GEOLOGIC HAZARD EVALUATION AND PRELIMINARY GEOTECHNICAL INVESTIGATION

ROWLEY PROPERTY
MARKSHEFFEL ROAD AND COLORADO TECH DRIVE
COLORADO SPRINGS, COLORADO

Prepared for:

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Project No. CS20042-115

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TABLE OF CONTENTS

TABLE OF CONTENTS, CONT.

Include a vicinity map

Include map for potential geologic hazards

Include soil map

Add Sketch Plan layout inclining roads/trails and land uses to pages 29-31 figures (this can be drafted in to existing maps by hand)

SCOPE

This report presents the results of our Geologic Hazard Evaluation and Preliminary Geotechnical Investigation for an approximately 60-acre site encompassing 5 separate parcels of land. The project area is located southwest of the intersection of North Marksheffel Road and Venture Street in El Paso County Colorado (Fig. 1). We understand one parcel is developed (permanent structures) and the remaining four parcels are either occupied with storage and semi-truck trailer or are vacant and undeveloped. The purpose of our investigation was to evaluate general geologic and subsurface conditions that influence development to assist in planning and preliminary design. The scope was described in our Proposal (CS-25-0186) dated November 24, 2025. Evaluation of the property for the presence of potentially hazardous materials (Environmental Site Assessment) was conducted by CTL in 2023 under a separate letter head.

This report is based on our understanding of the planned construction, subsurface conditions disclosed by exploratory borings, results of field and laboratory tests, engineering analysis, and our experience. It contains descriptions of the soil conditions and groundwater levels found in our exploratory borings, and preliminary design and construction criteria for foundations, floor systems, pavements, and surface drainage. The discussions of foundation, floor systems, and pavement are intended for planning purposes only. The geotechnical exploration and laboratory testing information contained in this report can be used as a supplement for future design-level investigations. CTL|Thompson can drill additional borings and prepare a design-level geotechnical investigation under a as a separate scope of work that utilizes the seven boring drilled during this investigation, if requested. The following section summarizes our conclusions and recommendations, with more detailed discussion throughout this report.

SUMMARY OF CONCLUSIONS

1. Strata encountered in our exploratory borings generally consisted of areas of surficial, silty and clayey sand to sandy clay fill. Natural silty and clayey sand were encountered at the ground surface or underlying the existing fills. Sandstone bedrock was encountered underlying the natural soils in each of the borings.
2. Groundwater was observed in six borings at depths of between 9 and 22 feet. Groundwater levels will fluctuate with seasonal precipitation and landscaping irrigation.

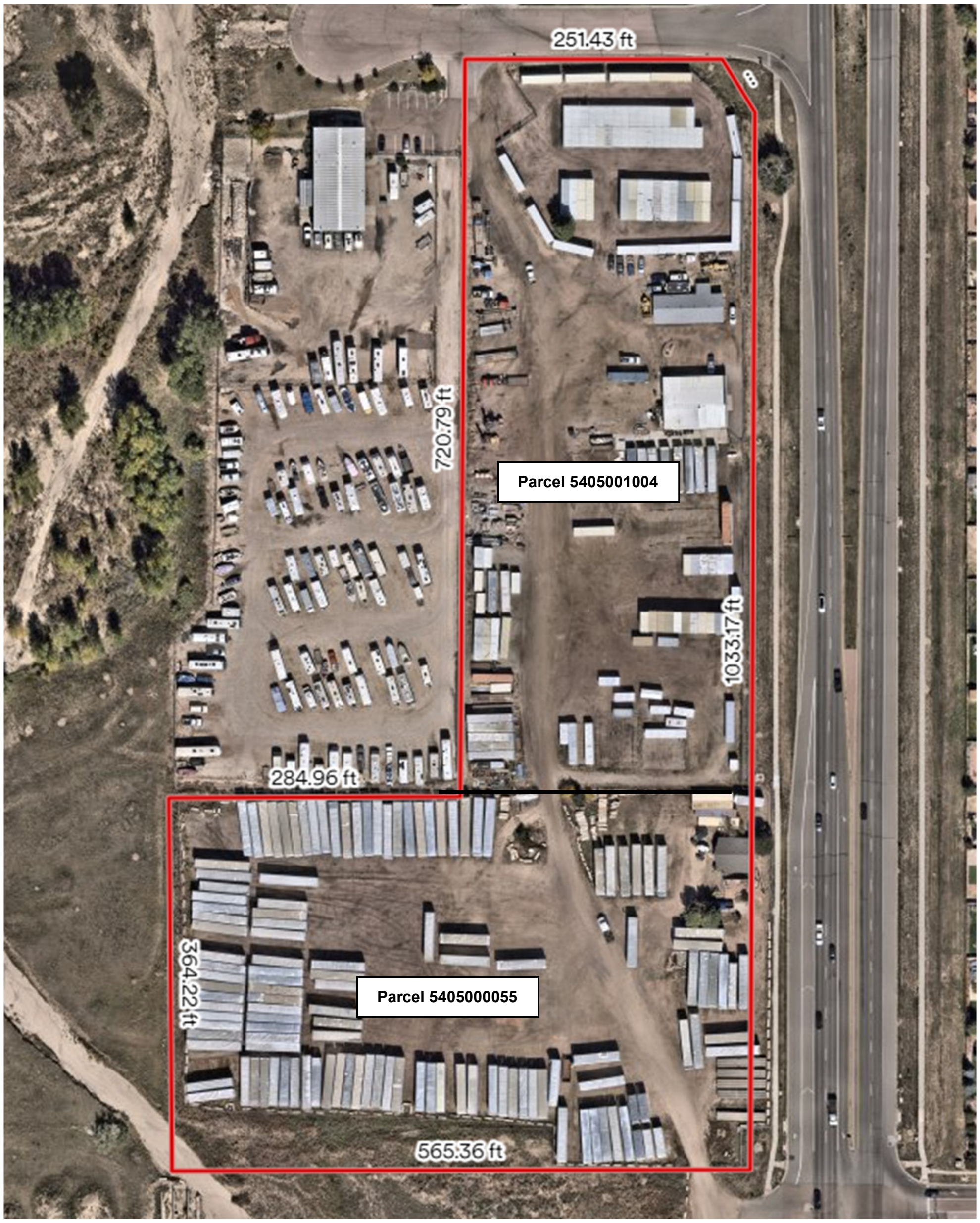
3. We recommend the preparation of design-level geotechnical investigations for proposed buildings to develop specific foundation recommendations for the design and construction of foundations and floor systems. We expect spread footing foundations will be the preferred foundation type for the proposed development type. For preliminary planning purposes, spread footing foundations with a maximum allowable soil pressure of 2,000 to 3,000 psf is anticipated.
4. The natural sand, or new, moisture conditioned, densely compacted site grading fill should provide reliable support characteristics. Over-excavation of existing fill and loose soil, if encountered, and replacement with moisture conditioned fill can enhance performance of foundations and slabs.
5. We understand the project will include the construction of commercial and residential roadways. On a preliminary basis, we suggest budgeting for a pavement section of 4 inches of asphalt over 8 inches of aggregate base course. A pavement design report should be prepared in accordance with El Paso County criteria after site plans and grading plans have been completed.
6. Control of surface drainage will be critical to the performance of foundations and slabs-on-grade. Overall surface drainage should be designed to provide rapid removal of surface runoff away from the proposed residences. Conservative irrigation practices should be followed to avoid excessive wetting.

SITE CONDITIONS

The overall project site is located southwest of the intersection of Venture Street and Marksheffel Road in unincorporated El Paso County, Colorado (Fig. 1). The project area is divided into two separate sites totaling about 60 acres, referred to herein as the northern site and the southern site. The two sites are separated by a future extension of Colorado Tech Drive and other undeveloped land.

Northern Site

The northern site consists of two separate parcels (Parcel Nos. 5404001004 and 540000055) that comprise 9 acres of land. At the time of this report, the northern site was predominantly utilized as storage for numerous containers and semi-trailers. Two relatively small, single-story buildings are located in the northern portion of the site adjacent to Marksheffel Road. Similar land used for storage is located west of the northern parcel. A minor, unchanneled tributary of the East Fork Sand Creek is located west of the northern site. The northern site is generally devoid of vegetation. The overall topography is relatively flat with a very gently descent to the south and southwest. An aerial image of the site with approximate parcel boundaries is shown below.



Near Map Aerial Image of Northern Site

Southern Site

The southern site is comprised of three separate parcels, totaling about 50 acres. This includes an east-west elongated, 19-acre undeveloped parcel (Parcel No. 5405000033), an approximately 30-foot-wide by 450-foot-long strip of undeveloped land that extends west from Marksheffel Road (Parcel No. 5405000049), and an irregular shaped, 31-acre parcel (Parcel No. 5405000050) that includes a portion of the East Fork Sand Creek drainage.

A minor, unchanneled tributary to the Sand Creek East Fork crosses the 19-acre parcel from north to south and lies to the west of the 31-acres site, forming a confluence at the Sand Creek East Fork, just south of the southernmost property boundary. Over the past 25 years, the tributary creek has shifted toward the west. Both creeks are considered seasonal and were observed to be dry at the time of our investigation. A couple of dirt vehicle paths extend across the 19-acre parcel. The majority of the 31-acre parcel has been disturbed by clearing of vegetation and leveling the surface for parking of semi-trailers. Vacant, undeveloped land is located to the north and west of the site. Single-family residences are present to the northwest and Marksheffel Road and Meadowbrook Drive are located to the east and southeast, respectively. The overall topography includes a very gentle descent to the south and southwest. An aerial image of the southern site with approximate parcel boundaries is shown below.

Near Map Aerial Image of Southern Site

PROPOSED DEVELOPMENT

Preliminary development plans provided to us identify each of the included parcels and include a proposed land use exhibit by NES, Inc., dated September 22, 2025. The plan identifies proposed zoning, use for each parcel, roadway right-of-way, and future intersections.

We understand the development is expected to include about 10 acres of residential use located within the western half of Parcel No. 5405000033. The two northern parcels (Parcel Nos. 5405001004 and 5405000055) are identified as having a proposed retail or commercial use. The eastern half of the southern site (Parcel Nos. 5405000033, 5405000049, and 5405000050) are planned to be developed as industrial uses. Proposed infrastructure improvements will likely include access roadways and underground utilities, as well as creek channel stabilization of the existing East Fork Sand Creek tributary.

INVESTIGATION

Subsurface conditions at the site were investigated by drilling seven, widely spaced, exploratory borings to depths between 20 and 30 feet. The approximate locations of the borings are shown in Fig. 1. Our representative observed the drilling operations, logged the subsurface conditions found in the borings, and obtained samples for laboratory testing. Graphical logs of the borings, including the results of field penetration resistance tests, and some laboratory test data are presented in Appendix A. Soil samples obtained during drilling were visually classified and laboratory testing was assigned to representative samples. Swell-consolidation and gradation test results are presented in Appendix B and are summarized in Table B-1.

SUBSURFACE CONDITIONS

The soils encountered during this investigation generally consisted of areas of suspect quality, silty or clayey sand and very sandy clay fill. Natural, slightly silty to slightly clayey sand soils with occasional clayey lenses were found at the ground surface or underlying existing fill. Sandstone bedrock was encountered in the borings underlying the natural soils. Some of the pertinent engineering characteristics of the soils and bedrock encountered and groundwater conditions are discussed in the following paragraphs.

Fill

Existing fill was encountered in five of the seven borings and consisted of silty or clayey sand and very sandy clay. The fill extended to depths of about 6 feet below existing ground surface. The fill was judged to be loose to medium dense or medium stiff to stiff based on the results of field penetration resistance tests. The measured moisture content of a sample of fill was 4.8 percent and the sample contained 53 percent silt and clay-sized particles (passing the No. 200 sieve).

Natural Soils

The natural soils encountered consisted of slightly silty to slightly clayey sand. The sand encountered in the borings extended to depths between 11 and 16 feet. The sand was loose to dense based on the results of field penetration resistance tests. Samples of the sand tested in our laboratory contained between 2 and 11 percent silt and clay-sized particles (passing the No. 200 sieve). Atterberg Limits testing was performed on three samples. One sample exhibited a Liquid Limit of 31 and a plasticity index of 13. Two samples of the sands were non-plastic. The measured moisture contents of the natural sand ranged from 2.9 to 11 percent. Based on our experience and results of laboratory testing, we judge the sands to exhibit low expansion potential or to be non-expansive when wetted.

Bedrock

Sandstone bedrock was encountered during this investigation underlying the natural soils at depths between 11 and 16 feet and extended to the maximum depths explored of 20 to 30 feet. The bedrock was judged to be hard to very hard based on field penetration resistance testing. Eight samples of the bedrock subjected to laboratory testing contained 5 to 10 percent silt and clay-sized particles. Two samples of the sandstone were subjected to Atterberg Limits resulting in Liquid Limits of 26 and 27 and Plasticity Indices 6 and 8.

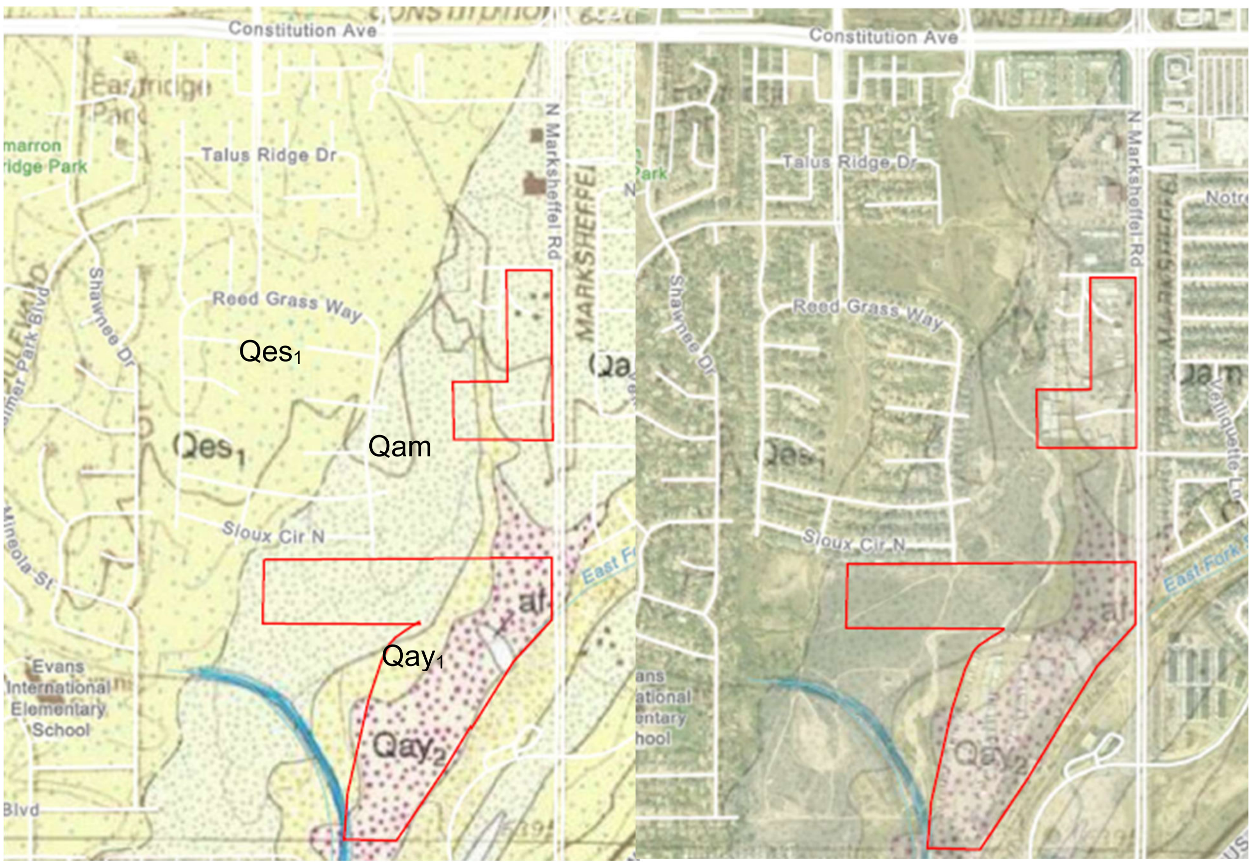
Groundwater

At the time of drilling, groundwater was encountered at depths between 9 and 22 feet below existing ground surfaces in six of the seven borings. Delayed groundwater measurements were conducted one day following the completion of our drilling operation. Groundwater was measured at depths of between 8.5 and 18 feet in four of the seven borings. One boring was found to be collapsed at the time of our delayed measurements. Groundwater levels will fluctuate with seasonal precipitation and landscaping irrigation. A seasonal fluctuation of 3 to 5 feet is typical for this area. Our borings were drilled during the winter season when groundwater levels are typically found to be lowest. High groundwater conditions generally occur in mid to late summer season. Shallow groundwater levels found in exploratory borings TH-3, TH-4, and TH-5 may influence development and foundation design, depending on final grading and foundation depths.

