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

GEOLOGIC HAZARD ASSESSMENT
PARCEL NOS. 74111-24-137 and 74111-24-206
SUN MOUNTAIN TOWNHOMES
WEST UINTAH STREET AND NORTH 21ST STREET
COLORADO SPRINGS, COLORADO

Prepared for:

RM3, Inc.
50 Polo Pony Drive
Colorado Springs, Colorado 80906

Attn: René Mondejar

Job No. 221101

July 1, 2024
Revised November 1, 2024

GEOLOGIC HAZARD STUDY APPLICATION

Applicant: RM3, Inc. Telephone: 719-339-7555

Address: 50 Polo Pony Drive Email: rmondejar61@gmail.com

City/State/Zip: Colorado Springs, CO 80906

Site Location: West Uintah and North 21st Street (Sun Mountain Townhomes)

The following documents have been included and considered as part of this study (checked off by individual(s) preparing the geologic study):

____ Rezoning

X Development Plan

____ Land Use Plan

____ Public Improvement construction drawings

____ Final Plat

ENGINEER'S STATEMENT

I hereby attest that I am qualified to prepare a Geologic Hazard Study in accordance with the provisions of the City of Colorado Springs Unified Development Code Section, 7.4.5 Geological Hazards. I am qualified as:

__X__ Professional Geologist as defined by C.R.S. § 23-41-208; or,

_____ A Professional Geotechnical Engineer licensed by the Colorado State Board of Licensure for Architects, Professional Engineers and Professional Land Surveyors.

Submitted by: _____ Logan L. Langford, P.G. Date: 11/1/2024

This Geologic Hazard Study is filed in accordance with the City of Colorado Springs Unified Development Code Section 7.4.5 Geological Hazards.

City Engineering: _____ **Date:** 12-5-24

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July 1, 2024
Revised November 1, 2024

RM3, Inc.
50 Polo Pony Drive
Colorado Springs, CO 80906

Attn: René Mondejar

Re: Geologic Hazard Assessment
Parcel Nos. 74111-24-137 and 74111-24-206
Sun Mountain Townhomes
West Uintah Street and North 21st Street
Entech Job No. 221101

Dear Mr. Mondejar:

As requested, personnel of Entech Engineering, Inc. (Entech) have investigated the above-referenced site to evaluate the conditions with respect to geology and geologic hazards affecting the proposed development of the site. The site is located to the northeast of West Uintah Street and North 21st Street in the western portion of Colorado Springs, Colorado. The approximate location of the site is shown on the Vicinity Map, Figure 1. This report has been updated based on the latest development plan.

SITE CONDITIONS

The site is located in a portion of the NE ¼ of Section 11, Township 14 South, Range 67 West, of the 6th Principal Meridian in Colorado Springs, Colorado. The topography of the site is gradually sloping to the south with moderate to steep slopes in the northwestern portion of the site, and to the north of the subject property. The site is vacant, previous structures located on the site have been removed. Vegetation observed on site consisted of field grasses, weeds, deciduous trees with scattered juniper and pine. The approximate location of the site is shown on the USGS Map, Figure 2. Site photographs taken May 13, 2024 are included in Appendix A. The locations and directions of these photographs are indicated on the Site Plan/Test Boring Location Map, Figure 3.

The site is currently zoned as R2 UV, and R2 PUD (Two-Family Residential). The site does not lie within the Hillside Overlay (Reference 1). Development plans consist of the construction of townhomes with six four-plex structures and one duplex, retaining walls, detention pond, and other associated site improvements shown on the Site and Exploration Plan, Figure 3. Proposed cuts in the building areas range from approximately 2 to 10 feet. Retaining walls that vary in height from 4 to 8 feet are proposed in the northwest corner and central portion of the site. A detention pond is proposed in the southwestern portion of the site.

The scope of this report includes a geologic analysis of the site utilizing published geologic data, subsurface soils information, and site-specific mapping of major geologic features, and identification of geologic hazards with respect to potential development with recommended mitigation techniques. Slope stability analyses has been conducted on the site to reflect the current development plan using the GSTABL7 computer software. Additional investigation may be necessary to evaluate the soils and slope stability after development and grading plans are finalized. Four (4) additional test borings (TB-5 through TB-8) were recently drilled in the proposed building locations as part of the subsurface investigation. The locations of the test borings are indicated on the Exploration and Site Plan, Figure 3. The test boring logs are included in

Appendix B, a Summary of Laboratory Test Results is presented in Table 1. Results of the laboratory testing are included in Appendix C.

PREVIOUS REPORTS

The following reports were reviewed as part of the preparation of this report; Entech Engineering, Inc., *Subsurface Soil Investigation, Lot 1, Block 1, Henderson Street Subdivision,* dated May 22, 2002 (Reference 2), John Himmelreich and Associates, *Geologic Hazards Evaluation Summary Report, Lot 1, Block 1, Henderson Street Subdivision,* dated September 11, 2002 (Reference 3), and Entech Engineering, Inc., *Geologic Hazard Study, Madison Ridge, A Replat of a Portion of Stepping Stones West Subdivision, revised* January 9, 2002 (Reference 4).

