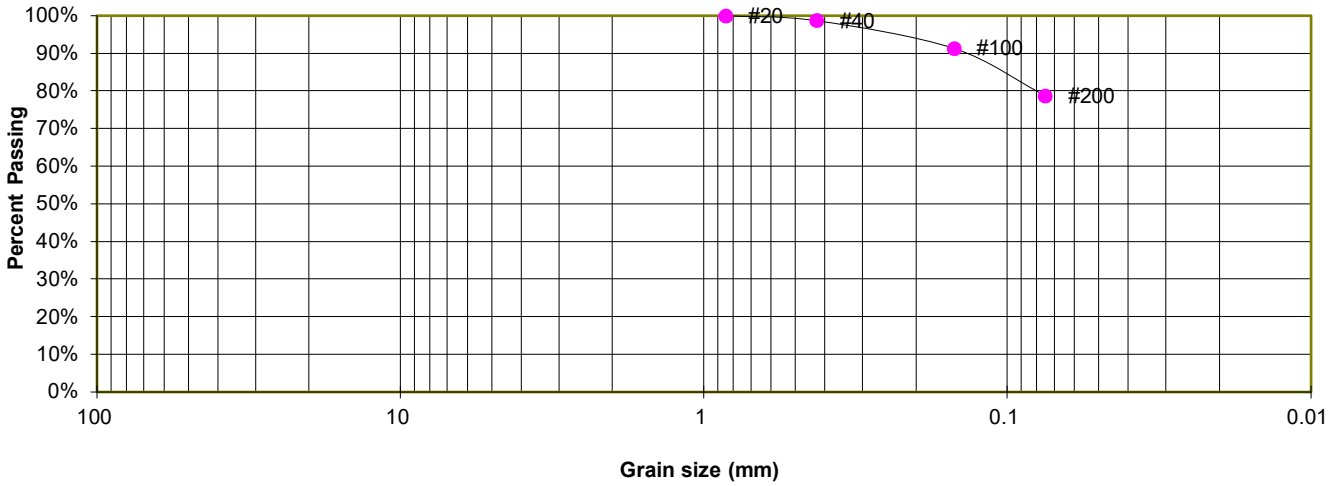
LABORATORY TEST RESULTS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

JOB NO. 240323

FIG. B-4

TEST BORING	4	SOIL DESCRIPTION	CLAY, WITH SAND
DEPTH (FT)	20	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	100.0%
40	98.7%
100	91.4%
200	78.8%

ATTERBERG LIMITS

Plastic Limit	21
Liquid Limit	34
Plastic Index	13

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

ENTECH ENGINEERING, INC.

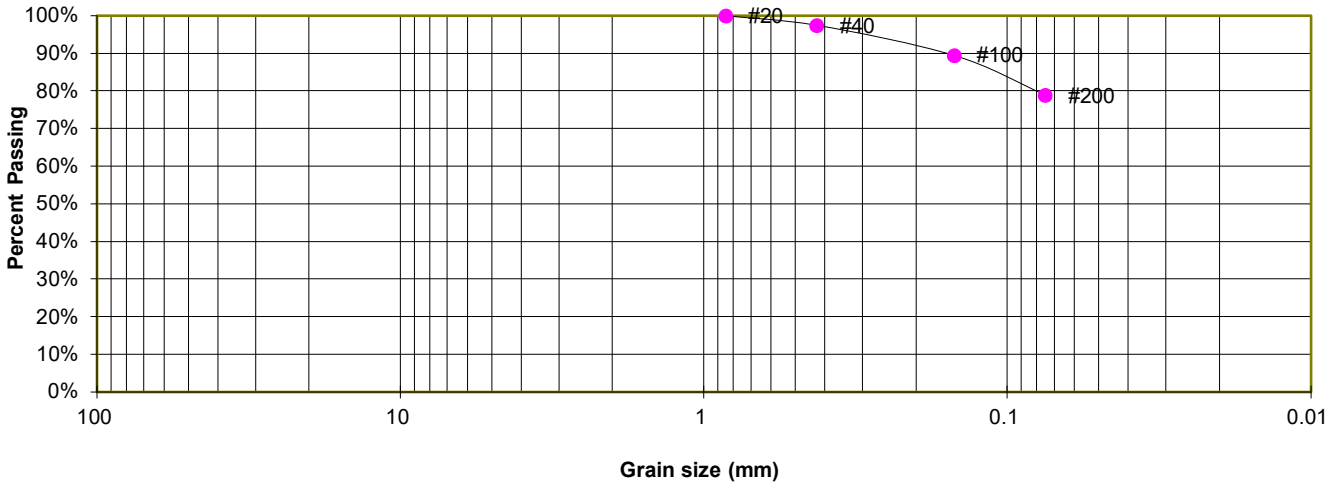
LABORATORY TEST RESULTS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