Based on depths of groundwater, groundwater could be an issue with design. If monitoring could be helpful with future design, suggest getting those monitoring wells set now so once preliminary plan stage is going, will already have additional information regarding groundwater depths and not need to wait around for that information.

SITE GEOLOGY

The surficial geology at the site was evaluated by reviewing published geologic maps and our site reconnaissance and subsurface exploration. The Elsmere Quadrangle map published by the Colorado Geological Survey (CGS), by Richard F. Madole, and Jon P. Thorson, 2002[1] was reviewed for the project site. Our borings generally confirm the CGS mapping. The various deposits mapped at the site are described in more detail based on the Geologic Map descriptions in the following sections. Mapping shown below was obtained from the USGS National Geologic Map Database. Our interpretation of the geologic mapping is also depicted in Fig. 2 of this report.



Excerpt from the Elsmere Quadrangle with the approximate project area shown in red

[1] Madole, Richard F., and Thorson, Jon P., 2002, Geologic Map of the Elsmere Quadrangle, El Paso County, Colorado: Colorado Geological Survey Open-File Map 02-2, scale 1:24,000.

Artificial Fill (Map Unit af): Disturbed areas or artificial fill placed during prior development activities.

Young Alluvium One (Qay_1): late Holocene age, alluvial deposits transported and deposited by flowing water in channels, chiefly light brownish-gray, grayish-brown, and dark-grayish-brown, poorly sorted sand, silty sand, and minor pebble gravel. Exists on narrow flood plains and the floors of stream channels, most of which are incised. The exposed thickness of this unit is generally 2 to 8 feet.

Young Alluvium Two (Qay_2): late to middle Holocene age, similar to Qay_1 except that it includes thin beds and lenses of dark to very dark gray-brown sediment deposited by flowing water in channels. The unit exists on broad valley floors and is generally overlain by Qay_1. The estimated thickness of this unit is 10 to 20 feet.

Middle Alluvium (Qam): late Pleistocene age, alluvial deposits transported and deposited by flowing water in channels, chiefly light-brownish-gray, pale-brown, light-yellowish-brown, and grayish brown, poorly sorted sand and subordinate amounts of gravel. Estimated thickness is 20 to 50 feet.

Younger Eolian Sand One (Qes_1): middle to early Holocene and late Pleistocene age, alluvial deposits transported and deposited by wind. Materials generally consist of very coarse to coarse sand that have been deposited as sand sheets. Materials are very pale-brown, pale brown, and light yellowish-brown sand. Estimated thickness is 3 to 20 ft.

Mapped bedrock units: mapped bedrock formations found near the site include the Dawson Formation Facies unit one and two ($TKda_1$, $TKda_2$). Bedrock was encountered during this investigation underlying the overburden alluvium materials. The mapped bedrock units can generally be described as sandstone which often contains interbedded layers of claystone.

GEOLOGIC HAZARDS

Geologic hazards were evaluated through the use of geologic maps, exploratory borings, site reconnaissance, and local experience. Primary geologic hazards include shallow groundwater and the possibility of localized areas of expansive soils and bedrock, and regional issues of erosion, seismicity, and radioactivity. Our interpretation of the engineering conditions of the site is depicted in Fig. 3 of this report.

Assessment of the site for: the potential for wildfire hazards; corrosive soils; erosion problems; protections against erosion, such as the design and implementation of a Stormwater Management Plan; flooding; flood protection; assessment of estimated peak flows and physiographic flood plains of drainages; source permanence and variation in amounts of surface water; hydraulic gradients of groundwater; hazards associated with airports and major utility facilities; polluted water; problems of groundwater circulation; and excessive flow of groundwater is beyond the scope of this investigation.

The following conditions were considered in this evaluation:

- Shallow groundwater, Springs, and Seeps
- Expansive soils and expansive rock
- Collapse-prone soils
- A history of landfill, uncontrolled, or undocumented fill activity
- Flood prone areas
- Landslide areas or potential landslide areas
- Existing unstable or potentially unstable slopes
- Debris flow and debris fans
- Rockfall
- Subsidence and abandoned mining activity
- Groundwater springs or seeps
- Steeply dipping bedrock
- Seismicity
- Faults
- Elevated radioactivity and Radon

It is our opinion that no geologic hazards exist at this site that preclude subdividing the site and commercial or residential development. We believe conditions that exist on-site can be mitigated with engineering design and construction methods commonly employed in the area.

Shallow Groundwater, Springs, and Seeps

At the time of drilling, groundwater was encountered in six of the seven borings at depths between 9 and 22 feet. Groundwater levels will fluctuate with seasonal precipitation and landscaping irrigation. A seasonal fluctuation of 3 to 5 feet is typical for this area. Our borings were drilled during the winter season when groundwater levels are typically found to be near seasonal lows. High groundwater conditions will typically occur during the mid to late summer months. Groundwater may impact basement construction. This condition can be mitigated by installing drain systems around below-grade spaces and providing a gravity outfall.

Available geologic mapping does not indicate the presence of groundwater springs or seeps. Areas graded to retain or detain surface water and/or stormwater runoff may locally influence groundwater levels. We believe local variations in groundwater levels can be mitigated with engineering design.

Expansive Soils and Expansive Bedrock

Soils identified at the site exhibited low to no expansive potential. Design-level geotechnical investigations conducted for each building site should address procedures for mitigation associated with expansive soils.

Collapse-Prone Soils

Features indicating subsidence or settlement were not observed in the project area. Collapse-prone soils that are typically susceptible to hydro-collapse, a phenomenon where soils undergo a decrease in volume upon an increase in moisture content, with or without an increase in external loads. Collapse-prone soils were not encountered in our borings; however, our borings were widely spaced and collapse-prone soils may be present at the site.

Landfill, Uncontrolled, or Undocumented Fill Activity

We did not identify materials in our exploratory borings indicative of landfill activities, nor did we identify obvious landfill features or surficial evidence. Review of historic aerial imagery also did not indicate obvious landfill activities on the site.

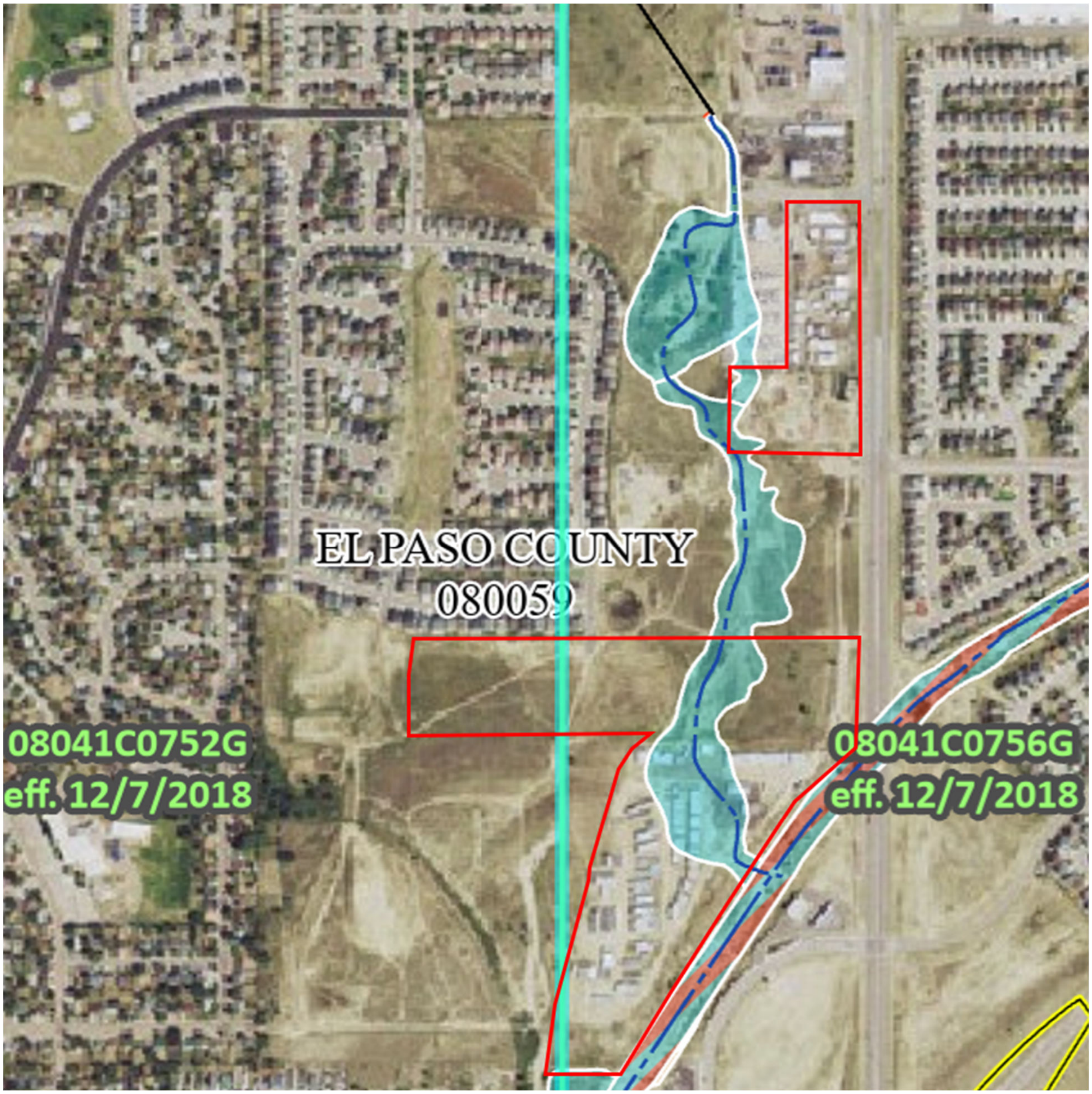
Silty sand and sandy clay fill was encountered at the ground surface of five borings. The fill was found to be up to about 6 feet in depth. Geologic mapping identified a comparatively small area of fill adjacent to the existing creek. Fill placement records were not available at the time of this investigation and the fill is considered to be undocumented. If documentation such as field observation and density testing reports is available, it should be provided to our office.

The site has been disturbed, and our borings were widely spaced. Due to the historic disturbance of the site and existing structures, areas of additional fill may be identified during a design-level investigation or during future site development. A design-level geotechnical investigation should be conducted and will include identification of extents of existing fill within structure footprints which may be present after grading operations. A design-level investigation will provide recommendations for fill mitigation.

Flooding

The FEMA panels covering the project site include Map Numbers 08041C0752G and 08041C0756G effective 12/7/2018. FEMA Map No. 08041C752G includes the west half of parcel 5405000033, and FEMA Map No. 0841C07556G includes coverage for the remainder of the parcels that make up the site.

Based on review of FEMA Mapping, portions of the site lie within the 100-year floodplain. The mapping of the 100-year floodplain, including Zones AE and AO mapping in the FEMA panels, have a 1% chance of being subject to inundation annually. Special flood hazards exist along the west edge of Parcel No. 5405000055 and across Parcels 540500003, 5405000049, and 5405000050. The western edge of the northern parcel 5405000055 lies within the mapped Zone AO, and the southern parcels 5405000033, 5405000049, and 5405000050 lies within Zone AE mapping. The project Civil Engineer should determine the extents of the flood mapping for the site, the flood potential, and design surface drainage. Parcel numbers are designated by the El Paso County Assessor and each corresponding number is identified in Fig. 1 of this report.



Clip from FEMA Flood Map Service Center mapping.
100-year floodplain in blue and approximate project area outlined in red.

Erosion

The site is susceptible to the effects of wind and water erosion. Water flowing across the site in an uncontrolled manner will likely result in considerable erosion, particularly where water flow is concentrated. The surficial sandy soils are relatively stable and resistant to wind erosion in the areas where vegetation is established. Establishing and maintaining vegetative cover, channelizing the creek tributary, and utilizing surface drainage collection and distribution systems will reduce the potential for erosion from wind and water.

Potentially Unstable Slopes and Landslide Areas

The project site is within the study area of the CGS Landslide Inventory of El Paso County; however, the site does not contain areas mapped as potential landslide susceptibility. We reviewed slope shaded digital elevation models (DEMs) generated from the El Paso County 2020 1m resolution LIDAR data. We did not identify landslide indicators within the project area.

Debris Flow, Debris Fans and Mudflow

The project is not located within areas with conditions favorable for the generation and deposition of debris flows, especially during extreme precipitation events, as mapped in the Colorado Geological Survey Open-File Report 18-11 “Debris Flow Susceptibility Map of El Paso County, Colorado” (2018) by Kevin M. McCoy, Matthew L. Morgan, and Karen A. Berry, and does not appear susceptible per our observations.

This site has been disturbed, and any surficial evidence of debris flows and mudflows are no longer observable. The potential for sheetwash should be identified in a drainage report. The project Civil Engineer should design surface drainage.

Rockfall

The project area is outside of known, local rockfall susceptibly mapping. The site topography is relatively flat, and does not appear susceptible based on our observations.

Subsidence and Abandoned Mining Activity

This project site is not covered by the “Colorado Springs Subsidence Investigation” completed by Dames & Moore of the State of Colorado, Division of Mine Reclamation, dated April 1985, which reported areas that have been or could potentially be affected by mine subsidence activity. The subject site was not located within the investigated area. Sub-surface coal mining in, and near Colorado Springs underlie the Rockrimmon neighborhood and extend southeast, toward the County Club Golf Corse, UCCS, Rustic Hills, and as far east as the Corral Bluffs area. The project area is to the north of the projected extension of the mapped subsurface mine structure. We observed no evidence of subsurface mining at the site.

Steeply Dipping Bedrock

We reviewed mapping of "Areas Susceptible to Differential Heave in Expansive, Steeply Dipping Bedrock, City of Colorado Springs, Colorado" (1999) by John W. Himmelreich, Jr., and David C. Noe published by the Colorado Geologic Survey. Mapping indicates the project area is outside of areas mapped as having steeply dipping bedrock.