The site was previously reviewed by the Colorado Geological Survey (CGS), August 9, 2022 (Reference 5) for a previous development plan. The CGS review letter is included in Appendix D. A Neighborhood Meeting coordinated by Colorado Springs Planning and Community Development Department was held on October 12, 2022 at West Middle School. An additional neighborhood meeting was held on May 29, 2024 to present the current development plan. This report has been prepared for the new development plan and to address previous comments and concerns from the CGS review. The latest CGS review letter from July 30, 2024 (Reference 6) and Entech *Response to CGS Comments* dated September 4, 2024 are included in Appendix F.

FIELD INVESTIGATION

Our field investigation consisted of the preparation of a geologic map of bedrock features and significant surficial deposits. The position of mappable units within the subject property are shown on the Geologic Map. Our mapping procedures involved field reconnaissance, measurements and interpretation. The same mapping procedures have also been utilized to produce the Engineering Geology Map which identifies pertinent geologic conditions affecting development. The field mapping was performed by personnel of Entech Engineering, Inc. on April 4, 2022 and June 10, 2022. The site was revisited May 13, 2024, to evaluate current site conditions and verify previous field mapping.

Eight (8) test borings were drilled on the site for the subsurface soil investigation by Entech. The borings were drilled with a power driven continuous flight auger drill rig to depths of 20 to 25 feet below grade surface (bgs). Samples were obtained during drilling using the Standard Penetration Test, ASTM D-1586, utilizing a 2-inch O.D. Split Barrel Sampler and a California Sampler. Results of the penetration tests are shown on the drilling logs to the right of the sampling point. The locations of the test borings are indicated on the Site and Exploration Plan, Figure 3. The test boring logs are included in Appendix B.

Laboratory testing was performed to classify and determine the soils engineering characteristics. Laboratory tests included moisture content, ASTM D-2216, grain size analysis, ASTM D-422, and Atterberg Limits, ASTM D-4318. Volume change testing was performed on selected samples using Swell/Consolidation (ASTM D-4546) tests in order to evaluate potential expansion/compression characteristics of the soil Sulfate testing was performed to determine the corrosive characteristics of the soils. A Summary of Laboratory Test Results is presented in Table 1. Results of the laboratory testing are included in Appendix C.

GEOLOGIC CONDITIONS

The geology of the site was evaluated using the test borings drilled on the site by Entech, the *Geologic Map of the Colorado Springs Quadrangle* by Carroll and Crawford in 2000 (Figure 4, Reference 7), the *Reconnaissance Geologic Map of Colorado Springs* by Scott and Wobus, 1973 (Reference 8), the *Geologic Map of Colorado Springs – Castle Rock Area* by Trimble and Machette, 1979 (Reference 9), and site-specific mapping of the site. The Geology/Engineering Geology Map prepared for the site is presented in Figure 5.

Approximately 1 mile west of the site are a series of faults associated with two major structural features known as the Rampart Range Fault and the Ute Pass Fault. Along these fault systems, older Precambrian rocks to the west of the faults have been uplifted against younger sediments east of the fault. The bedrock underlying the site consists of the Pierre Shale Formation of Cretaceous Age (Kp). According to the *Geologic Map of the Colorado Springs Quadrangle* (Reference 7), the Pierre Shale in the area of the site is dipping approximately 13° to 19° to the northeast. Overlying the Pierre Shale Formation are areas of colluvial, and residual soils of Quaternary Age. One (1) mappable unit was identified on this site which are described as follows:

Qc/Kp **Colluvium of Quaternary Age overlying the Pierre Shale of Cretaceous Age:** The bedrock underlying this site consists of olive brown to gray claystone and shale associated with the Pierre Shale. These are marine deposits associated with the Cretaceous Western Interior Seaway. They are typically expansive. Bedrock was encountered in the test borings at depths ranging from 3 to 19 feet below grade surface (bgs). Overlying the claystone in many places is a variable layer of colluvial and residual soils. The colluvium was deposited by action of sheetwash and gravity. The residual soils were derived from the in-situ weathering of the bedrock materials.

SOIL CONDITIONS

The soils encountered in the test borings can be grouped into two general soil and rock types. The soils were classified using the Unified Soil Classification System (USCS). Bedrock was encountered in all of the test borings at depths ranging from 3 to 19 feet. The test borings were drilled to depths of 20 to 25 feet below grade surface (bgs). The Test Boring Logs and Laboratory Test Results are presented in Appendixes B and C and are summarized in Table 1.

Soil Type 1 consists of stiff to hard sandy clay to clay with sand (CL, CH). The clay was encountered in all of the test borings at the existing grade surface and extending to depths ranging from 3 to 19 feet. Swell/Consolidation Testing resulted in a volume change of 4.4 to 6.4 percent, which indicates very high expansion potential. Sulfate testing on the clay resulted in 0.27 percent soluble sulfate by weight, indicating a severe potential for below grade concrete degradation due to sulfate attack.

Soil Type 2 consists of hard sandy claystone and shale (CL, CH) or as clay slightly sandy when classified as a soil. The claystone and shale were encountered in all of the test borings at depths ranging from 3 to 19 feet bgs and extending to depths ranging from termination of the test borings (20 to 25 feet). Swell/Consolidation Testing resulted in volume changes of 1.7 to 5.9 percent, which indicates moderate to very high expansion potential. Sulfate testing resulted 0.35 percent soluble sulfate by weight, indicating a severe potential for below grade concrete degradation due to sulfate attack.