JOB NO. 240323

FIG. B-5

TEST BORING	5	SOIL DESCRIPTION	CLAY, WITH SAND
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	
10	
20	100.0%
40	97.5%
100	89.5%
200	78.9%

ATTERBERG LIMITS

Plastic Limit	25
Liquid Limit	42
Plastic Index	17

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

ENTECH ENGINEERING, INC.

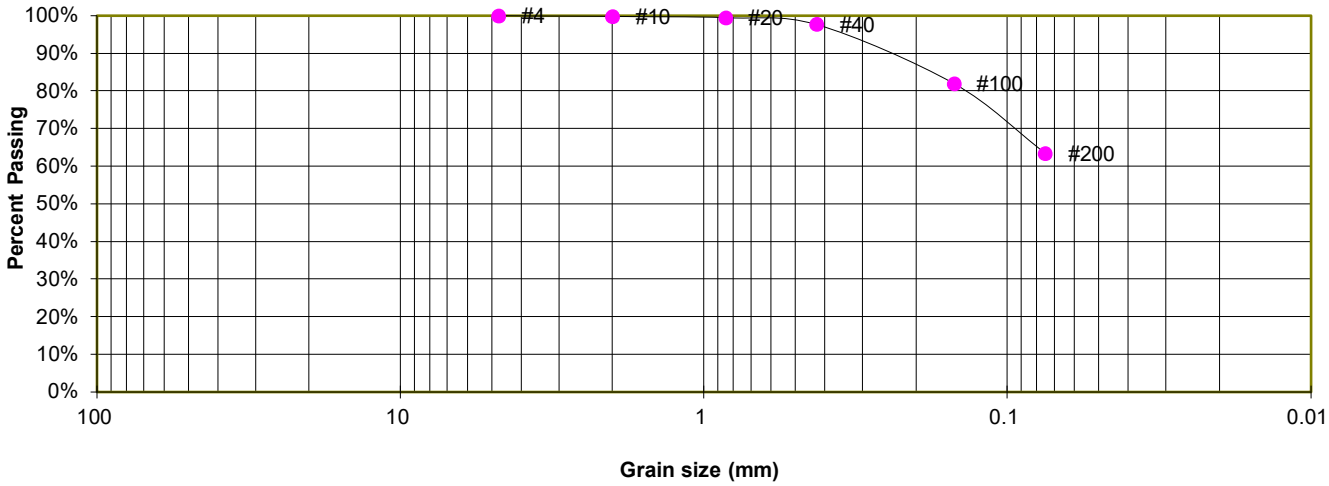
LABORATORY TEST RESULTS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

JOB NO. 240323

FIG. B-6

TEST BORING	6	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	5	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	99.9%
20	99.5%
40	97.7%
100	82.0%
200	63.5%

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

ENTECH ENGINEERING, INC.