Seismicity

According to the USGS, Colorado's Front Range and eastern plains are considered low seismic hazard zones. The earthquake hazard exhibits higher risk in western Colorado compared to other parts of the state. The Denver Metropolitan area has experienced earthquakes within the past 100 years, shown to be related to deep drilling, liquid injection, and oil/gas extraction. Naturally occurring earthquakes along faults due to tectonic shifts are rare in this area.

The soil and bedrock at this site are not expected to respond unusually to seismic activity. The 2021 International Building Code (Section 1613.2.2) defers the estimation of Seismic Site Classification to ASCE 7-16, as outlined in the table below.

ASCE 7-16 SITE CLASSIFICATION CRITERIA

Seismic Site Class	$\bar{s}_u$, Average Undrained Shear Strength (lb/ft^2)	$\bar{N}$, Average Standard Penetration Resistance (blows/ft)	$\bar{v}_s$, Average Shear Wave Velocity (ft/s)
A. Hard Rock	N/A	N/A	>5,000
B. Rock	N/A	N/A	2,500 to 5,000
C. Very Dense Soil and Soft Rock	>2,000	>50 blows/ft	1,200 to 2,500
D. Stiff Soil	1,000 to 2,000	15 to 50 blows/ft	600 to 1,200
E. Very Loose Sand or Soft Clay Soil	<1,000	<15 blows/ft	<600
F. Soils requiring Site Response Analysis	See Section 20.3.1	See Section 20.3.1	See Section 20.3.1

Based on the results of our investigation, we judge the subsurface is likely Seismic Site Classification D (Stiff Soil). The subsurface conditions indicate low susceptibility to liquefaction from a materials and groundwater perspective.

Faults

The geologic mapping does not indicate the presence of faulting on the project site. The nearest mapped fault is the Rampart Range Fault, which runs roughly north-south along the eastern flank of the southern Rocky Mountains. The Rampart Range Fault at its closest point to the project site, is about 9 miles to the west.

The Rampart Range Fault is dated at the middle and late Quaternary by the Colorado Geological Survey. The fault shows limited activity in recent recorded history, which makes determining an accurate recurrence interval difficult. Studies have shown no movement of the fault has occurred in the last 30,000 to 50,000 years. We are not aware of detailed studies performed on the fault that have provided fault-specific Maximum Credible Earthquake or recurrence interval. Although the fault is considered to be potentially active, the apparent large timeframe between earthquakes makes it unlikely that the fault will produce an earthquake, during the design lifetime of this project, that will detrimentally affect the site.

Radioactivity and Radon

We believe no unusual hazard exists from naturally occurring sources of radioactivity on the site. However, the materials found in this area are often associated with the production of radon gas and concentrations in excess of those currently accepted by the EPA can occur. Passive and active mitigation procedures are commonly employed in this region to effectively reduce the buildup of radon gas. Measures that can be taken after a structure is enclosed during construction include installing a blower connected to the foundation drain and sealing the joints and cracks in concrete floors and foundation walls. If the occurrence of radon is a concern, we recommend structures be tested after they are enclosed. Commonly utilized mitigation techniques may minimize risk.

SITE DEVELOPMENT CONSIDERATIONS

The project is currently in the preliminary planning phase; therefore, grading plans were not available at the time of our investigation. Geotechnical constraints which can be mitigated by careful design, common construction practices, grading considerations, and maintenance procedures, include potential shallow groundwater; loose soils; and the presence of undocumented fill.

Shallow Groundwater

Groundwater was encountered and measured at depths between 8.5 and 22 feet below existing ground surfaces. Our borings were drilled during the winter season when groundwater levels are typically considered to be low. High groundwater conditions generally occur in the mid to late summer months. Groundwater levels will fluctuate with seasonal precipitation and landscaping irrigation. Seasonal fluctuations are anticipated to range from about 3 to 5 feet in this area. Localized shallow groundwater such as at exploratory borings TH-3, TH-4, and TH-5 may influence development and foundation design, depending on final grading and foundation depths. The development of site grading plans, and proposed foundation depths should include considerations for the requirements of cuts and fills needed to achieve final grades and the relative depths of observed groundwater. A design-level geotechnical investigation should be conducted to confirm the presence and depths of groundwater following the completion of grading operations.

Existing Fills

Silty sand and very sandy clay fill was encountered at the ground surface of five borings. The fill extended to depths of about 6 feet below existing grades. Site development and grading plans should include considerations for requirements of cuts and fills needed to achieve final grades and the relative locations of identified fills. The existing fill is unsuitable for support of structure foundations in its present condition. The fills at this site are generally relatively shallow, and the grading plan can include provisions for removal and reprocessing of the existing fills. A design-level geotechnical investigation should be conducted to confirm the extents of fill which may be present after grading operations.

Grading Considerations

We have not been provided the grading plans. Site grading will be necessary to achieve final design grades. We believe site grading can be accomplished using conventional heavy-duty earthmoving equipment.

Exiting fill, vegetation, topsoil, and organic materials should be removed from the ground surface of areas to be filled. Soft or loose soils, if encountered, should be stabilized or removed to expose stable material prior to placement of fill. Existing fills encountered at the site should be removed to expose natural soils and reconstructed as new fill.

The onsite materials, including existing fill, are generally suitable for use as grading fill, and excavation backfill, provided they are free of debris, vegetation/organics, and other deleterious materials. Grading fills should be properly moisture treated and compacted.

The ground surface in areas to receive fill should be scarified deeply, moisture conditioned and compacted to a high density to establish a stable subgrade for fill placement. The properties of the fill will affect the performance of foundations, slabs-on-grade, and pavements. Detailed recommendations for moisture conditioning, placement, and compaction of grading fill are set forth in Appendix C. Placement and compaction of the grading fill should be periodically observed and tested by our representative during construction.

We recommend grading plans consider long-term cut and fill slopes no steeper than 3:1 (horizontal to vertical). This ratio considers that no seepage of groundwater occurs. If groundwater seepage does occur, a drain system and flatter slopes may be appropriate. Flatter slopes should be considered to reduce erosion potential. Slopes should be revegetated as soon as possible to control erosion by wind and water. Concentrated water flows over slopes should be avoided.

Buried Utilities

Based on the subsurface conditions encountered in our exploratory borings, we anticipate the materials encountered during utility trench excavation will consist of predominantly silty and clayey sands. Utility trench excavation can likely be accomplished using heavy-duty track hoes. Localized areas of shallow groundwater may impact utility installation. Dewatering of deep utility installations in the central portion of the site and near existing drainages may be necessary.

Excavations for utilities should be braced or sloped to maintain stability and should meet applicable local, state, and federal safety regulations. The contractor should identify the soils and bedrock encountered in trench excavations and refer to Occupational Safety and Health Administration (OSHA) standards to determine appropriate slopes. We anticipate the near-surface sand and clay soils will classify as Type C soils. Temporary excavations in Type C materials require maximum slope inclinations of 1.5:1 (horizontal to vertical) in the absence of groundwater, unless the excavation is shored or braced. Where excavations extend into sound bedrock, these materials will classify as Type A requiring maximum slope inclinations of 0.75:1. Excavations deeper than 20 feet should be designed by a professional engineer.

Water and sewer lines are usually constructed beneath paved areas. Compaction of trench backfill will have a significant effect on the life and serviceability of pavements. We recommend trench backfill be moisture conditioned and compacted in accordance with the recommendations set forth in Appendix C. Personnel from our firm should periodically observe and test the placement and compaction of the trench backfill during construction.

Underdrain Systems

Where basement construction is planned, we believe the use of underdrains incorporated into the design of sanitary sewer systems is appropriate. The underdrains will provide a positive gravity outfall at individual residences for below-grade foundation drains and help control localized shallow groundwater conditions. The drain should consist of a smooth wall, rigid PVC pipe placed at a minimum slope of 0.5 percent. An “active” section of smooth, perforated or slotted, rigid PVC pipe should be placed for a minimum distance of one pipe length upstream of manholes. The perforated pipe should be encased in at least 6 inches of free-draining gravel, separated from the surrounding trench backfill be geotextile fabric. Seepage collars should be constructed at the manhole locations to force water flowing through pipe bedding into the underdrain. The seepage collars can be constructed of concrete or clay.

If wet conditions or free water are encountered in the sanitary sewer trenches, we recommend an active underdrain system with perforated or slotted pipe for these areas. A conceptual drain detail is shown in Fig. 4. A cutoff collar should be constructed around the sewer pipe and underdrain immediately downstream of the point the underdrain pipe exists the sewer trench or changes from active to passive. Solid pipe should be used down gradient of this cutoff collar to the point of discharge. The underdrain should be maintained at least 3 to 5 feet below the lowest nearby foundation elevation. Where no groundwater is encountered in sanitary sewer excavations, passive underdrains may be used as presented in Fig. 5.

The design of the underdrain system should consider adjacent developments that will connect to the system. If a gravity outfall will be used for the underdrain system, the outfall point should be planned to not affect developments located down gradient. As-built plans of the underdrain system should be prepared including locations, elevation, and cleanouts. The entity responsible for maintenance of the underdrain system should retain the as-built plans for future reference.

The appropriate sizes of the underdrain pipe are dependent on the actual alignments, area served, and gradients. We can review grading, drainage, and underground utility plans and provide suggested pipe sizing recommendations, if requested. For preliminary planning purposes, we expect pipe diameters of 6 to 8 inches will be appropriate for 60 dwellings or less.

Where active seepage exists, 8-inch diameter or larger pipes will be appropriate for 60 dwellings or less. We should review the design once sewer plans have been developed.

FOUNDATION AND FLOOR SYSTEM CONCEPTS

We recommend the preparation of design-level geotechnical investigations for each proposed building and/or residence to develop specific foundation recommendations for the design and construction of foundations and floor systems. The foundation type should be chosen based on the building type, building loads, subsurface conditions, and other factors. Selection of floor system alternatives should consider risk of movement associated with slab-on-grade floors.

We expect spread footing foundations will be the preferred foundation type for the proposed development type. For preliminary planning purposes, spread footing foundations with a maximum allowable soil pressure of 2,000 to 3,000 psf is anticipated. A post-tension slab-on-grade, where the floor slab is structurally integrated with the foundation may also be an option. Areas of existing suspect quality fill and natural, loose sand may require improvement such as over-excavation to establish a stable foundation subgrade. Over-excavation to remove existing fill should be to depths that expose natural soils.

PAVEMENTS

Near surface surficial materials identified in our borings generally consisted of silty to clayey sand. Specific pavement recommendations can be provided at the time of the design level-investigation, after grading plans have been developed.

The surficial materials will exhibit variable subgrade support for pavements. We judge the natural sand soils will predominantly exhibit excellent to good support characteristics and generally exhibit low to non-swelling properties. Based on our experience, we believe a preliminary Hveem stabilometer (“R”) value of 50 would be appropriate for preliminary design purposes.

We understand the project will include the extension of access roadways with anticipated residential and commercial use. On a preliminary basis, we suggest budgeting for section of 4 inches of asphalt over 8 inches of aggregate base course for public roadways. Private roadways may use a reduced section. A pavement design report should be prepared in accordance with El Paso County or City of Colorado Springs criteria after site plans and grading plans have been completed.

CONCRETE

Concrete in contact with soil can be subject to sulfate attack. We measured water-soluble sulfate concentrations of less than 0.1 percent in one sample. As indicated in our tests and ACI 318-19, the sulfate exposure class is *Not Applicable or S0*. Deviations from the exposure class may occur with additional sampling and testing performed during design-level investigations.

SULFATE EXPOSURE CLASSES PER ACI 318-19

Exposure Classes		Water-Soluble Sulfate (SO_4) in Soil [A] (%)
Not Applicable	S0	< 0.10
Moderate	S1	0.10 to <0.20
Severe	S2	0.20 to 2.00
Very Severe	S3	> 2.00

A) Percent sulfate by mass in soil determined by ASTM C1580

For severe levels of sulfate concentration, ACI 318-19, *Building Code Requirements for Structural Concrete,* indicates there are special cement type requirements for sulfate resistance as indicated in the table below.

CONCRETE DESIGN REQUIREMENTS FOR SULFATE EXPOSURE PER ACI 318-19

Exposure Class		Maximum Water/ Cement Ratio	Minimum Compressive Strength (psi)	Cementitious Material Types [A]			Calcium Chloride Admixtures
				ASTM C150/ C150M	ASTM C595/ C595M	ASTM C1157/ C1157M	
S0		N/A	2500	No Type Restrictions	No Type Restrictions	No Type Restrictions	No Restrictions
S1		0.50	4000	II [B]	Type with (MS) Designation	MS	No Restrictions
S2		0.45	4500	V [B]	Type with (HS) Designation	HS	Not Permitted
S3	Option 1	0.45	4500	V + Pozzolan or Slag Cement [C]	Type with (HS) Designation plus Pozzolan or Slag Cement [C]	HS + Pozzolan or Slag Cement [C]	Not Permitted
S3	Option 2	0.4	5000	V [D]	Type with (HS) Designation	HS	Not Permitted

A) Alternate combinations of cementitious materials shall be permitted when tested for sulfate resistance meeting the criteria in section 26.4.2.2(c).
B) Other available types of cement such as Type III or Type I are permitted in Exposure Classes S1 or S2 if the C3A contents are less than 8 or 5 percent, respectively.
C) The amount of the specific source of pozzolan or slag to be used shall not be less than the amount that has been determined by service record to improve sulfate resistance when used in concrete containing Type V cement. Alternatively, the amount of the specific source of the pozzolan or slab to be used shall not be less than the amount tested in accordance with ASTM C1012 and meeting the criteria in section 26.4.2.2(c) of ACI 318.
D) If Type V cement is used as the sole cementitious material, the optional sulfate resistance requirement of 0.040 percent maximum expansion in ASTM C150 shall be specified.

Superficial damage may occur to the exposed surfaces of highly permeable concrete. To control this risk and to resist freeze-thaw deterioration, the water-to-cementitious materials ratio should not exceed 0.50 for concrete in contact with soils that are likely to stay moist due to surface drainage or high-water tables. Concrete should have a total air content of 6 percent ± 1.5 percent. We advocate damp-proofing of all foundation walls and grade beams in contact with the subsoils.

SURFACE DRAINAGE

The performance of structures, flatwork, and pavements will be influenced by surface drainage. When developing an overall drainage scheme, consideration should be given to drainage around each structure and on pavement areas. Drainage should be planned such that surface runoff is directed away from foundations and is not allowed to pond adjacent to foundations or over pavements. The ground surface around the buildings should be sloped to provide positive drainage away from the foundations. We recommend a slope of at least 5 percent for the first 10 feet surrounding each building in landscaped areas. In flatwork areas adjacent to buildings, the slope may be reduced to grades that comply with ADA requirements. A minimum slope of 2 percent is suggested. More slope is desirable. Concrete curbs and sidewalks may “dam” surface runoff adjacent to the buildings and disrupt proper flow. Use of “chase” drains or weep holes at low points in the curb should be considered to allow proper drainage. Roof downspouts and other water collection systems should discharge beyond the limits of backfill around structures.

RECOMMENDED FUTURE INVESTIGATIONS

We recommend the following additional investigations and services be prepared and conducted by our firm:

- After site development plans have been formalized, we recommend a design-level geotechnical investigation be completed, which are typically required to determine the appropriate building foundation and floor systems.
- Construction materials testing and observation services during site development and construction.
- Subgrade Investigation and Pavement Design for on-site pavements.