Test Boring logs are included in Appendix B. A Summary of Laboratory Results are presented in Table C-1 and Laboratory results are included in Appendix C.

GROUNDWATER

Groundwater was not encountered in the test borings which were drilled to depths ranging from 20 to 25 feet bgs. Fluctuations in groundwater conditions may occur due to variations in rainfall or other factors not readily apparent at this time. Isolated sand layers within the soil profile can carry water in the subsurface. Water may also flow on top of less permeable clay lenses and the bedrock. Contractors should be cognizant of the potential for the occurrence of subsurface water features during construction

ENGINEERING GEOLOGIC HAZARDS

The geologic hazards identified on this site, which includes possible fill, expansive soils, downslope creep, and the potential for high radon levels, are indicated on the Geology/Engineering Geology Map, Figure 5. In accordance with the Geologic Hazards Ordinance of the City of Colorado Springs, the following geologic hazards are discussed:

Artificial Fill

Fill was not mapped on the site, however, fill will likely be encountered where the previous houses that have been removed. Some fill will be encountered in the old excavations and old utility lines. Any uncontrolled fill encountered beneath the proposed structures will require mitigation.

Mitigation: Uncontrolled fill encountered beneath foundations, floor slabs, or in the areas of proposed retaining walls will require mitigation. Due to the expansive nature of the soil and debris, any fill encountered beneath foundations or floor slabs will require complete removal and replacement with non-expansive, granular structural fill compacted to a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557. Fill removal-replacement will likely be required to stabilize the building areas and slopes. An option to fill removal below foundations is the use of drilled pier foundation systems as discussed under “Expansive Soils”. Proof rolling or recompaction of uncontrolled fill in drive or parking areas may also be required.

Expansive Soils

The clay, and claystone encountered in the test borings exhibited high to very high expansion properties. The site is mapped in areas of very high swell potential according to the *Map of Potentially Swelling Soil and Rock in the Front Range Urban Corridor* by Hart, 1974 (Reference 10). Expansive soils can cause differential movement in the structure foundation if not properly mitigated.

Mitigation: Expansive soils encountered on the site will require mitigation. Mitigation of expansive soils will require special foundation design. Overexcavation and replacement with non-expansive soils at a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557 is a suitable mitigation which is common in the area. Overexcavation depths for expansive clays and claystone on this site are expected to be 6 to 7 feet. An option in areas of highly expansive soils is the use of drilled pier foundation systems. Typical minimum pier depths on the order of 25 to 30 feet are required with penetration into competent shale bedrock a minimum of 6 feet or 4 pier diameters, depending on building loads. Floor slabs placed on expansive soils should be expected to experience movement. Overexcavation and replacement has been successful in minimizing slab movements. Structural floors should be considered in areas of highly expansive soils. Final recommendations should be made after additional site investigation and when development and grading plans are finalized.

Landslide Hazard and Slope Stability

The site is not mapped within any area susceptible to landslides according to the *Map of Potential Areas of Landslide Susceptibility in Colorado Springs, El Paso County, Colorado.* by White and Wait, 2003 (Figure 6, Reference 11). The site is generally gradually sloping to the south with moderate to steep slopes in the northwestern portion of the site, and to the north of the subject site. Slope stability analysis was conducted for the proposed cuts and retaining wall in the northwestern portion of the site as part of this investigation and is discussed below. Slope sections were also analyzed on the eastern portion of the site.

No surficial signs of landslide deposits were observed on the site, however, a weak layer was encountered within the claystone in Test Boring No. 2 at an approximate depth of 14 feet below the existing surface grade. No slides have previously been mapped on the site, and the site is not mapped within any areas susceptible to landslides. However, many numerous landslides have occurred in the surrounding area in similar site conditions where past landslides have been concealed by colluvium (Reference 11). However, landslides have occurred in the surrounding area in similar site conditions where past landslides have been concealed by colluvium (Reference 10). Additional detailed site investigation will be required at each location prior to construction. Any special mitigation should be determined at that time.

- *Downslope Creep*
  The moderate to steep slopes on the site have been identified as downslope creep on the Geology/Engineering Geology Map, Figure 5. The potentially unstable slopes were traversed to observe any signs of recent movement or failures. In these areas we would anticipate lateral and vertical movement of the near surface soils in the downslope direction.

- *Slope Stability Analysis*
  Slope Stability Analysis was conducted on the site utilizing the GSTABL7 computer program. The section analyzed is shown on the Slope Section Map, Figure 7, and slope sections are included in Appendix E and summarized on Table E-1A & E1-B. Soil strength values used for the program were as follows.

	Angle of Internal Friction (degrees)	Cohesion (psf)
Clay	28	200
Claystone/Shale	16	500-700
Structural Fill	30	0

Soil strength values were obtained from previous direct shear testing on similar soils in the area and reduced to conservative values utilizing experience in the area and engineering judgement. Supplemental direct shear testing is included in Appendix F. The results of the slope stability analysis are further discussed in Table 3.