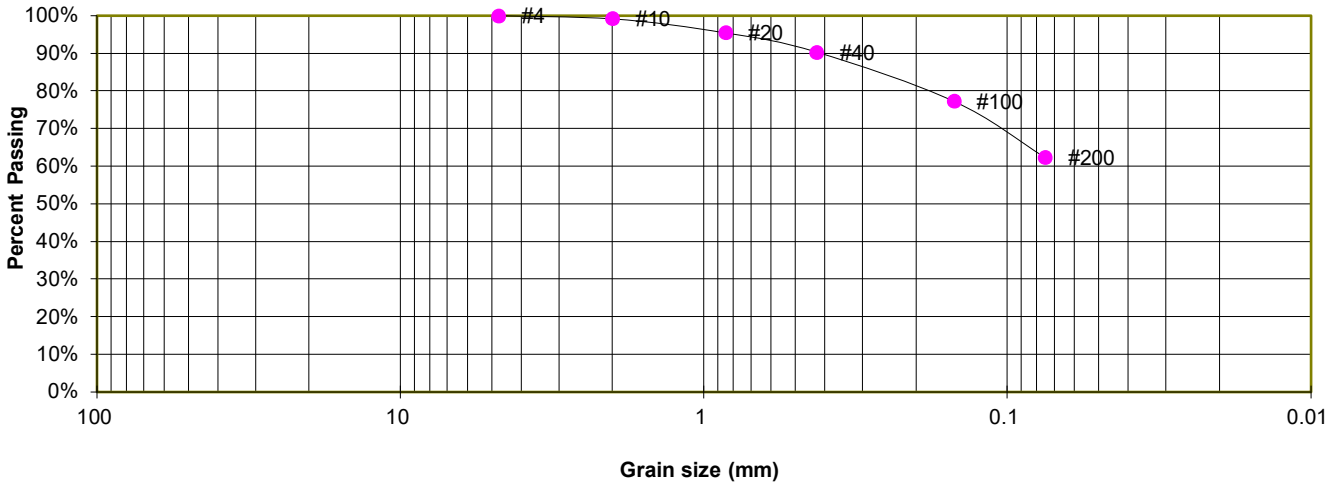
LABORATORY TEST RESULTS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

JOB NO. 240323

FIG. B-7

TEST BORING	8	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	20	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	99.2%
20	95.5%
40	90.3%
100	77.3%
200	62.4%

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

ENTECH ENGINEERING, INC.

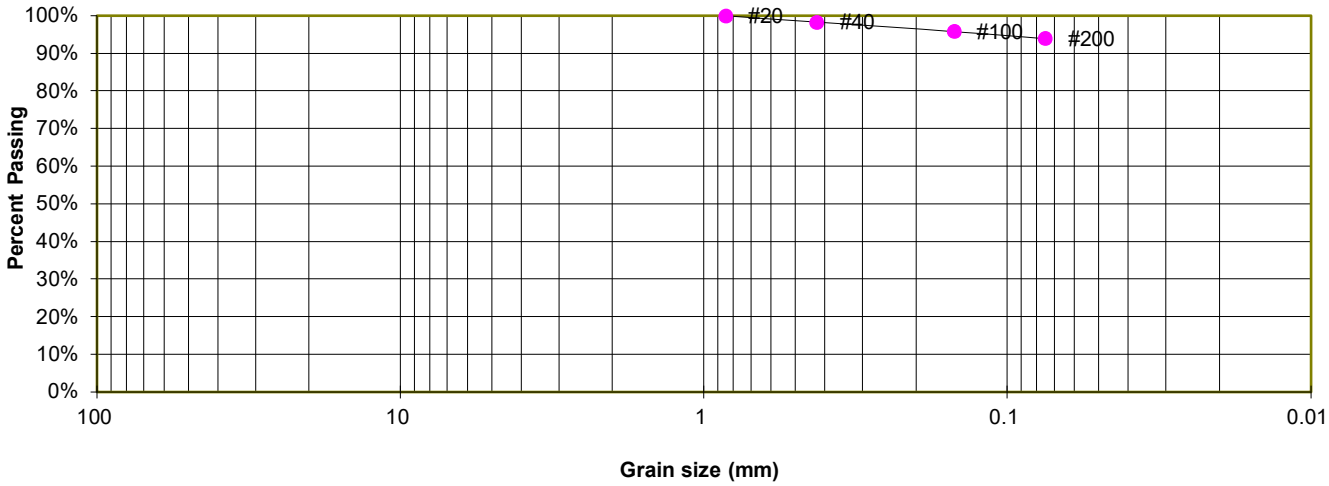
LABORATORY TEST RESULTS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

JOB NO. 240323

FIG. B-8

TEST BORING	9	SOIL DESCRIPTION	CLAY, SLIGHTLY SANDY
DEPTH (FT)	15	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	100.0%
40	98.4%
100	95.9%
200	94.0%

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

ENTECH ENGINEERING, INC.