GEOTECHNICAL RISK

The concept of risk is an important aspect with any geotechnical evaluation primarily because the methods used to develop geotechnical recommendations do not comprise an exact science. We never have complete knowledge of subsurface conditions. Our analysis must be tempered with engineering judgment and experience. Therefore, the recommendations presented in any geotechnical evaluation should not be considered risk-free. Our recommendations represent our judgment of those measures that are necessary to increase the chances that structures will perform satisfactorily.

LIMITATIONS

The information and conclusions presented herein are based upon consideration of many factors including, but not limited to, the geologic setting, and the subsurface conditions expected. The conclusions contained in the report are not valid for use by others. If the project is not constructed within about three years, we should be contacted to determine if we should update this report.

Our borings were widely spaced to provide a general idea of subsurface conditions for preliminary planning of construction. Variations from our borings should be anticipated. We believe this investigation was conducted in a manner consistent with that level of care and skill ordinarily used by geotechnical engineers practicing under similar conditions. No warranty, express or implied, is made.

If we can be of further service in discussing the contents of this report or analysis of the influence of subsurface conditions on the project, please call.

Respectfully submitted,

CTL|THOMPSON, INC.

Patrick Foley, EI
Staff Engineer

Reviewed by:

COLORADO LICENSED
JEFFREY MARK JONES
47539
5/11/26
PROFESSIONAL ENGINEER

Jeffrey M. Jones, P.E.
Principal Engineer

PF:JMJ:cw

Via e-mail: JAlwine@NESColorado.com

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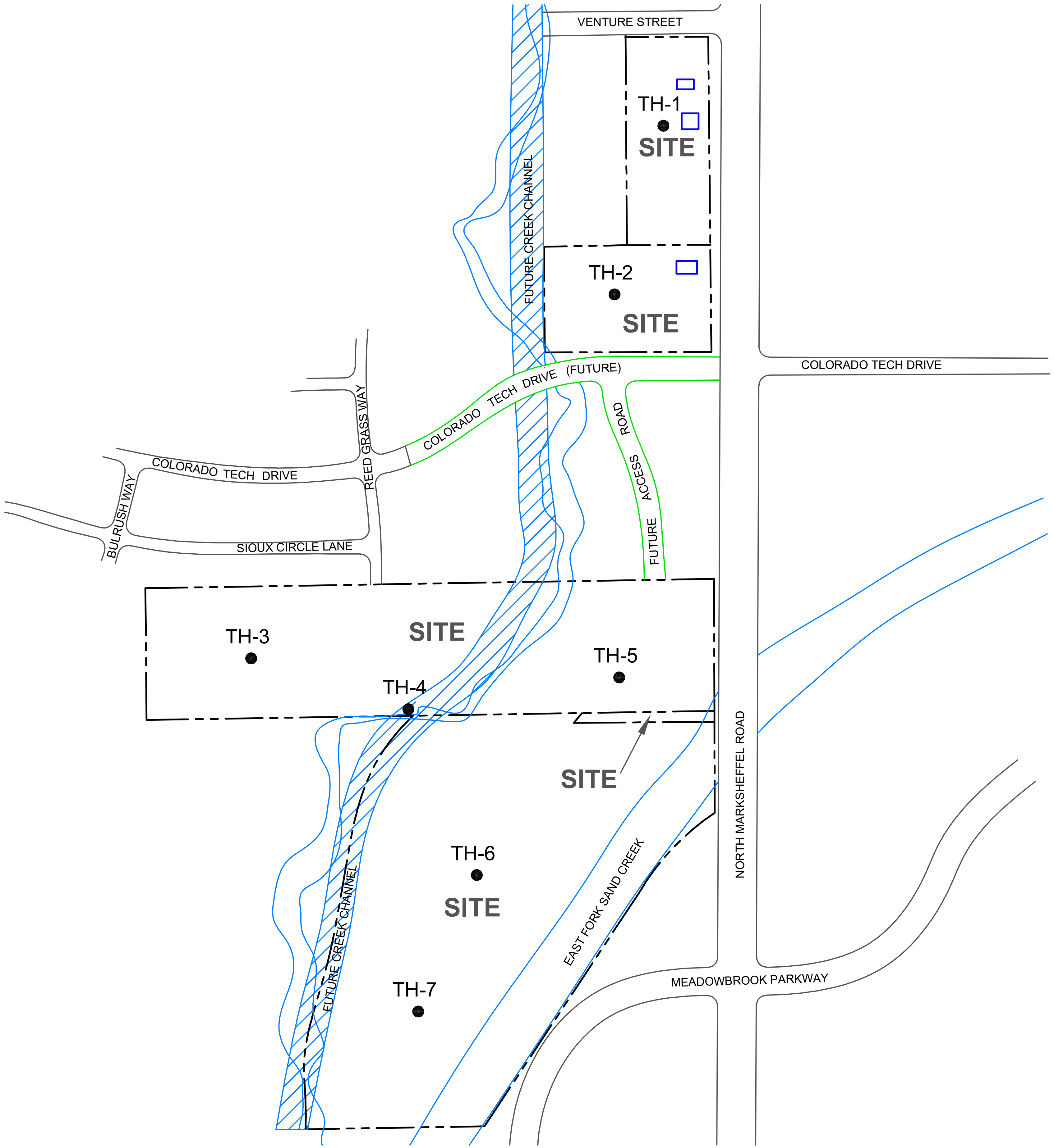
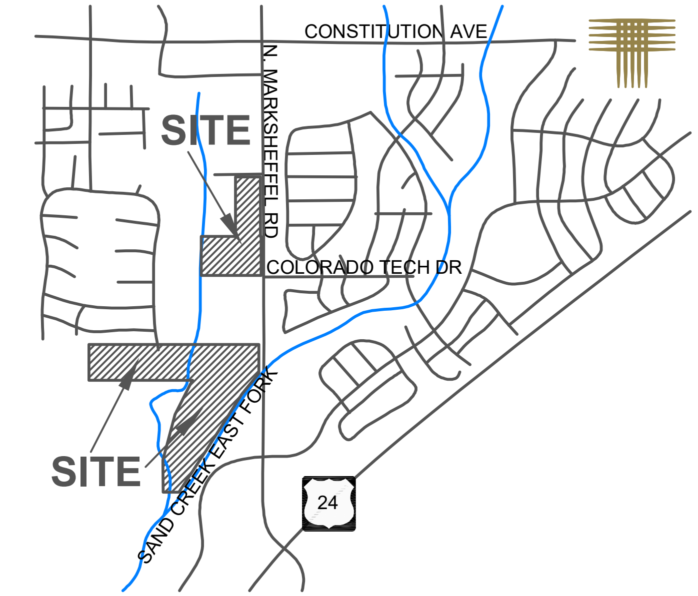


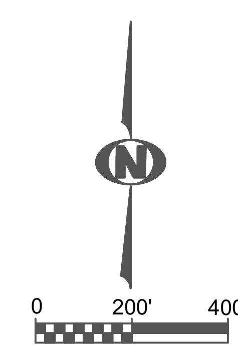


VICINITY MAP

(NOT TO SCALE)

LEGEND:

TH-1 ●	APPROXIMATE LOCATION OF EXPLORATORY BORING.
	PROJECT/PARCEL BOUNDARY
	LOCATION OF EXISTING BUILDING FOOTPRINT.
	LOCATION OF PROPOSED STREETS.
	LOCATION EXISTING CREEK.



SCALE: 1" = 400'

NOTE:
BASE DRAWING WAS PROVIDED BY N.E.S. INC. (DATED SEPTEMBER 22, 2025).

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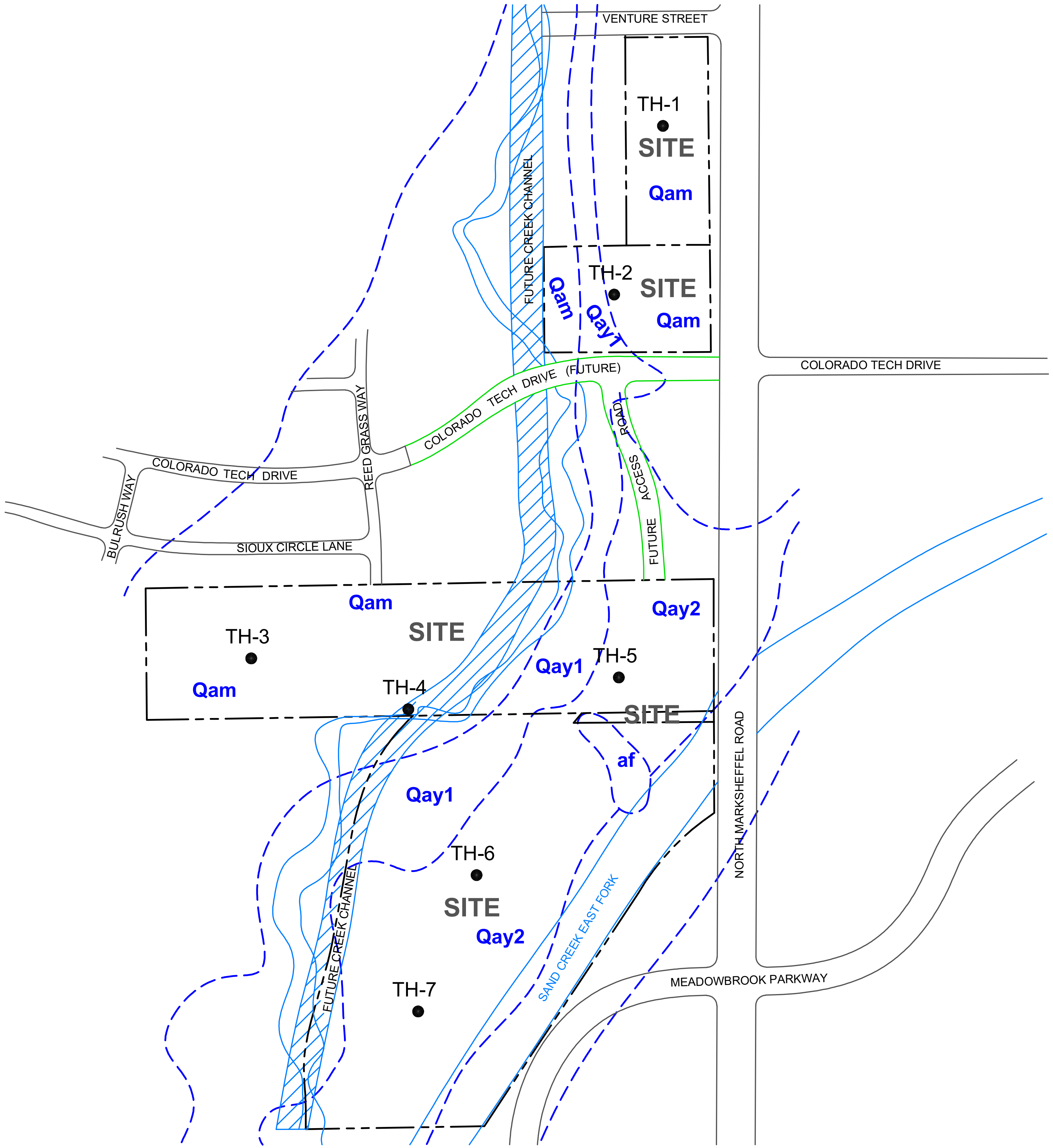
Location of Exploratory Borings

FIG. 1



LEGEND:

TH-1 ● APPROXIMATE LOCATION OF EXPLORATORY BORING.

– – – – PROJECT BOUNDARY

GEOLOGIC UNITS AND (MODIFIERS)

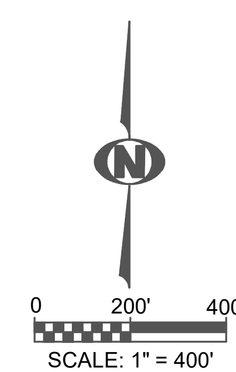
SURFICIAL GEOLOGIC CONTACTS

Qam ALLUVIAL DEPOSITS. SAND, SILT, GRAVEL, AND CLAY TRANSPORTED AND DEPOSITED BY FLOWING WATER. MIDDLE ALLUVIUM (LATE PLEISTOCENE) - POORLY SORTED SAND AND SUBORDINATE AMOUNTS OF GRAVEL. LIGHT BROWNISH-GRAY, PALE BROWN, LIGHT YELLOWISH-BROWN, AND GRAYISH-BROWN. ESTIMATED THICKNESS IS 20 TO 50 FEET.

Qay1 ALLUVIAL DEPOSITS. SAND, SILT, GRAVEL, AND CLAY TRANSPORTED AND DEPOSITED BY FLOWING WATER. YOUNG ALLUVIUM ONE (LATE HOLOCENE). UNIT EXISTS ON NARROW FLOOD PLAINS AND FLOORS OF STREAM CHANNELS. LIGHT BROWNISH-GRAY, GRAYISH-BROWN, AND DARK GRAYISH-BROWN, POORLY SORTED SAND, SILTY SAND, AND MINOR PEBBLE GRAVEL. ESTIMATED TO BE 2 TO 8 FEET THICK.

Qay2 ALLUVIAL DEPOSITS. SAND, SILT, GRAVEL, AND CLAY TRANSPORTED AND DEPOSITED BY FLOWING WATER. YOUNG ALLUVIUM TWO (LATE TO MIDDLE HOLOCENE). SIMILAR TO Qay1, EXPECT THAT IT INCLUDES SEVERAL THIN BEDS AND LENSES OF DARK GRAYISH-BROWN TO VERY DARK GRAYISH-BROWN SEDIMENT. ESTIMATED THICKNESS TO BE 10 TO 20 FEET.

af ARTIFICIAL FILL.



NOTES:
1. ALL BOUNDARIES SHOWN SHOULD BE CONSIDERED APPROXIMATE. THEY ARE BASED UPON A SUBJECTIVE INTERPRETATION OF PUBLISHED MAPS, AERIAL PHOTOGRAPHS AND AN INITIAL FIELD RECONNAISSANCE. CHANGES IN THE MAPPED BOUNDARIES SHOWN ARE POSSIBLE AND SHOULD BE EXPECTED WITH MORE DETAILED WORK AND FURTHER INFORMATION. ALL INTERPRETATIONS AND CONDITIONS SHOWN ARE PRELIMINARY AND FOR LAND-USE PLANNING ONLY.
2. MAP LEGEND IS MODIFIED FROM THE GEOLOGIC MAP OF THE ELSMERE QUADRANGLE, EL PASO COUNTY, COLORADO, 2002, BY MODALE AND THORSON, COLORADO GEOLOGICAL SURVEY.