Factors of safety were calculated using the Modified Bishop Method for Circular Failures and the simplified Janbu Method for block failures. The sections were analyzed for existing conditions and options of both overexcavation and drilled piers for the proposed site conditions. Factors of safety of 2.0 to 3.0 were obtained for proposed conditions through the section analyzed (with water sensitivity by raising the water table to the clay/claystone

interface, and claystone sensitivity by varying its cohesion). Results are further described in Table 3. A factor of safety of 1.5 is recommended for areas of critical structures such as buildings.

Proper control of drainage at both the surface and in the subsurface is extremely important to slope stability. Saturation of the slope could result in weakening of the materials and slope failure. Water should not be allowed to pond anywhere on site but should be intercepted by either drains or swales and carried off site in a non-erosive manner. Utility trenches, foundation excavation and other subsurface features should not be permitted to become water traps which promote saturation of subsurface features. Landscaping, utilizing native plantings or xeriscape landscaping that require less irrigation is recommended.

Mitigation: No structures are proposed in the downslope creep area. Retaining walls in this area should be designed to account for higher lateral pressures. Building is possible in areas of downslope creep if the following engineering and construction mitigation steps are taken. The design of foundations in these areas should account for additional pressures. A lateral pressure detail is shown in Figure 8. Long, rambling, irregular structures should be avoided in these areas as they are associated with a much greater potential for damaging differential movement. Tie walls and buttresses are often used to stiffen foundation systems.

Dipping Bedrock

The bedrock underlying the site is the Pierre Shale Formation of Cretaceous Age. According to a map by Himmelreich and Noe on *Areas Susceptible to Differential Heave in Expansive, Steeply Dipping Bedrock* (Reference 12), the site lies east of the area mapped with steeply dipping bedrock (>30º). According to the *Geologic Map of the Colorado Springs Quadrangle* by Carroll and Crawford in 2000 (Reference 7, Figure 5), the bedrock in the area is dipping 13° to 19° to the northeast. The bedrock encountered in the test borings did not exhibit steeply dipping characteristics (>30º) therefore, it is anticipated mitigation for steeply dipping bedrock will not be necessary for this site.

Debris Fans/Debris Flow

The proposed building area is not mapped within an area susceptible to debris flows according to the *Debris Flow Susceptibility Map of El Paso County, Colorado,* by McCoy, Morgan, and Berry (Reference 13). Based on site observations, recent debris flows or active debris fans were not observed on the site. Due to the material types, the drainages originating to the west of the site have the potential for hyper concentrated flows and significant erosion potential. No evidence of recent or active debris flows or flooding was observed on the site.

Subsidence

Based on a review of a subsidence investigation report for the Colorado Springs area by Dames and Moore, 1985 (Reference 14), the site is not undermined. The closest underground mines in the area are approximately 4 miles northeast of the site, and the area is not mapped within any potential subsidence zones.

Floodplain, Groundwater and Drainage Areas

The site does not lie within any floodplains according to the FIRM Map, No. 08041CO726G (Figure 9, Reference 15). Drainages were not observed on the site. Site grading should be conducted to direct water away from the proposed structures. A detention pond is proposed southwest side of the site.

Faults

Approximately 1 mile west of the site are a series of faults associated with two major structural features known as the Rampart Range Fault and the Ute Pass Fault. Previously, Colorado was mapped entirely within Seismic Zone 1, a very low seismic risk. Additionally, the International Residence Code (IRC), 2003, currently places this area in Seismic Design Category B, also a low seismic risk. According to a report by the Colorado Geological Survey by Kirkman and Rogers, Bulletin 43 (1981) (Reference 16), this area should be designed for Zone 2 due to more recent data on the potential for movement in this area and any resultant earthquakes.

Radon

Radon is a colorless, tasteless radioactive gas with a United States Environmental Protection Agency (EPA) specified action level of 4.0 picocuries per liter (pCi/L) of air. Radon gas has a very short half-life of 3.8 days. Radon levels for the area have been reported by the Colorado Geologic Survey in the open-file, Report No. 91-4 (Reference 17). Average Radon levels for the 80904-zip code of 12.16 pCi/l have been measured in the area. The following is a table of radon levels in this area.

Average Radon Levels for the 80904 Zip Code	
0 < 4 pCi/L	33.33%
4 < 10 pCi/L	33.33%
10 < 20 pCi/L	11.11%
> 20 pCi/L	22.22%

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

RELEVANCE OF GEOLOGIC CONDITIONS TO DEVELOPMENT

It is our opinion that the existing geologic and engineering geologic conditions will have some constraints on development and construction on this site. The most significant problems affecting development will be that associated with areas of possible fill, expansive soils, and the potential for high radon levels. An area of downslope creep is mapped in the northwest portion of the site where retaining walls and a driveway is proposed. Subsurface soil investigation and slope stability analysis were performed for the site. Additional investigation will be required when development and grading plans are finalized to provide additional foundation and construction recommendations.

The upper soils were encountered at firm to very stiff consistencies. The clay soils, and bedrock encountered on the site are highly expansive. Expansive soils will require overexcavation and replacement with compacted structural fill. Overexcavation depths of 6 to 7 feet for highly expansive soils are anticipated for the clays and claystone on this site. An alternative to overexcavation is the use of drilled pier foundation systems. Typical minimum pier depths on the order of 25 to 30 feet are required with penetration into competent bedrock a minimum of 6 feet or 4 pier diameters, depending on building loads. Floor slabs on expansive soils will still require overexcavation unless structural floors are used.