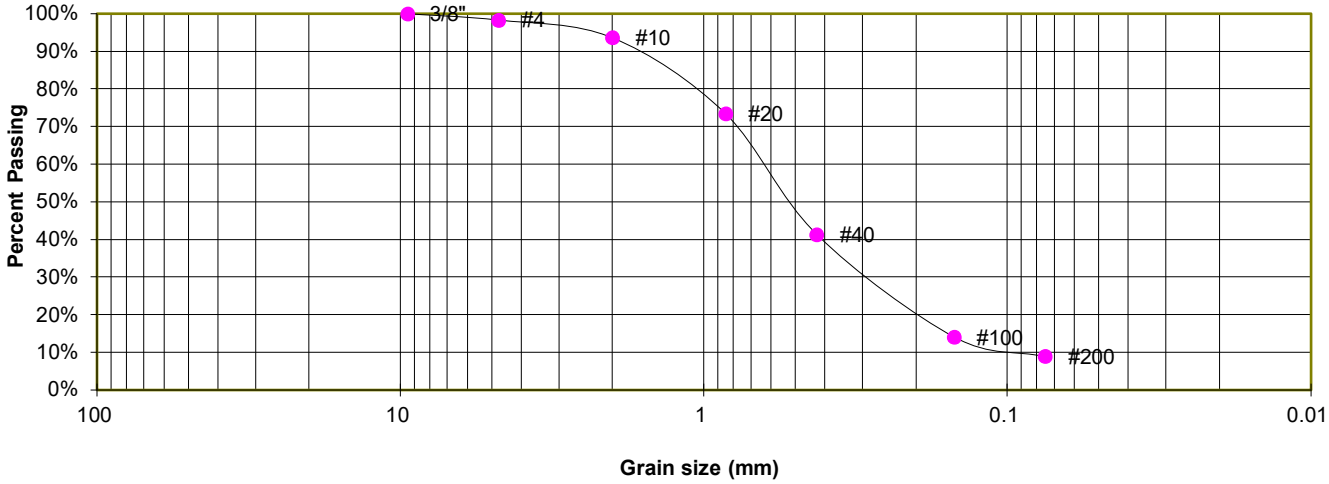
LABORATORY TEST RESULTS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

JOB NO. 240323

FIG. B-9

TEST BORING	7	SOIL DESCRIPTION	SAND, WITH SILT
DEPTH (FT)	40	SOIL TYPE	2



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.4%
10	93.6%
20	73.5%
40	41.3%
100	14.1%
200	9.0%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SW-SM

ENTECH ENGINEERING, INC.