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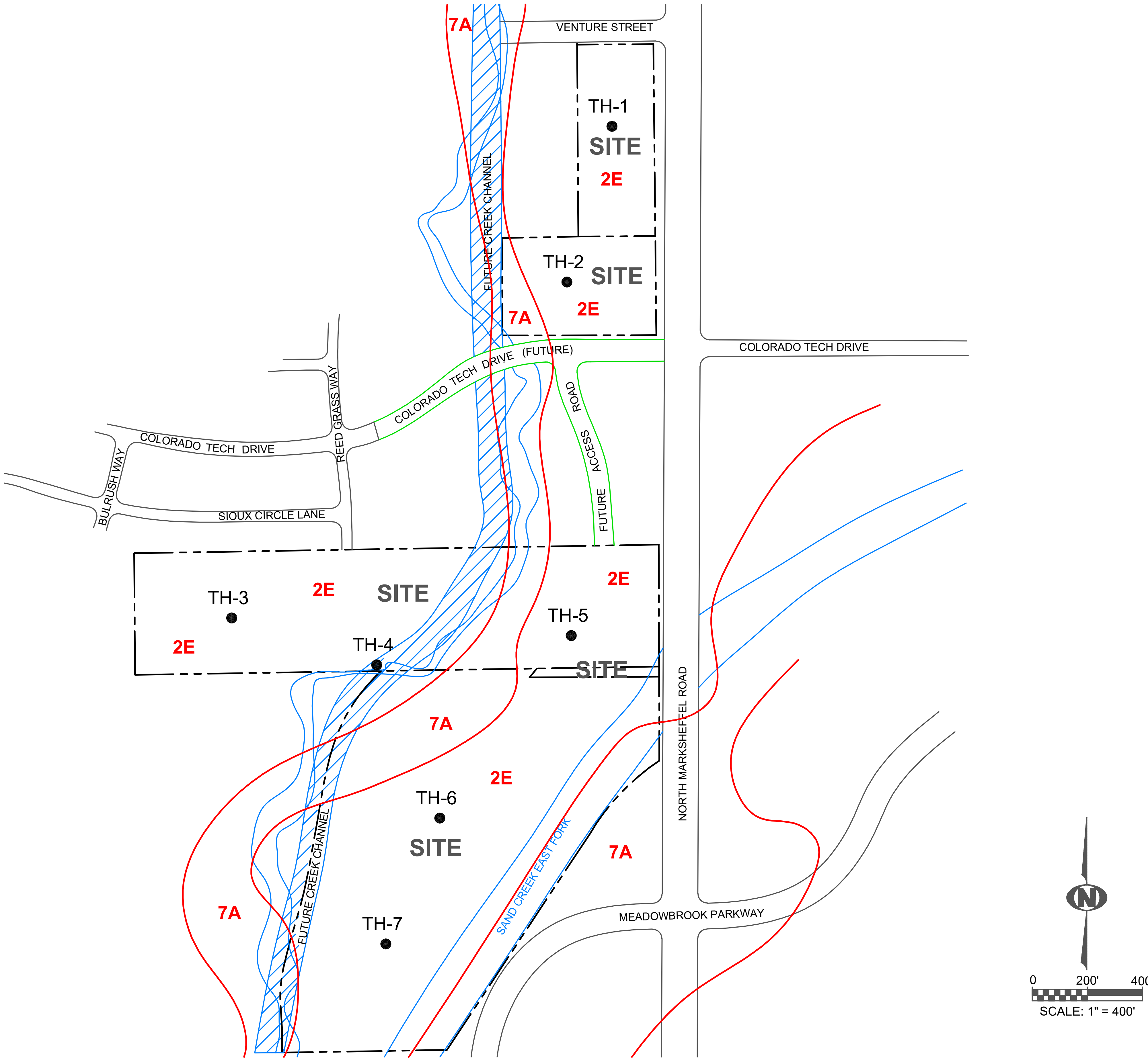
Surficial Geologic Conditions

FIG. 2



LEGEND:

TH-1 ● APPROXIMATE LOCATION OF EXPLORATORY BORING.

– – – – PROJECT BOUNDARY

ENGINEERING UNITS AND (MODIFIERS)

ENGINEERING CONTACTS

2E LOW TERRACES AND VALLEYS OF MINOR TRIBUTARY STREAMS SUBJECT TO PERIODIC HIGH FLOWS, SHEET FLOODING AND STREAM BANK EROSION. EMPHASIS ON SURFACE AND SUBSURFACE DRAINAGE.

7A PHYSIOGRAPHIC FLOODPLAIN WHERE EROSION AND DEPOSITION PRESENTLY OCCUR AND IS GENERALLY SUBJECT TO RECURRENT FLOODING. INCLUDES 100-YEAR FLOODPLAIN ALONG MAJOR STREAMS WHERE FLOODPLAIN STUDIES HAVE BEEN CONDUCTED. EMPHASIS ON FREQUENCY, DEPTH AND CONTROL.

NOTES:

1. ALL BOUNDARIES SHOWN SHOULD BE CONSIDERED APPROXIMATE. THEY ARE BASED UPON A SUBJECTIVE INTERPRETATION OF PUBLISHED MAPS, AERIAL PHOTOGRAPHS AND AN INITIAL FIELD RECONNAISSANCE. CHANGES IN THE MAPPED BOUNDARIES SHOWN ARE POSSIBLE AND SHOULD BE EXPECTED WITH MORE DETAILED WORK AND FURTHER INFORMATION. ALL INTERPRETATIONS AND CONDITIONS SHOWN ARE PRELIMINARY AND FOR INITIAL LAND-USE PLANNING ONLY.
2. MAP LEGEND IS MODIFIED FROM CHARLES S. ROBINSON & ASSOCIATES, INC., GOLDEN, COLORADO, DATED 1977.

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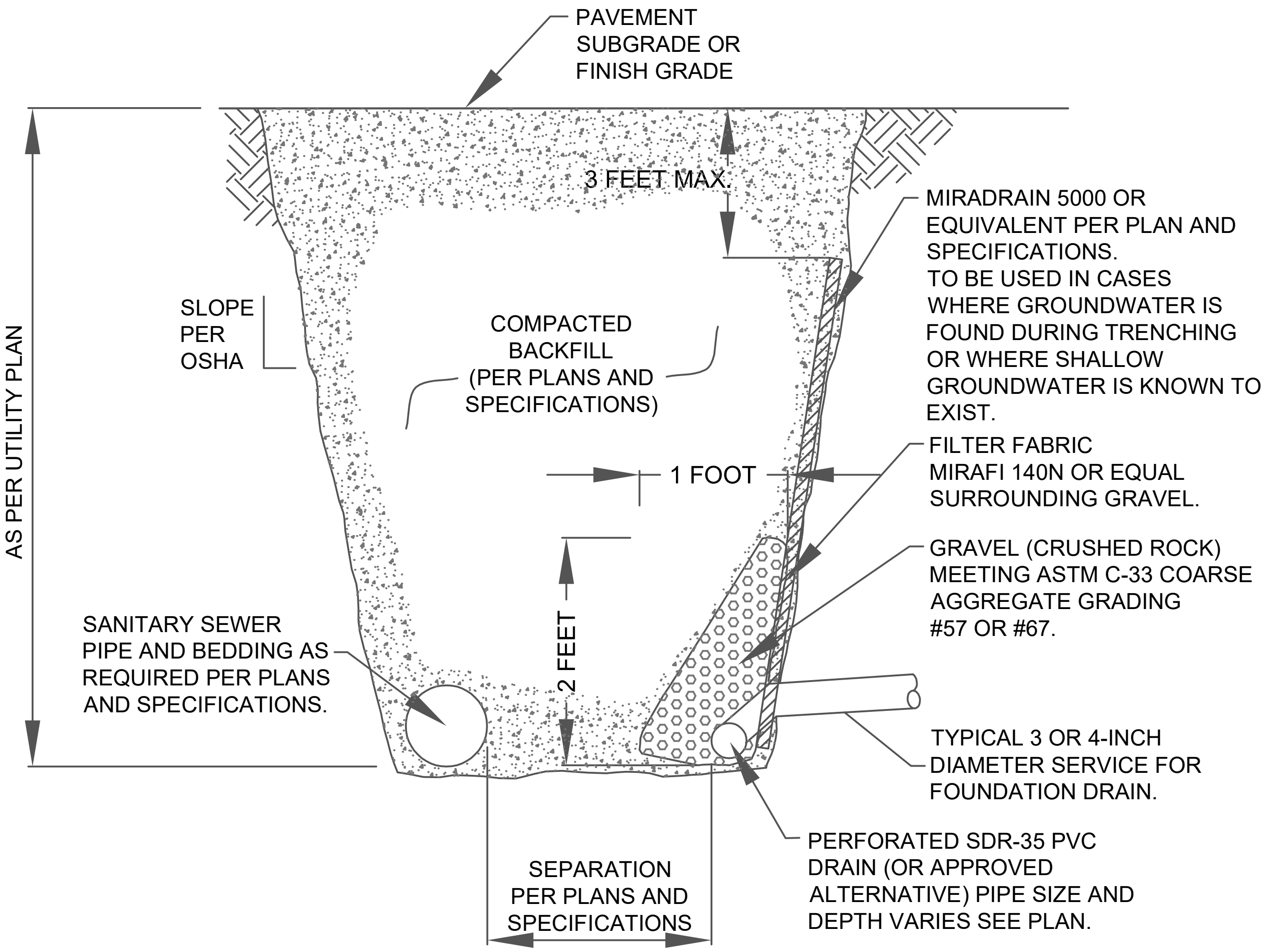
Engineering Conditions

FIG. 3



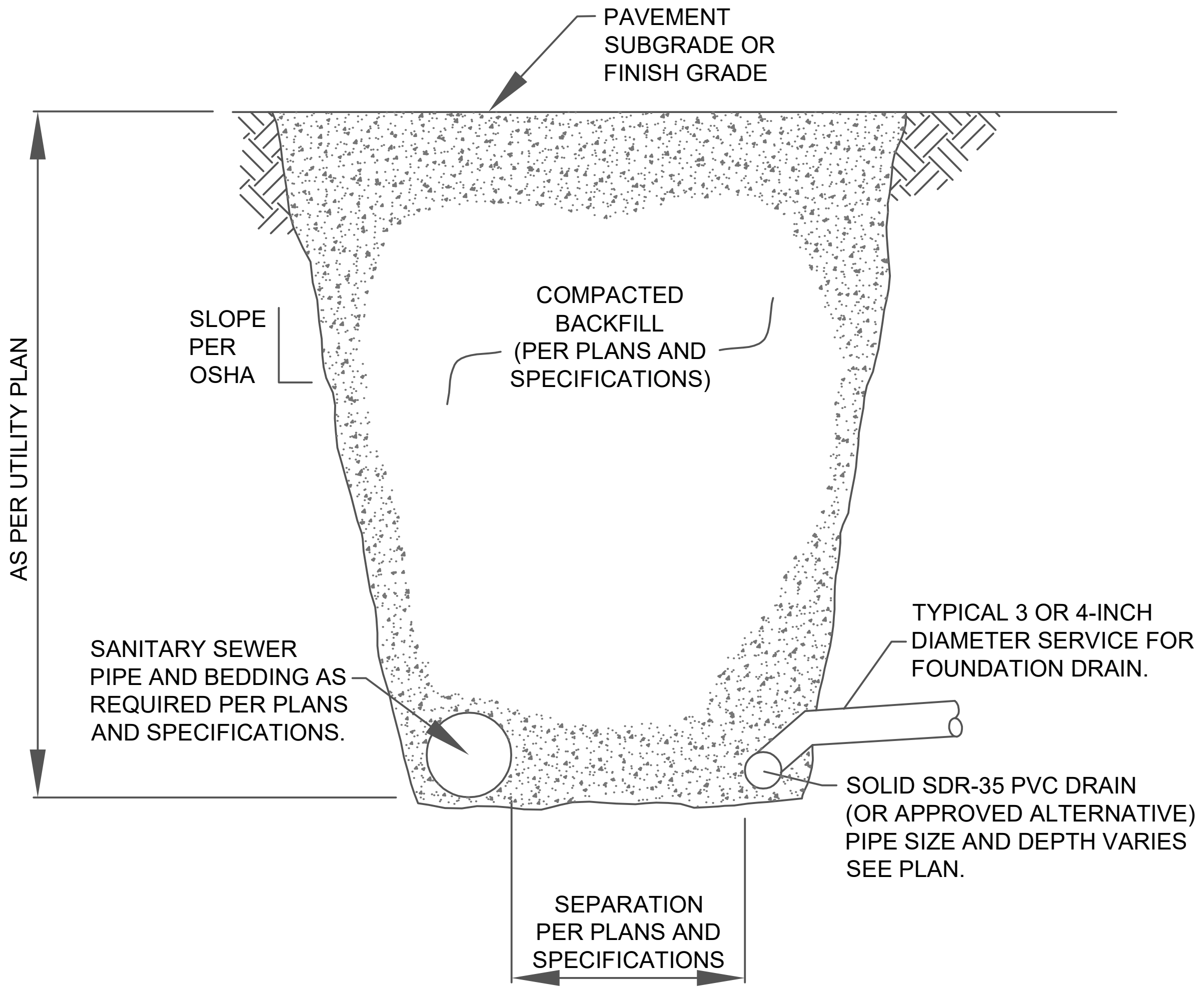
GRADING REQUIREMENTS FOR COARSE AGGREGATES PER ASTM C-33

SIZE NUMBER	NOMINAL SIZE (SIEVES WITH SQUARE OPENINGS)	AMOUNTS FINER THAN EACH LABORATORY SIEVE (SQUARE OPENINGS), WEIGHT PERCENT						
		1 1/2 INCH (37.5 mm)	1 INCH (25.0 mm)	3/4 INCH (19.0 mm)	1/2 INCH (12.5 mm)	3/8 INCH (9.5 mm)	NO. 4 (4.5 mm)	NO. 8 (2.36 mm)
67	3/4 INCH TO NO. 4 (19.0 TO 4.75 mm)	--	100	90 TO 100	--	20 TO 55	0 TO 10	0 TO 5
57	1 INCH TO NO. 4 (25.0 TO 9.5 mm)	100	95 TO 100	--	25 TO 60	--	0 TO 10	0 TO 5

NOTE:
TO BE USED IN CASES WHERE GROUNDWATER IS FOUND DURING TRENCHING OR WHERE SHALLOW GROUNDWATER IS KNOWN TO EXIST, AND UPSTREAM OF MANHOLES.