Fill was not mapped on the site, however, fill will likely be encountered in the areas where houses were previously located on the site. Any uncontrolled fill encountered beneath the proposed structures will require mitigation. Where uncontrolled fill is encountered, complete removal and replacement will likely be required. The extent of overexcavation should be determined after additional investigation and development plans with anticipated building areas are available. New structural fill should be compacted in lifts not to exceed 6 inches after compaction, while maintaining a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557. The soils should be placed at a moisture content conducive to adequate compaction (usually about ±2 percent of proctor optimum moisture content).

Moderate to steep slopes, mapped as downslope creep, exist in the northwestern corner of the site. Areas of downslope creep have been indicated on Figure 5. Retaining walls are proposed in this area. Slope stability analyses have been conducted on the slope retaining wall area. Factors of safety were calculated using the Modified Bishop Method for Circular Failures and the simplified Janbu Method for block failures. The section was analyzed for existing conditions, and options of overexcavation and drilled piers for the proposed site conditions. Factors of safety of 2.0 to 5.2 were obtained through the sections analyzed and are further described in Table 3. A factor of safety of 1.5 is recommended for areas of critical structures such as buildings.

No surficial signs of landslide deposits were observed on the site, however, a weak layer was encountered within the claystone in Test Boring No. 2 at an approximate depth of 14 feet below the existing surface grade. This boring is located in a relatively flat portion of the site. No slides have previously been mapped on the site, and the site is not mapped within any areas susceptible to landslides. Additional detailed site investigation is recommended at each building location prior to construction. Any special mitigation should be determined at that time.

Analysis of the existing conditions on this site have been provided. Based on the proposed development plan and deep foundations used on the structures at the Lofts at Mirrillion located north of the development, the proposed grading and construction plans will not impact the stability of the adjacent structures. The foundation designs for the existing buildings north of the site for the Lofts at Mirrillion were completed by Entech Engineering, Inc. Results of the slope stability analysis is included in Appendix E, and records of observation of the piers of the adjacent properties to the north of the project site are included in Appendix F. The five existing residences north of Uintah are located adjacent to the proposed alley and will not be impacted by the proposed structures, and the remaining eastern, southern, and western sides of the site are adjacent to existing roadways and will not be impacted.

Retaining walls constructed on this site should be designed by a qualified engineer for global stability. This office may be contacted to design the retaining walls. Mechanically stabilized earth walls consisting of concrete/masonry block facing units with geogrid tiebacks or reinforced concrete walls can be used for construction on this site.

Additional site investigations will be completed for each building location and retaining walls to include additional test borings and site-specific global slope stability analysis prior to construction once development plans are finalized.

Proper control of drainage at both the surface and in the subsurface is extremely important. Saturation of the slope could result in weakening of the materials and slope failure. Water should not be allowed to pond on site but should be intercepted by either drains or swales and carried off site in a non-erosive manner. Utility trenches, foundation excavation and other subsurface features should not be permitted to become water traps which promote saturation of subsurface

features. Landscaping, utilizing native plantings or xeriscape landscaping that require less irrigation is recommended

Drainages were not observed on the site. Site grading should be conducted to direct water away from the proposed structures. Infiltration ponds are proposed south of Building Nos. 2 and 3. Specific drainage improvements and studies are beyond the scope of this report.

The potential for high radon levels is present for the site. Build-ups of radon gas can be mitigated by providing increased ventilation of basements and crawlspaces and sealing of joints. Specific requirements for mitigation should be based on building specific testing.

In summary, development of the site can be achieved if mitigation of fill and slope conditions are performed. The proposed grading plan with engineered retaining walls and mitigation of expansive soils is appropriate for the site. Mitigation measure/approaches required for each building will be provided once building locations and grading are finalized.

CLOSURE

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

This report has been prepared for RM3, Inc. for application to the proposed project in accordance with generally accepted geologic, soil and engineering practices. No other warranty expresses or implied is made.

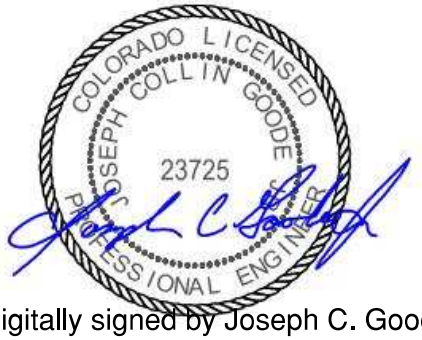
We trust that this report has provided you with all the information that you required. Should you require additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

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

Reviewed by:



Digitally signed by Joseph C. Goode Jr.
Date: 11/01/24

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

LLL/amn
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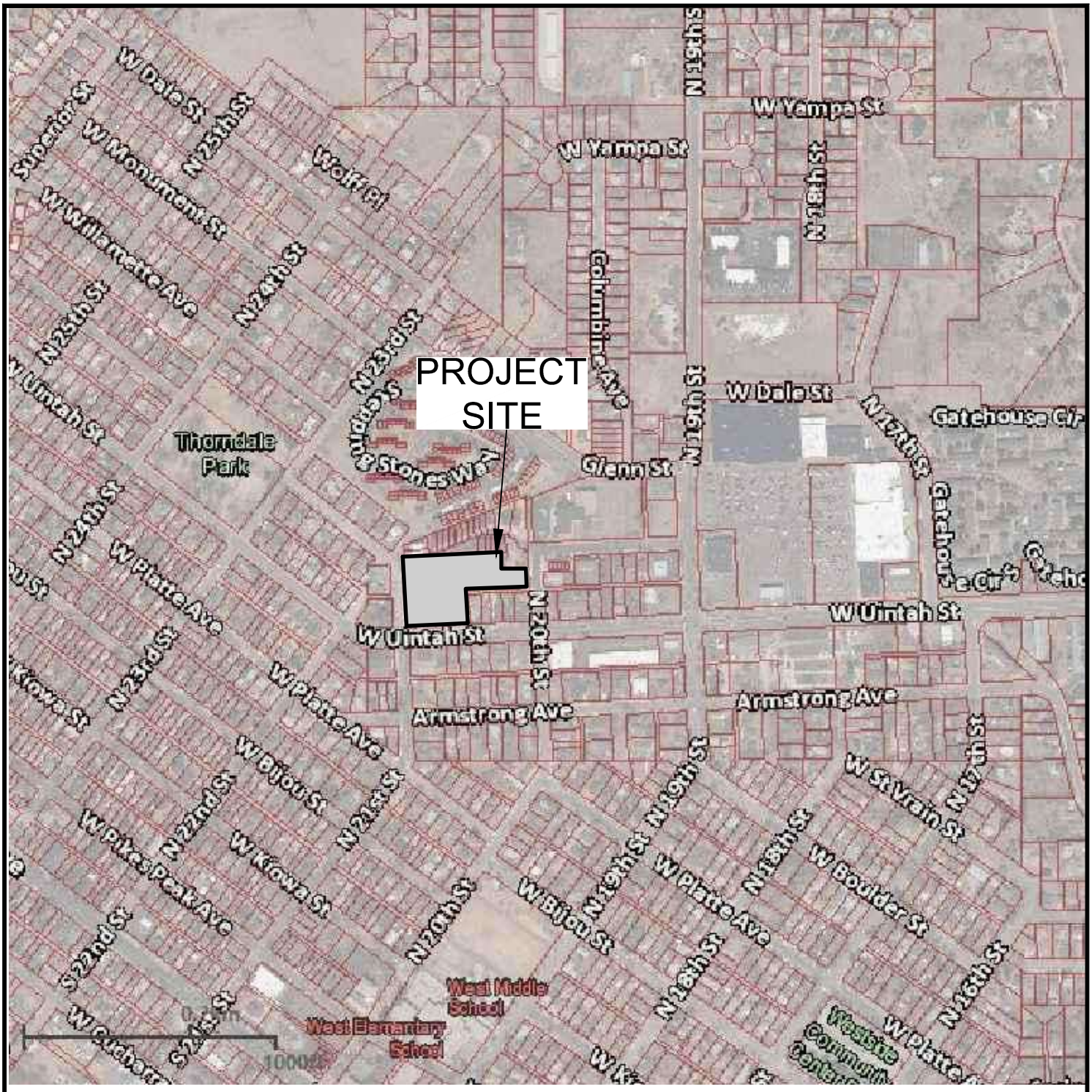
FIGURES