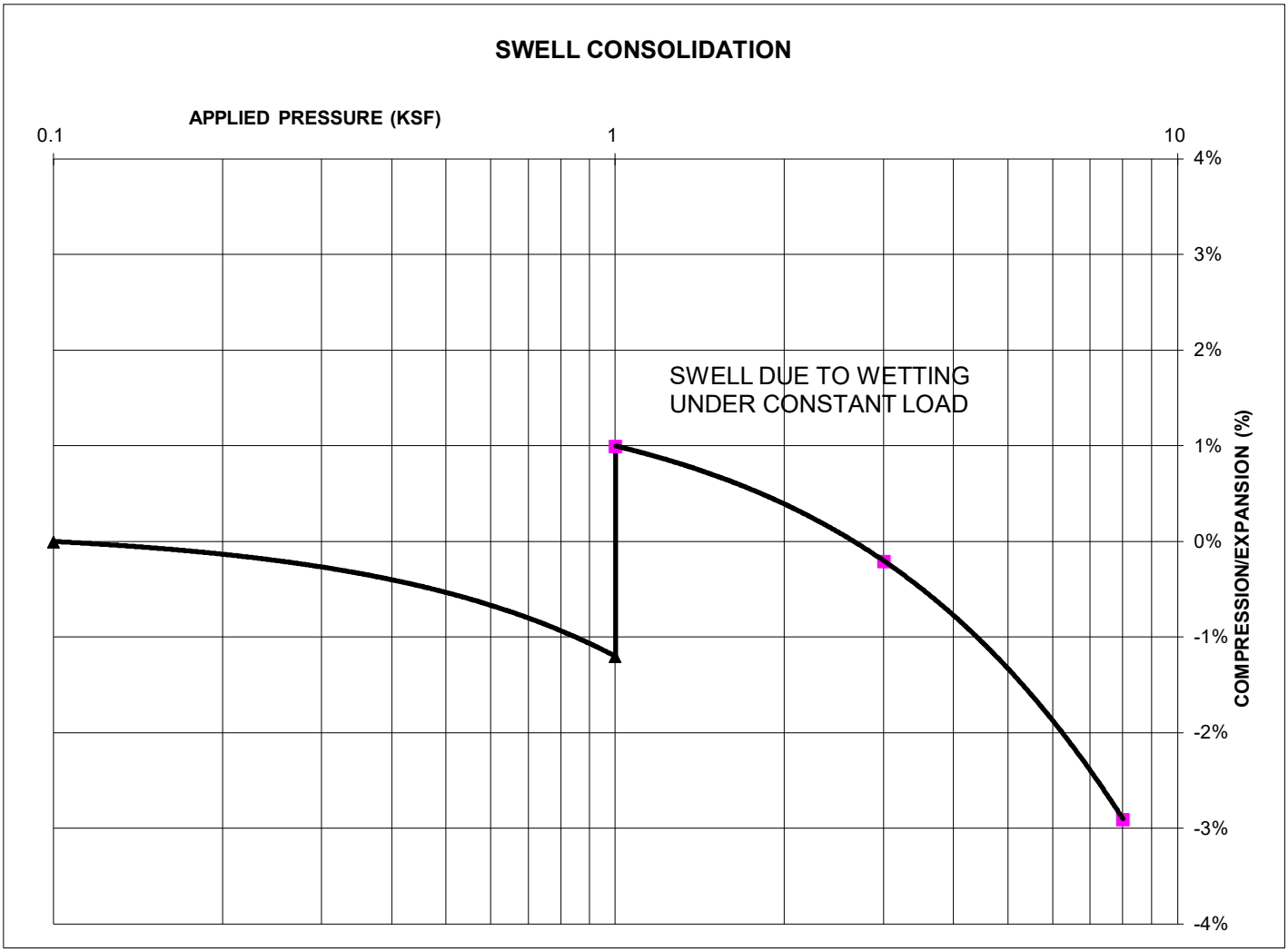
LABORATORY TEST RESULTS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

JOB NO. 240323

FIG. B-10

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



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF): 86
NATURAL MOISTURE CONTENT: 22.7%
SWELL/COLLAPSE (%): 2.2%

ENTECH ENGINEERING, INC.