Active Drain Beside Sewer

FIG. 4



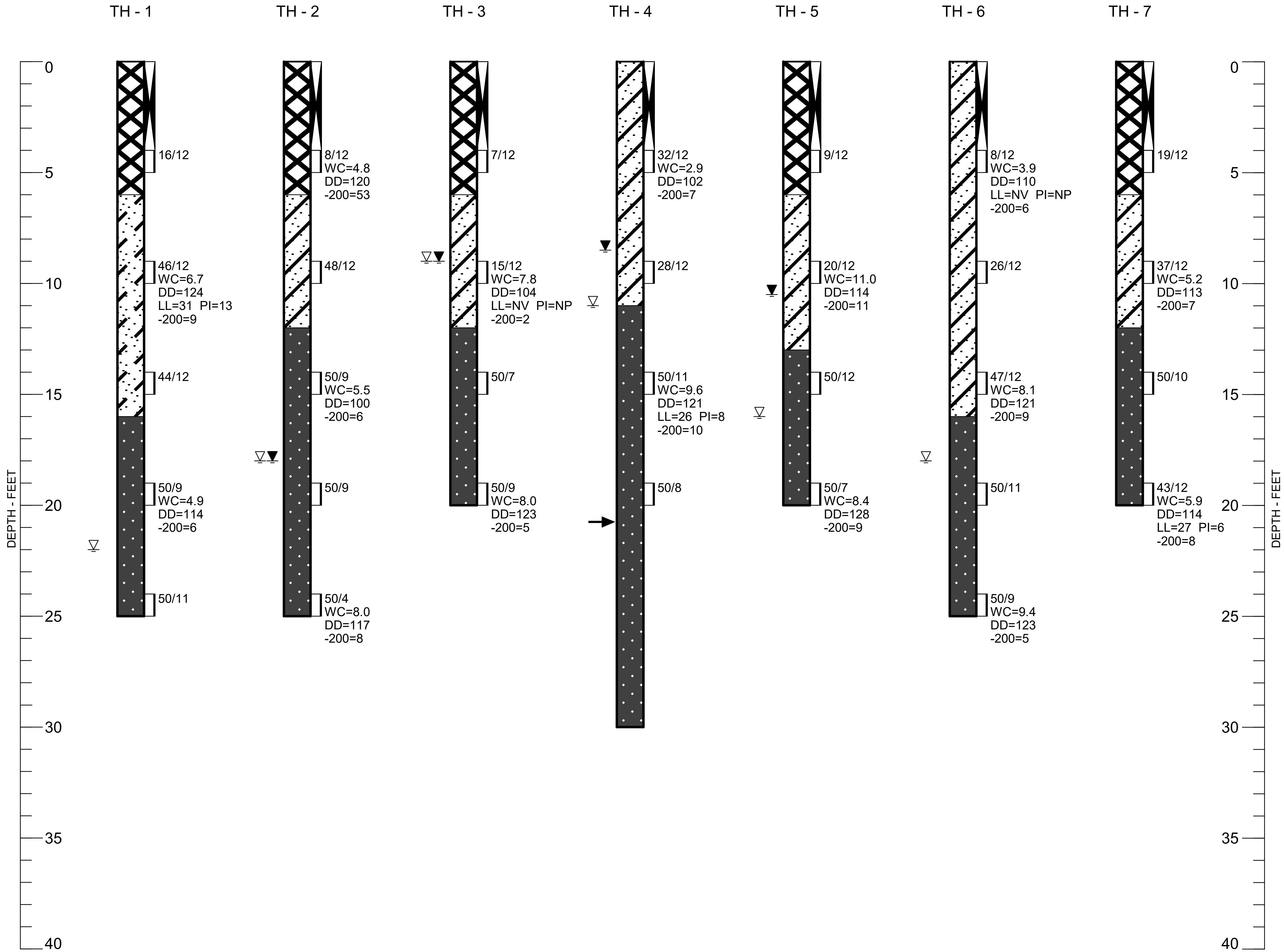
NOTE:
TO BE USED IN CASES WHERE NO
GROUNDWATER IS KNOWN TO EXIST.

Passive Drain beside Sewer

FIG. 5

APPENDIX A

SUMMARY LOGS OF EXPLORATORY BORINGS



LEGEND:

FILL, SAND, SILTY TO CLAYEY AND CLAY, VERY SANDY, LOOSE TO MEDIUM DENSE (SAND), MEDIUM STIFF TO STIFF (CLAY), SLIGHTLY MOIST TO MOIST, BROWN TO DARK BROWN.

SAND, SLIGHTLY CLAYEY, DENSE, SLIGHTLY MOIST TO MOIST, LIGHT BROWN TO BROWN (SW-SC, SC).

SAND, CLEAN TO SLIGHTLY SILTY, LOOSE TO DENSE, SLIGHTLY MOIST TO MOIST, LIGHT BROWN TO BROWN (SP, SP-SM)

BEDROCK. SANDSTONE, SLIGHTLY SILTY, MEDIUM HARD TO VERY HARD, SLIGHTLY MOIST TO MOIST, LIGHT BROWN TO BROWN.

DRIVE SAMPLE. THE SYMBOL 16/12 INDICATES 16 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.

INDICATES BULK SAMPLE OBTAINED FROM AUGER CUTTINGS.

GROUNDWATER LEVEL MEASURED AT TIME OF DRILLING.

GROUNDWATER LEVEL MEASURED ONE DAY AFTER DRILLING.

INDICATES DEPTH WHERE THE TEST HOLE CAVED DURING DRILLING.

NOTES:

1. THE BORINGS WERE DRILLED JANUARY 29, 2026 USING A 4-INCH DIAMETER, CONTINUOUS-FLIGHT AUGER AND A CME-55, TRUCK-MOUNTED DRILL RIG.
2. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS, AND CONCLUSIONS AS CONTAINED IN THIS REPORT.
3. WC - INDICATES MOISTURE CONTENT. (%)
   DD - INDICATES DRY DENSITY. (PCF)
   LL - INDICATES LIQUID LIMIT. (NV : NO VALUE)
   PI - INDICATES PLASTICITY INDEX. (NP : NON-PLASTIC)
   -200 - INDICATES PASSING NO. 200 SIEVE. (%)

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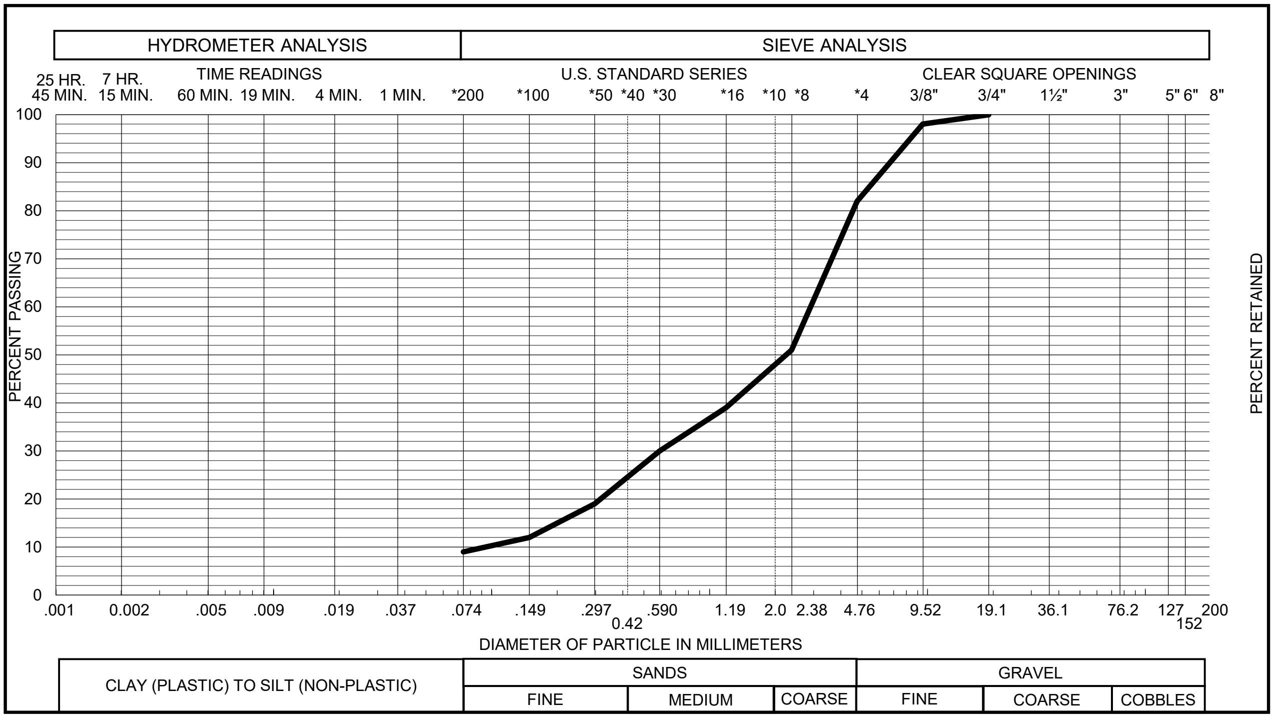
Summary Logs of Exploratory Borings

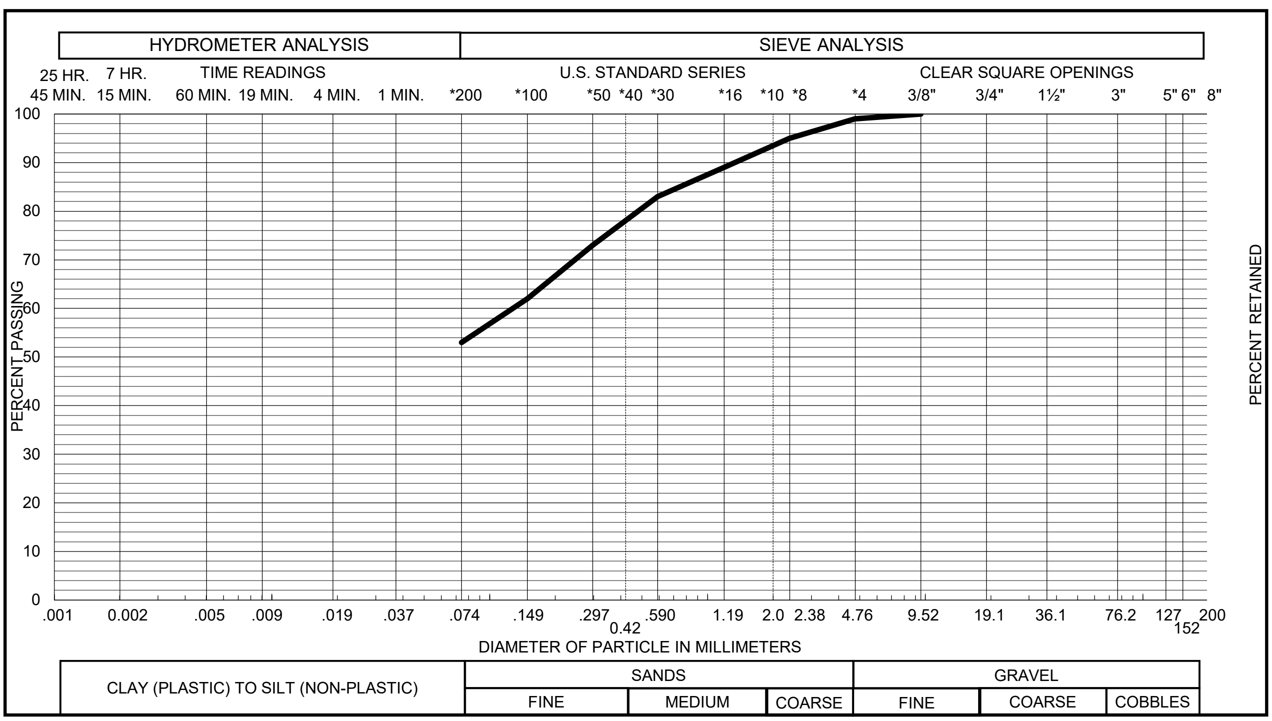
FIG. A-1

APPENDIX B

LABORATORY TEST RESULTS
TABLE B-1



Sample of	SAND, SLIGHTLY CLAYEY (SW-SC)	GRAVEL	18 %	SAND	73 %
From	TH - 1 AT 9 FEET	SILT & CLAY	9 %	LIQUID LIMIT	31 %
		PLASTICITY INDEX			13 %



Sample of	FILL, CLAY, VERY SANDY	GRAVEL	1 %	SAND	46 %
From	TH - 2 AT 4 FEET	SILT & CLAY	53 %	LIQUID LIMIT	%
		PLASTICITY INDEX			%

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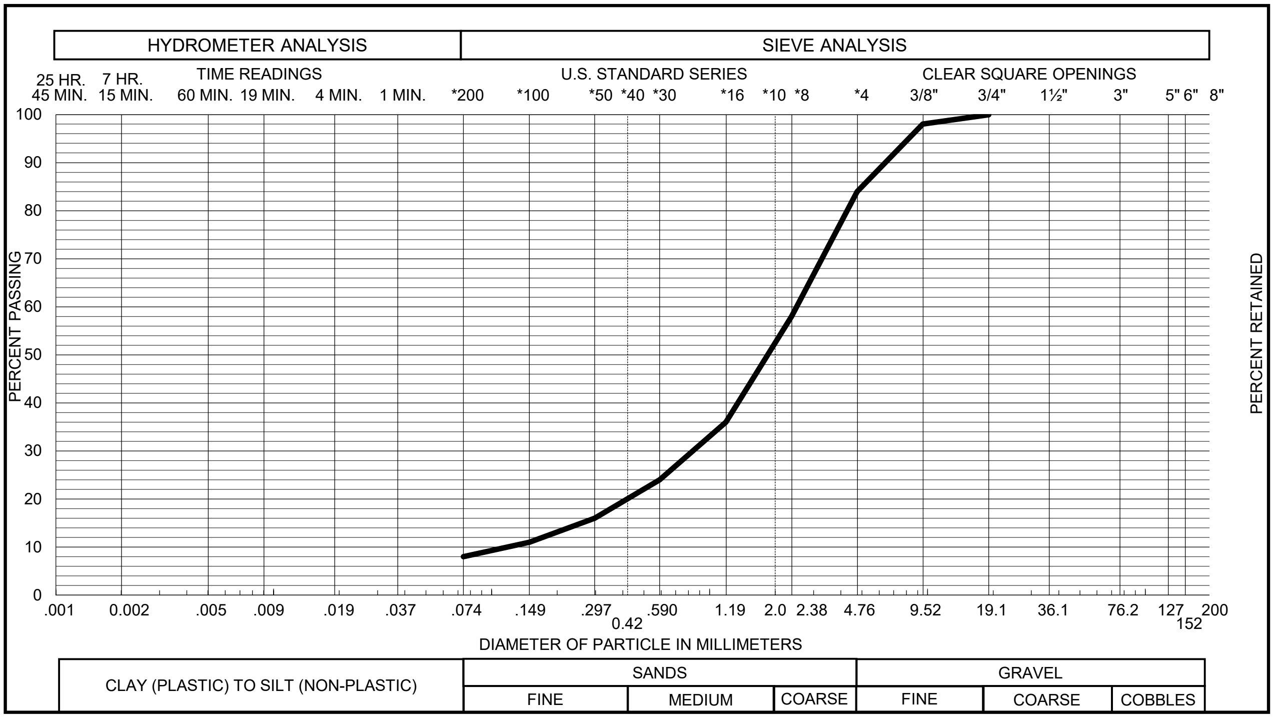
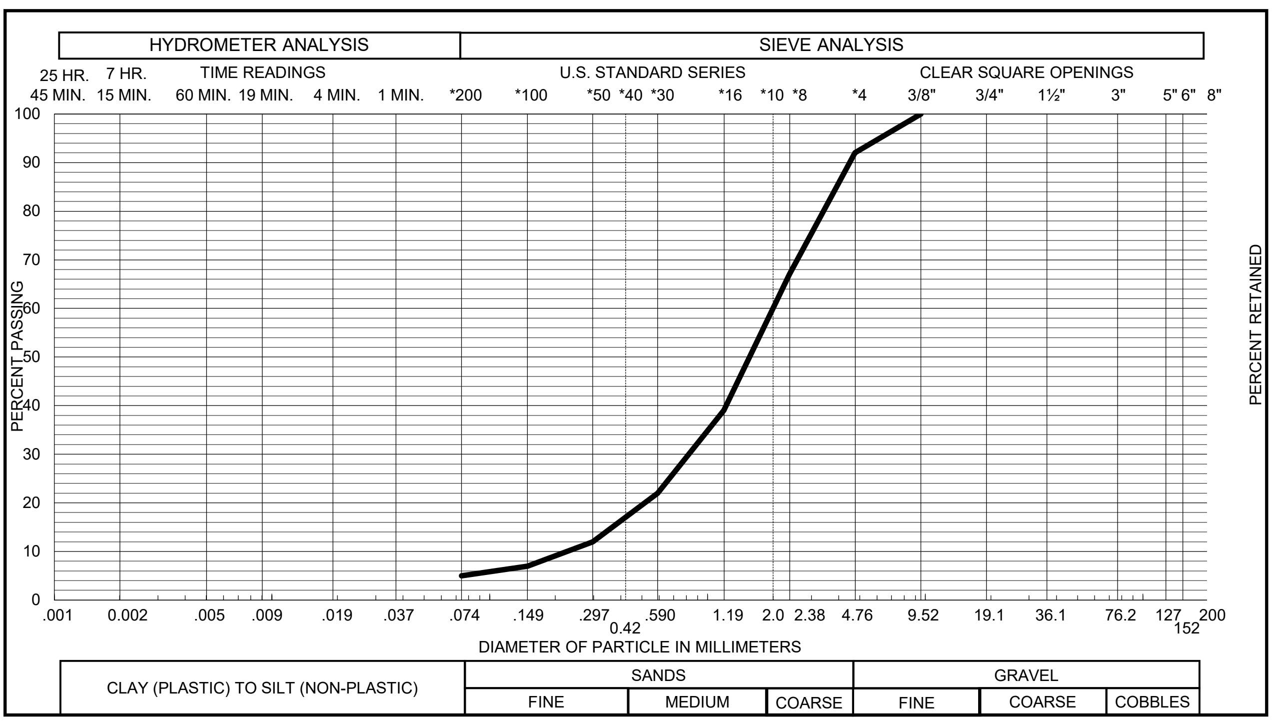
Gradation Test Results