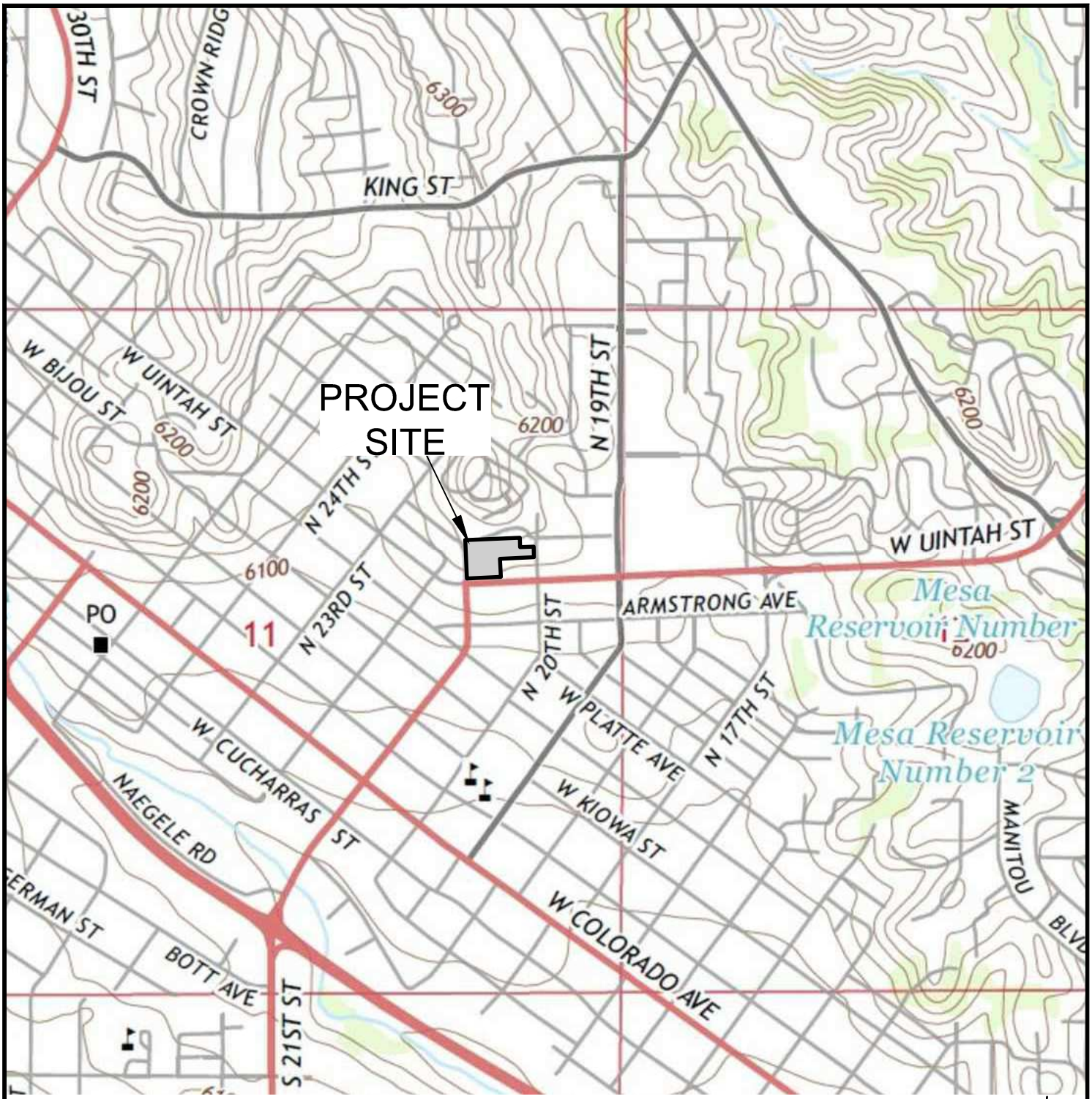
ENTECH ENGINEERING, INC.

VICINITY MAP

W UINTAH STREET & N 21ST STREET
RM3, INC.

JOB NO.
221101

FIG. 1



ENTECH ENGINEERING, INC.

USGS TOPOGRAPHY MAP

W UINTAH STREET & N 21ST STREET
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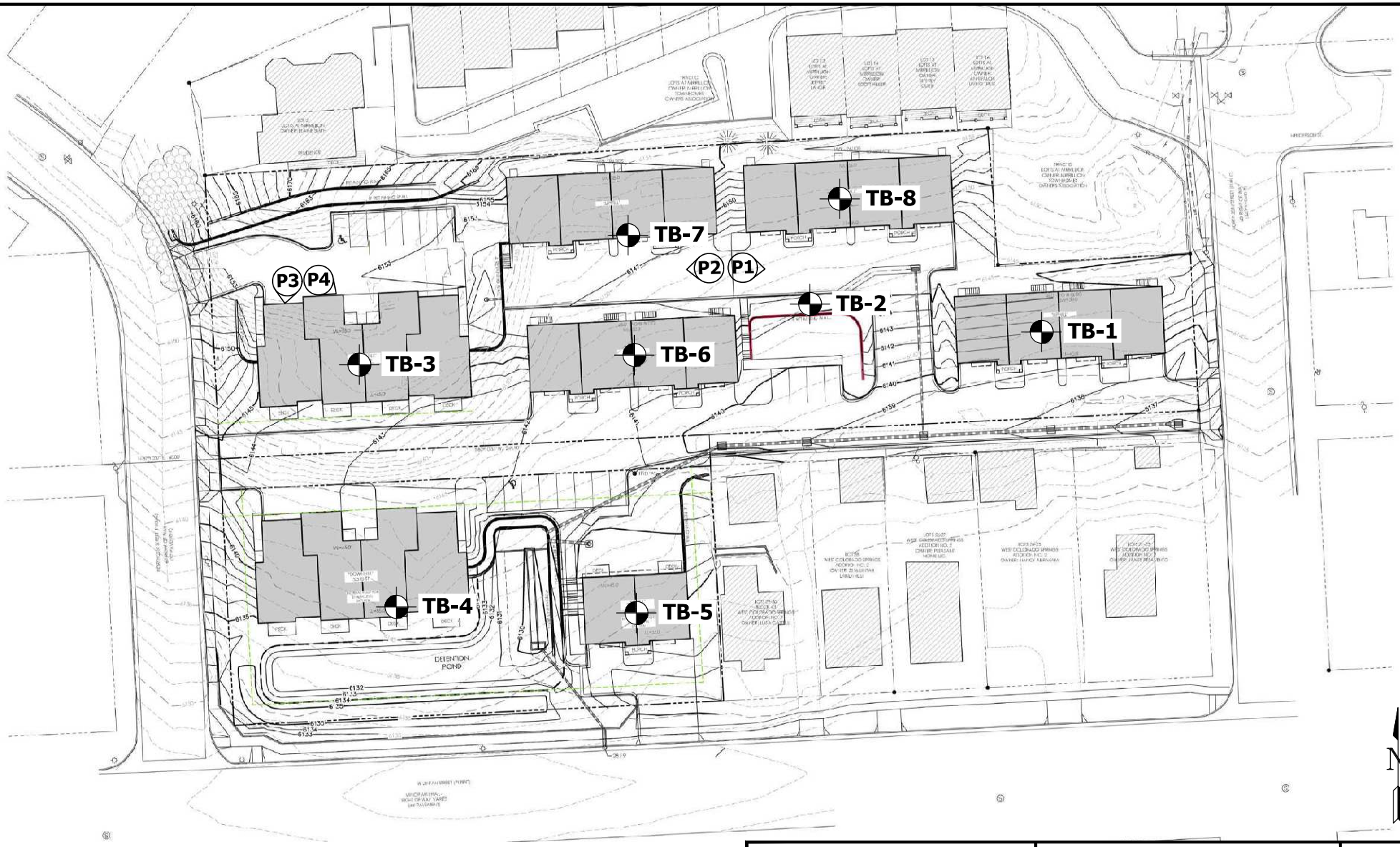
FIG. 2