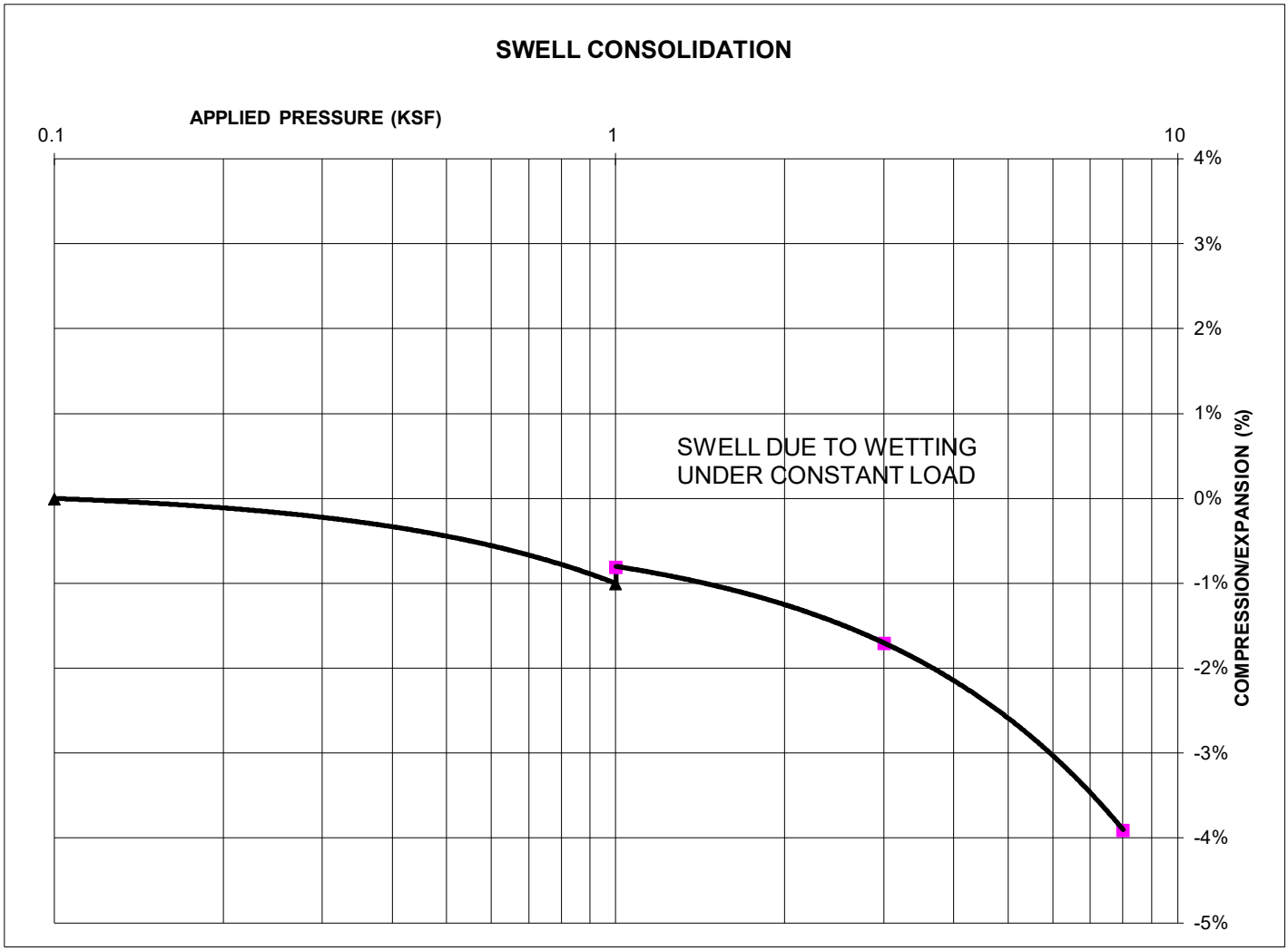
SWELL TEST RESULTS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

JOB NO. 240323

FIG. B-11

TEST BORING	3	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	10	SOIL TYPE	1



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF): 89
NATURAL MOISTURE CONTENT: 13.5%
SWELL/COLLAPSE (%): 0.2%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