FIG. B-1



Sample of SANDSTONE, SLIGHTLY SILTY
From TH - 2 AT 24 FEET

GRAVEL 16 % SAND 76 %
SILT & CLAY 8 % LIQUID LIMIT %
PLASTICITY INDEX %



Sample of SANDSTONE, SLIGHTLY SILTY
From TH - 3 AT 19 FEET

GRAVEL 8 % SAND 87 %
SILT & CLAY 5 % LIQUID LIMIT %
PLASTICITY INDEX %

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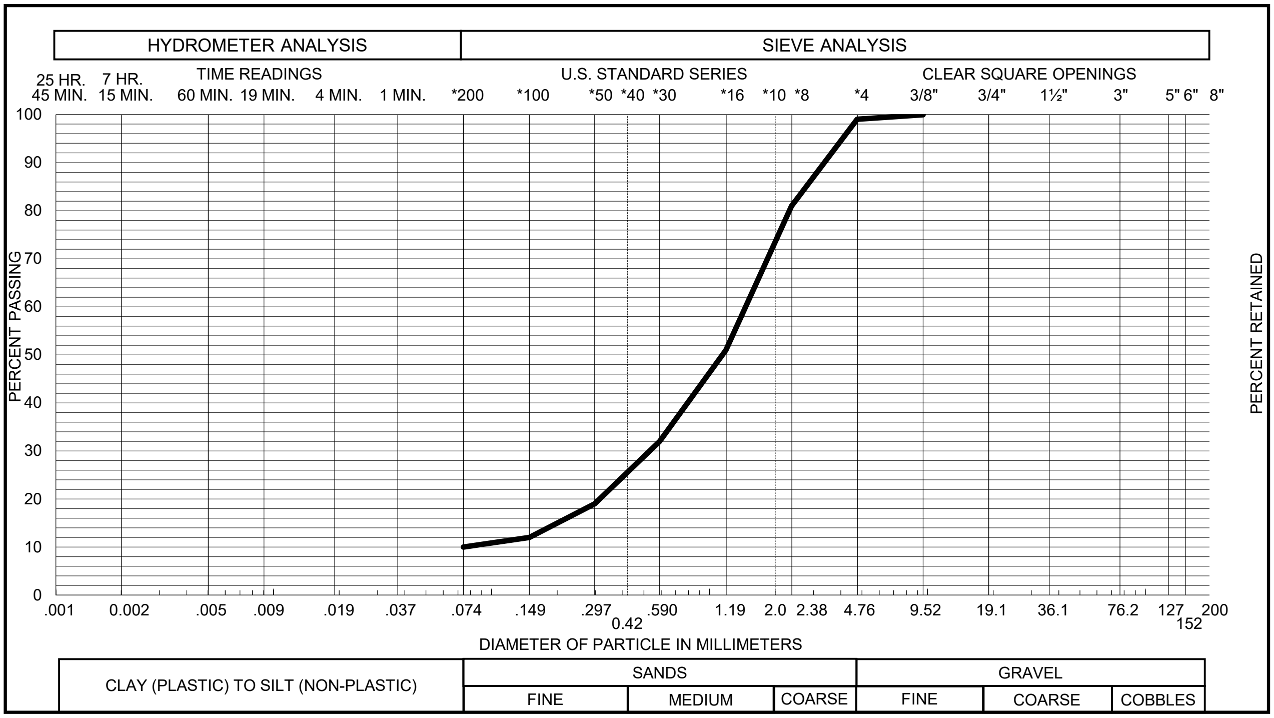
CTL|T PROJECT NO. CS20042-115

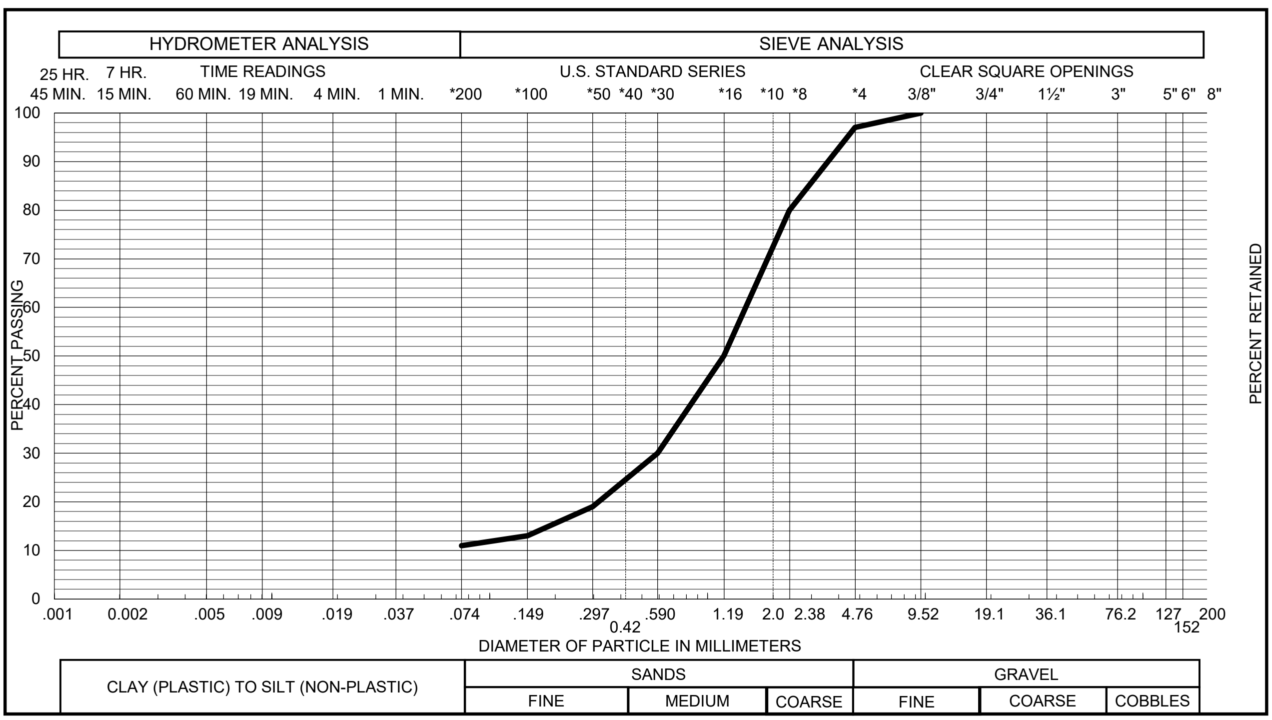
Gradation Test Results

FIG. B-2



Sample of SANDSTONE, SLIGHTLY CLAYEY
From TH - 4 AT 14 FEET

GRAVEL 1 % SAND 89 %
SILT & CLAY 10 % LIQUID LIMIT 26 %
PLASTICITY INDEX 8 %



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 5 AT 9 FEET

GRAVEL 3 % SAND 86 %
SILT & CLAY 11 % LIQUID LIMIT %
PLASTICITY INDEX %

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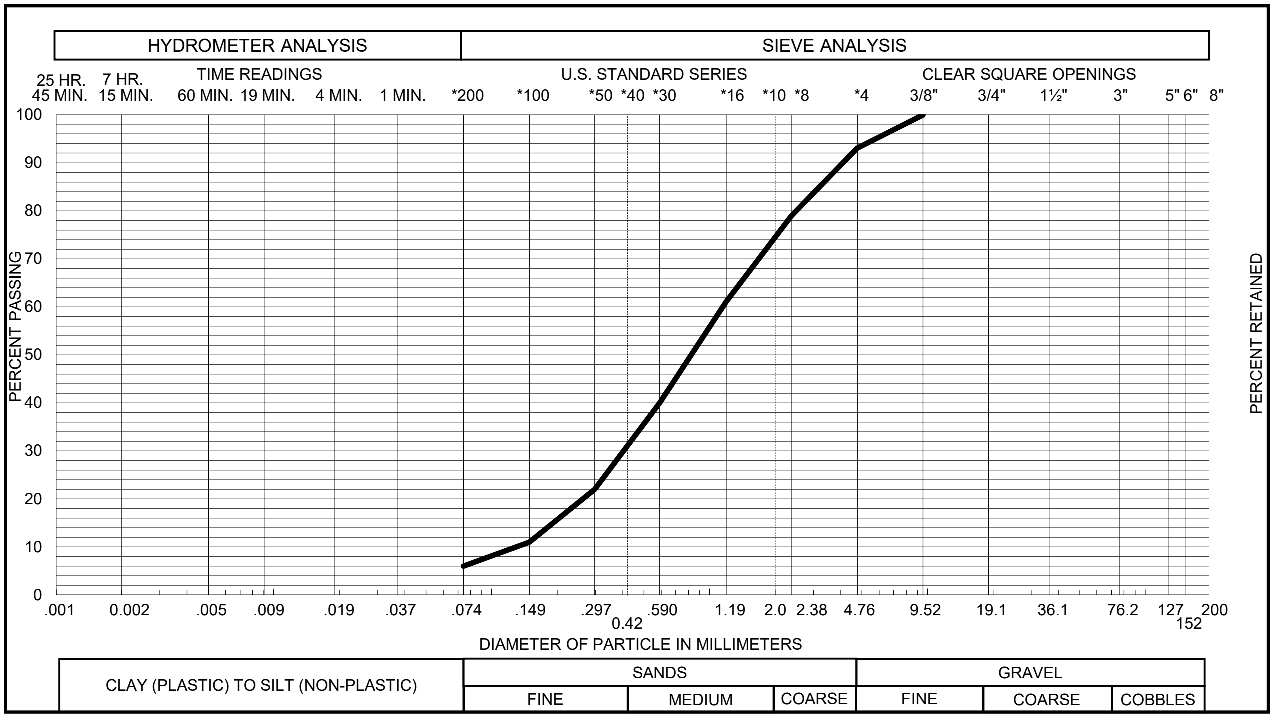
CTL|T PROJECT NO. CS20042-115