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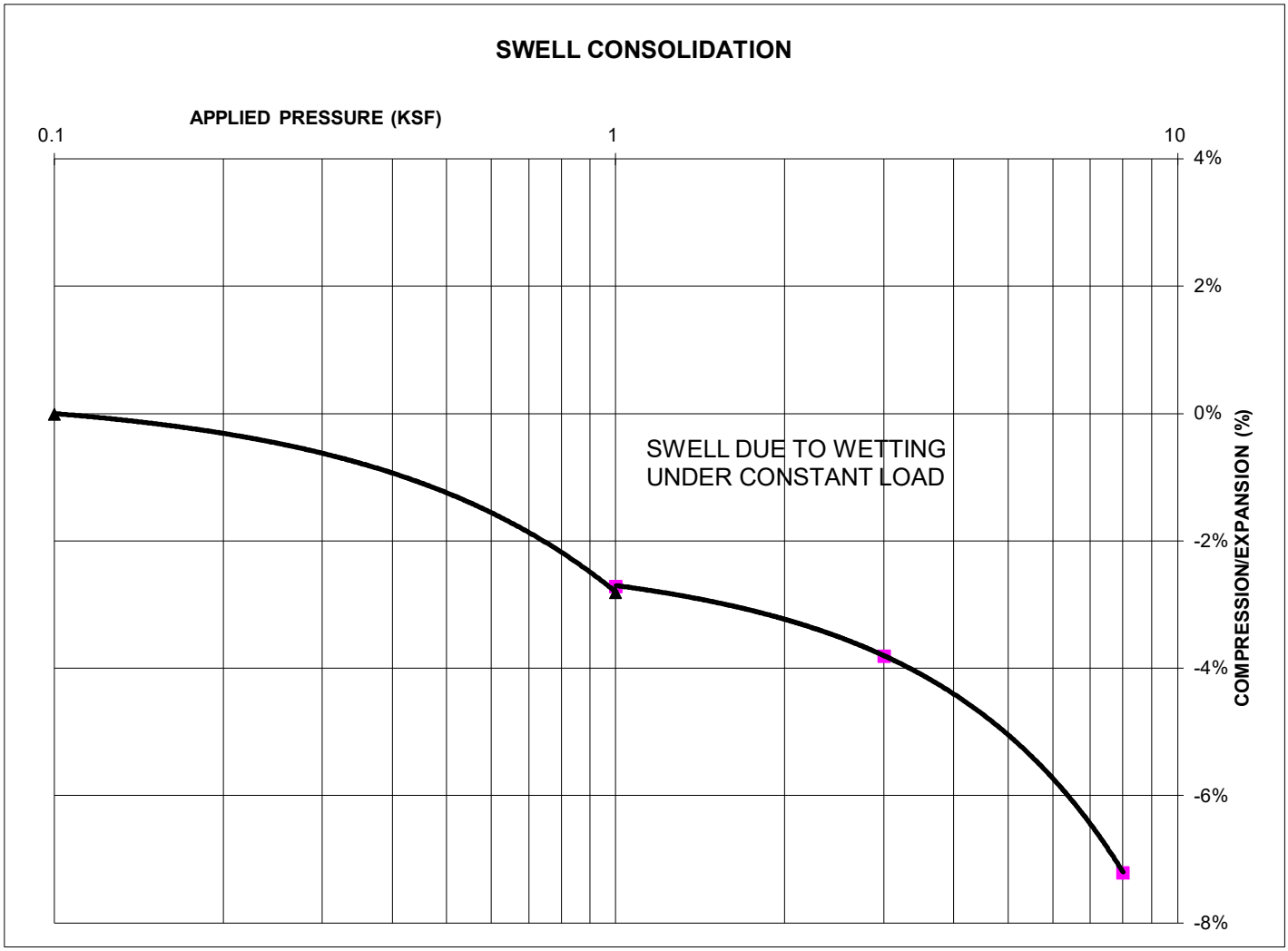
FIG. B-12

TEST BORING	4	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	20	SOIL TYPE	1



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF): 95
NATURAL MOISTURE CONTENT: 25.3%
SWELL/COLLAPSE (%): 0.1%

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SWELL TEST RESULTS

MEADOWWORKS HABITAT FOR HUMANITY
NORWOOD DEVELOPMENT

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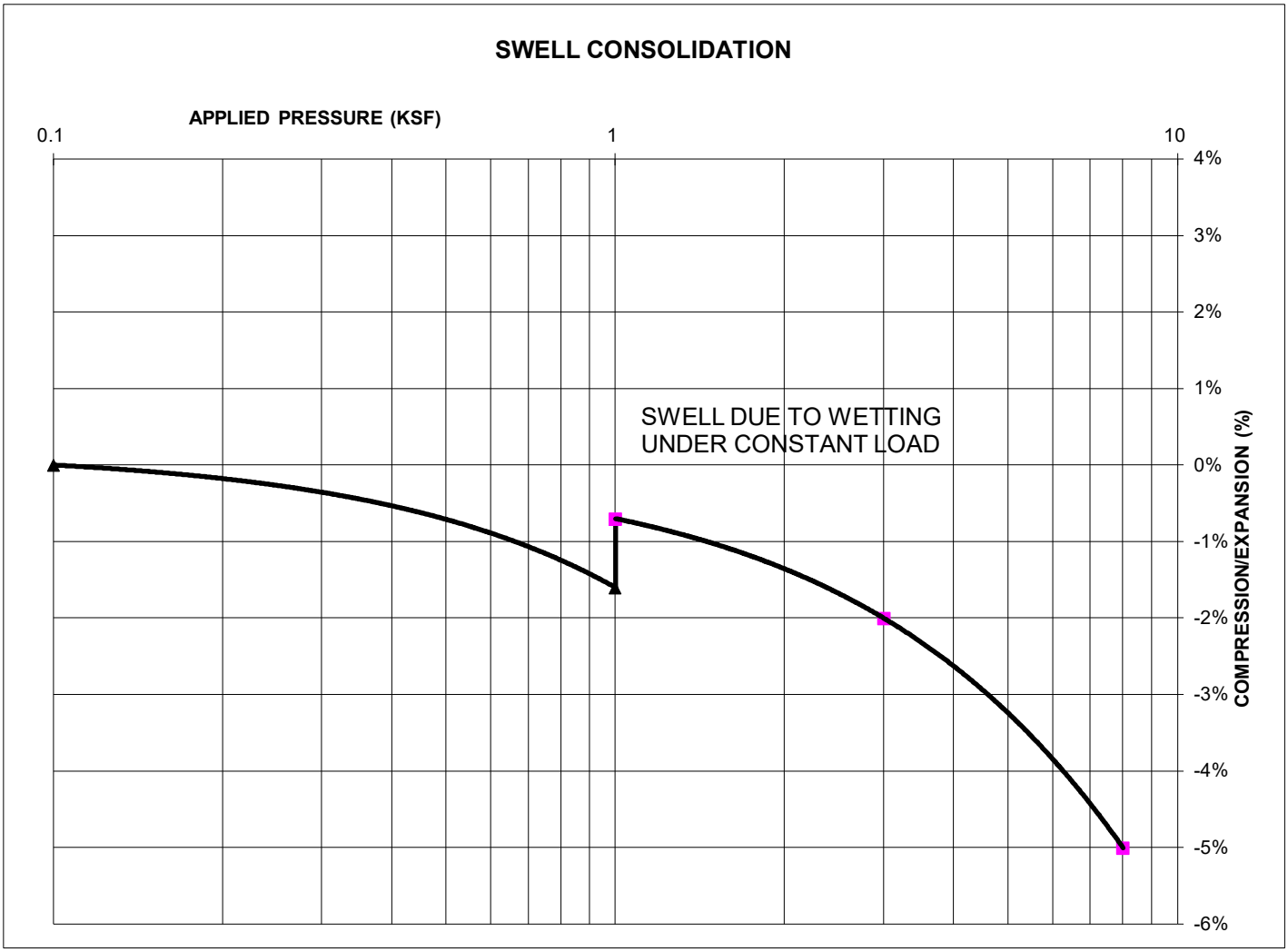
FIG. B-13

TEST BORING	9	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	15	SOIL TYPE	0



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF): 102
NATURAL MOISTURE CONTENT: 20.2%
SWELL/COLLAPSE (%): 0.9%

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SWELL TEST RESULTS

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FIG. B-14

APPENDIX D: USDA Soil Survey Descriptions

El Paso County Area, Colorado

101—Ustic Torrifluvents, loamy

Map Unit Setting

National map unit symbol: 3673
Elevation: 5,500 to 7,000 feet
Mean annual precipitation: 13 to 16 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 125 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Ustic torrifluvents and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ustic Torrifluvents

Setting

Landform: Flood plains, stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy, clayey, stratified loamy

Typical profile

A - 0 to 6 inches: variable
C - 6 to 60 inches: stratified loamy sand to clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R069XY037CO - Saline Overflow
Other vegetative classification: OVERFLOW (069BY036CO)

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 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 21, Aug 24, 2023