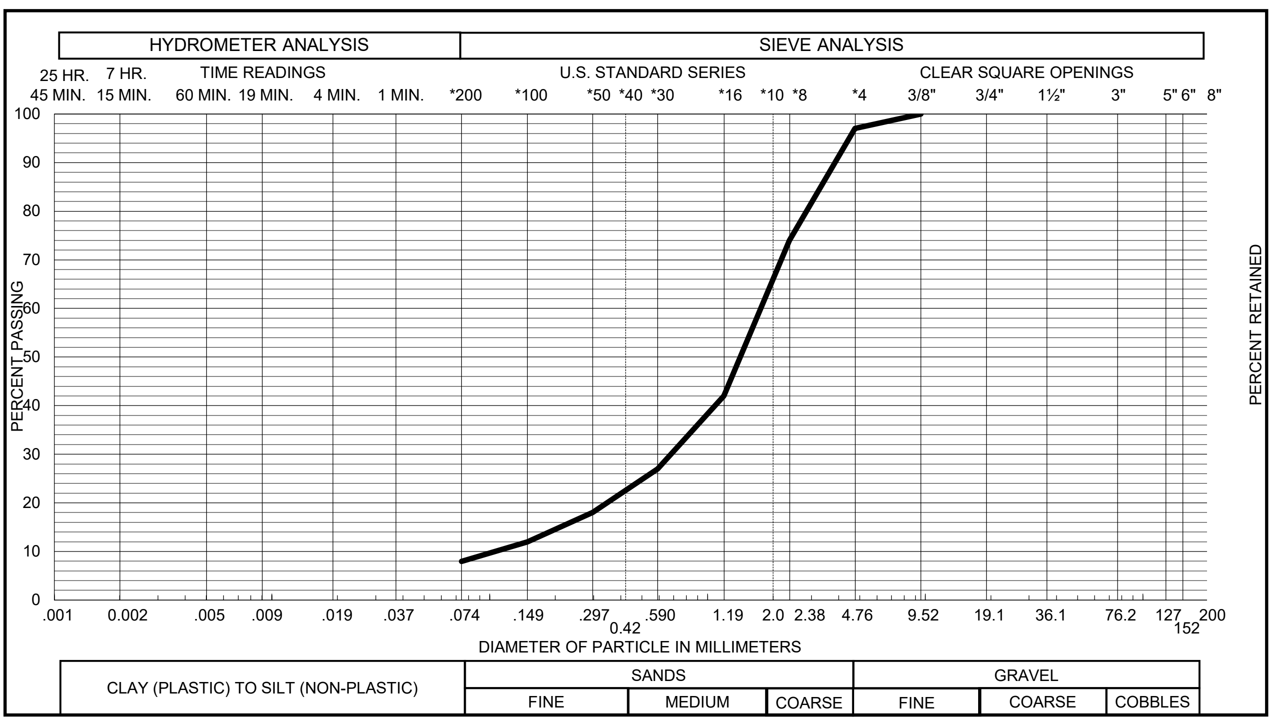
Gradation Test Results

FIG. B-3



Sample of SAND, SLIGHTLY SILTY (SW-SM)
From TH - 6 AT 4 FEET

GRAVEL 7 % SAND 87 %
SILT & CLAY 6 % LIQUID LIMIT NV %
PLASTICITY INDEX NP %



Sample of SANDSTONE, SLIGHTLY SILTY
From TH - 7 AT 19 FEET

GRAVEL 3 % SAND 89 %
SILT & CLAY 8 % LIQUID LIMIT 27 %
PLASTICITY INDEX 6 %

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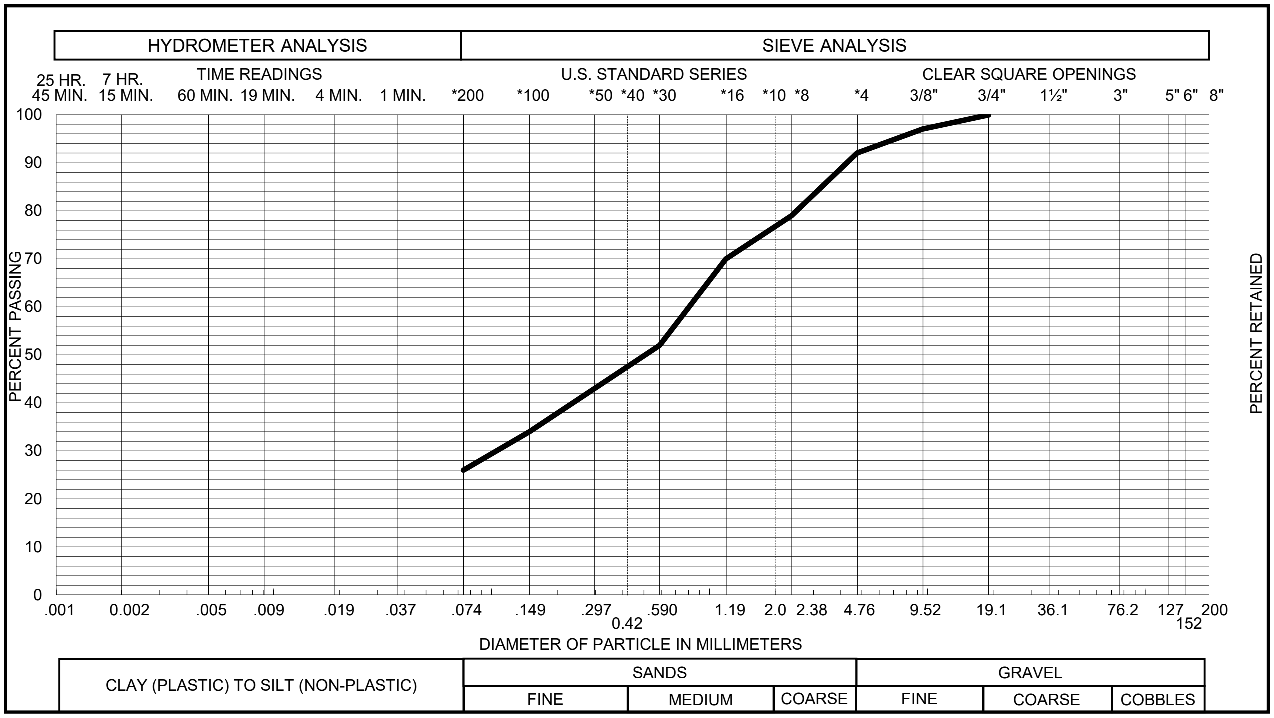
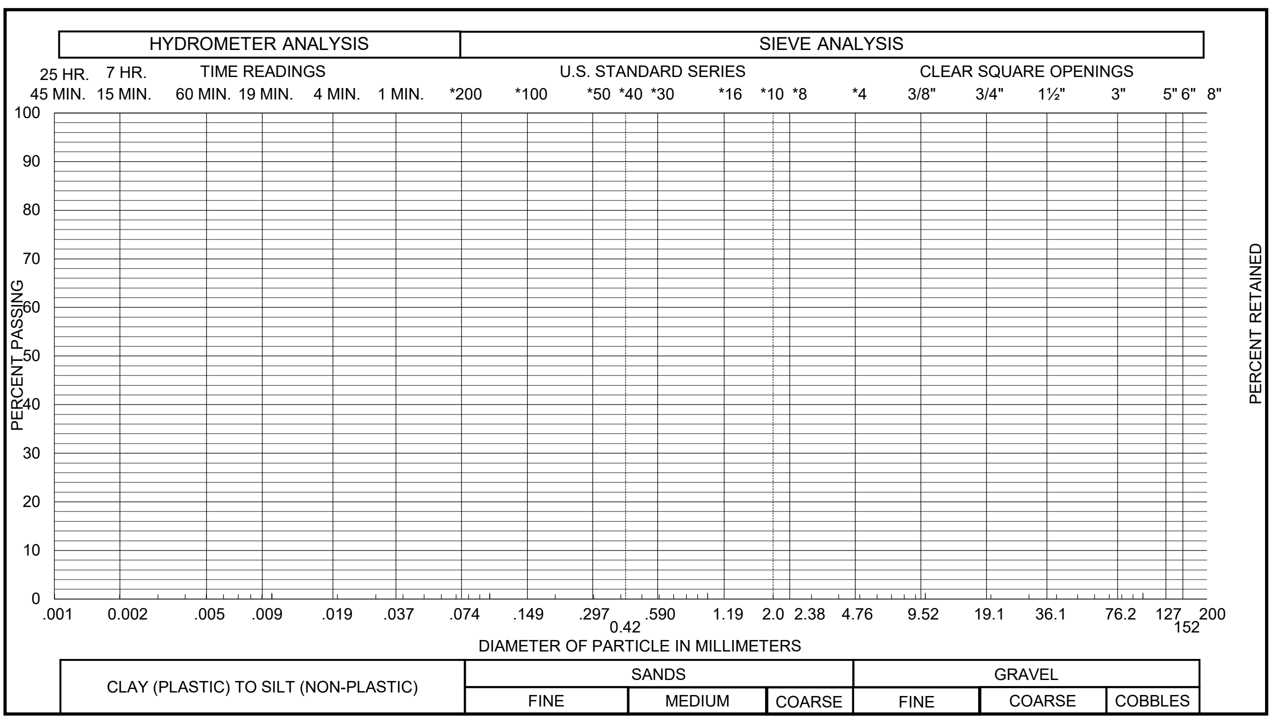
Gradation Test Results

FIG. B-4



Sample of SAND, CLAYEY (SC)
From COMBO - 1 AT 0 FEET

GRAVEL 8 % SAND 66 %
SILT & CLAY 26 % LIQUID LIMIT 24 %
PLASTICITY INDEX 6 %



Sample of
From

GRAVEL % SAND %
SILT & CLAY % LIQUID LIMIT %
PLASTICITY INDEX %

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CTL|T PROJECT NO. CS20042-115

Gradation Test Results

FIG. B-5

TABLE B-I

SUMMARY OF LABORATORY TESTING
CTL|T PROJECT NO. CS20042-115

BORING	DEPTH (FEET)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	SWELL TEST RESULTS*: SWELL (%)	SWELL TEST RESULTS*: SWELL PRESSURE (PSF)	PASSING NO. 200 SIEVE (%)	WATER SOLUBLE SULFATES (%)	DESCRIPTION
TH-1	9	6.7	124	31	13			9		SAND, SLIGHTLY CLAYEY (SW-SC)
TH-1	19	4.9	114					6		SANDSTONE, SLIGHTLY SILTY
TH-2	4	4.8	120					53		FILL, CLAY, VERY SANDY
TH-2	14	5.5	100					6		SANDSTONE, SLIGHTLY SILTY
TH-2	24	8.0	117					8		SANDSTONE, SLIGHTLY SILTY
TH-3	9	7.8	104	NV	NP			2		SAND (SP)
TH-3	19	8.0	123					5		SANDSTONE, SLIGHTLY SILTY
TH-4	4	2.9	102					7		SAND, SLIGHTLY SILTY (SP-SM)
TH-4	14	9.6	121	26	8			10		SANDSTONE, SLIGHTLY CLAYEY
TH-5	9	11.0	114					11		SAND, SLIGHTLY SILTY (SP-SM)
TH-5	19	8.4	128					9		SANDSTONE, SLIGHTLY SILTY
TH-6	4	3.9	110	NV	NP			6		SAND, SLIGHTLY SILTY (SW-SM)
TH-6	14	8.1	121					9		SAND, SLIGHTLY SILTY (SP-SM)
TH-6	24	9.4	123					5		SANDSTONE, SLIGHTLY SILTY
TH-7	9	5.2	113					7		SAND, SLIGHTLY SILTY (SP-SM)
TH-7	19	5.9	114	27	6			8		SANDSTONE, SLIGHTLY SILTY
COMBO-1	0-4	5.9		24	6			26	<0.1	SAND, CLAYEY (SC)

* SWELL MEASURED WITH 1000 PSF APPLIED PRESSURE, OR ESTIMATED IN-SITU OVERBURDEN PRESSURE.
NEGATIVE VALUE INDICATES COMPRESSION.

APPENDIX C

GUIDELINE SITE GRADING SPECIFICATIONS
ROWLEY PROPERTY
COLORADO SPRINGS, COLORADO

GUIDELINE SITE GRADING SPECIFICATIONS
ROWLEY PROPERTY
COLORADO SPRINGS, COLORADO

1. DESCRIPTION

This item consists of the excavation, transportation, placement and compaction of materials from locations indicated on the plans, or staked by the Engineer, as necessary to achieve preliminary pavement and building pad elevations. These specifications also apply to compaction of materials that may be placed outside of the project.

2. GENERAL

The Soils Engineer will be the Owner's representative. The Soils Engineer will approve fill materials, method of placement, moisture contents and percent compaction.

3. CLEARING JOB SITE

The Contractor shall remove all trees, brush and rubbish before excavation or fill placement is begun. The Contractor shall dispose of the cleared material to provide the Owner with a clean, neat appearing job site. Cleared material shall not be placed in areas to receive fill or where the material will support structures of any kind.

4. SCARIFYING AREA TO BE FILLED

All topsoil, vegetable matter, and existing fill shall be removed from the ground surface upon which fill is to be placed. The surface shall then be plowed or scarified until the surface is free from ruts, hummocks or other uneven features that would prevent uniform compaction by the equipment to be used.

5. PLACEMENT OF FILL ON NATURAL SLOPES

Where natural slopes are steeper than 20 percent (5:1, horizontal to vertical) and fill placement is required, horizontal benches shall be cut into the hillside. The benches shall be at least 12 feet wide or 1-1/2 times the width of the compaction equipment and be provided at a vertical spacing of not more than 5 feet (minimum of two benches). Larger bench widths may be required by the Engineer. Fill shall be placed on completed benches as outlined within this specification.

6. COMPACTING AREA TO BE FILLED

After the foundation for the fill has been cleared and scarified, it shall be disced or bladed until it is free from large clods, brought to a workable moisture content, and compacted.

7. FILL MATERIALS

Fill soils shall be free from vegetable matter or other deleterious substances and shall not contain rocks or lumps having a diameter greater than six (6) inches. Fill materials shall be obtained from cut areas shown on the plans or staked in the field by the Engineer or imported to the site.

8. MOISTURE CONTENT

For fill material classifying as CH or CL, the fill shall be moisture treated to between 1 and 4 percent above optimum moisture content as determined by ASTM D 698, if it is to be placed within 15 feet of the final grade. For deep cohesive fill (greater than 15 feet below final grade), it shall be moisture conditioned to within ±2 percent of optimum. Soils classifying as SM, SC, SW, SP, GP, GC and GM shall be moisture treated to within 2 percent of optimum moisture content as determined by ASTM D 1557. Sufficient laboratory compaction tests shall be made to determine the optimum moisture content for the various soils encountered in borrow areas.

The Contractor may be required to add moisture to the excavation materials in the borrow area if, in the opinion of the Soils Engineer, it is not possible to obtain uniform moisture content by adding water on the fill surface. The Contractor may be required to rake or disc the fill soils to provide uniform moisture content throughout the soils.

The application of water to embankment materials shall be made with any type of watering equipment approved by the Soils Engineer, which will give the desired results. Water jets from the spreader shall not be directed at the embankment with such force that fill materials are washed out.

Should too much water be added to any part of the fill, such that the material is too wet to permit the desired compaction to be obtained, all work on that section of the fill shall be delayed until the material has been allowed to dry to the required moisture content. The Contractor will be permitted to rework wet material in an approved manner to hasten its drying.

9. COMPACTION OF FILL AREAS

Selected fill material shall be placed and mixed in evenly spread layers. After each fill layer has been placed, it shall be uniformly compacted to not less than the specified percentage of maximum density. Granular fill placed less than 15 feet below final grade shall be compacted to at least 95 percent of maximum dry density as determined in accordance with ASTM D 1557. Cohesive fills placed less than 15 feet below final grade shall be compacted to at least 95 percent of maximum dry density as determined in accordance with ASTM D 698. For deep, cohesive fill (to be placed 15 feet or deeper below final grade), the material shall be compacted to at least 98 percent of maximum standard Proctor dry density (ASTM D 698). Granular fill placed more than 15 feet below final grade shall be compacted to at least 95 percent of maximum modified Proctor dry density (ASTM D 1557). Deep fills shall be placed within 2 percent of optimum moisture content. Fill materials shall be placed such that the thickness of loose materials does not exceed 10 inches and the compacted lift thickness does not exceed 6 inches.

Compaction, as specified above, shall be obtained by the use of sheepsfoot rollers, multiple-wheel pneumatic-tired rollers, or other equipment approved by the Soils Engineer for soils classifying as claystone, CL, CH or SC. Granular fill shall be compacted using vibratory equipment or other equipment approved by the Soils Engineer. Compaction shall be accomplished while the fill material is at the specified moisture content. Compaction of each layer shall be continuous over the entire area. Compaction equipment shall make sufficient trips to ensure that the required density is obtained.

10. COMPACTION OF SLOPES

Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compaction operations shall be continued until slopes are stable, but not too dense for planting, and there is no appreciable amount of loose soil on the slopes. Compaction of slopes may be done progressively in increments of 3 to 5 feet in height or after the fill is brought to its total height. Permanent fill slopes shall not exceed 3:1 (horizontal to vertical).

11. DENSITY TESTS

Field density tests will be made by the Soils Engineer at locations and depths of his/her choosing. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density tests will be taken in compacted material below the disturbed surface. When density tests indicate the density or moisture content of any layer of fill or portion thereof is below that required, the particular layer or portion shall be reworked until the required density or moisture content has been achieved. The criteria for acceptance of fill shall be:

A. Moisture

The allowable ranges for moisture content of the fill materials specified above in "Moisture Content" are based on design considerations. The moisture shall be controlled by the Contractor so that moisture content of the compacted earth fill, as determined by tests performed by the Soils Engineer, shall be within the limits given. The Soils Engineer will inform the Contractor when the placement moisture is less than or exceeds the limits specified above and the Contractor shall immediately make adjustments in procedures as necessary to maintain placement moisture content within the specified limits.

B. Density

1. The average dry density of all material shall not be less than the dry density specified.
2. No more than 20 percent of the material represented by the samples tested shall be at dry densities less than the dry density specified.
3. Material represented by samples tested having a dry density more than 2 percent below the specified dry density will be rejected. Such rejected materials shall be reworked until a dry density equal to or greater than the specified dry density is obtained.

12. SEASONAL LIMITS

No fill material shall be placed, spread or rolled while it is frozen, thawing, or during unfavorable weather conditions. When work is interrupted by heavy precipitation, fill operations shall not be resumed until the Soils Engineer indicates the moisture content and density of previously placed materials are as specified.

13. NOTICE REGARDING START OF GRADING

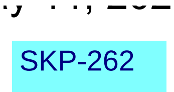
The Contractor shall submit notification to the Soils Engineer and owner advising them of the start of grading operations at least three (3) days in advance of the starting date. Notification shall also be submitted at least three days in advance of any resumption dates when grading operations have been stopped for any reason other than adverse weather conditions.

14. REPORTING OF FIELD DENSITY TESTS

Density tests made by the Soils Engineer, as specified under “Density Tests” above, will be submitted progressively to the Owner. Dry density, moisture content and percent compaction will be reported for each test taken.

V1_Soils & Geology Report.pdf Markup Summary

CDurham (5)



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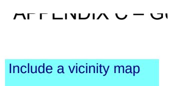

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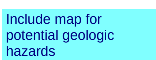

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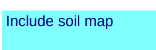
Include map for potential geologic hazards



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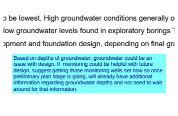

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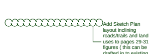
Based on depths of groundwater, groundwater could be an issue with design. If monitoring could be helpful with future design, suggest getting those monitoring wells set now so once preliminary plan stage is going, will already have additional information regarding groundwater depths and not need to wait around for that information.

dsdparsons (1)



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Add Sketch Plan layout inclining roads/trails and land uses to pages 29-31 figures (this can be drafted in to existing maps by hand)