- APPROXIMATE TEST BORING LOCATION AND NUMBER
P2 - APPROXIMATE PHOTOGRAPH LOCATION AND NUMBER

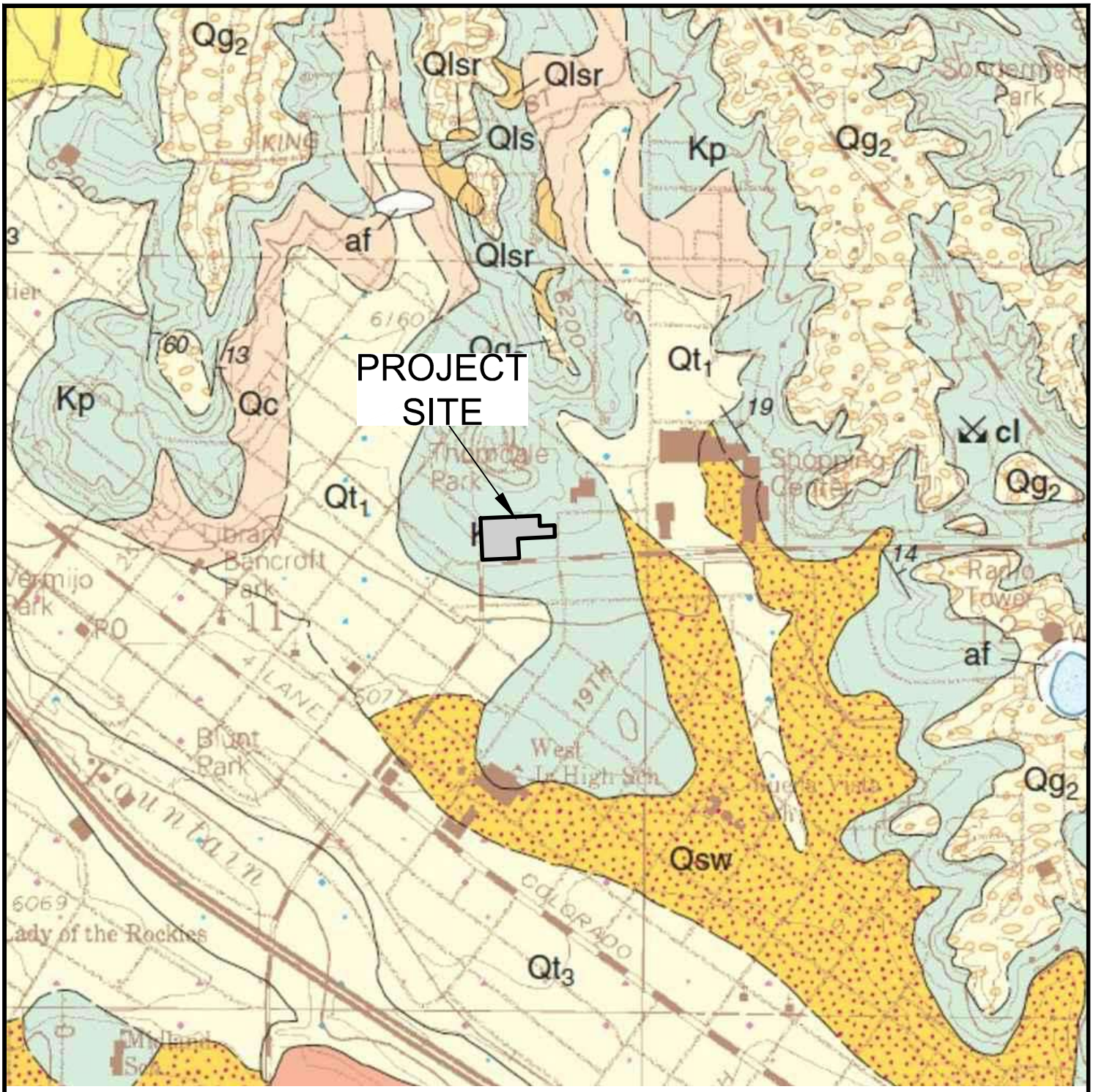
ENTECH ENGINEERING, INC.

SITE AND EXPLORATION PLAN

W UINTAH STREET & N 21ST STREET
RM3, INC.

JOB NO.
221101

FIG. 3



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ENTECH ENGINEERING, INC.

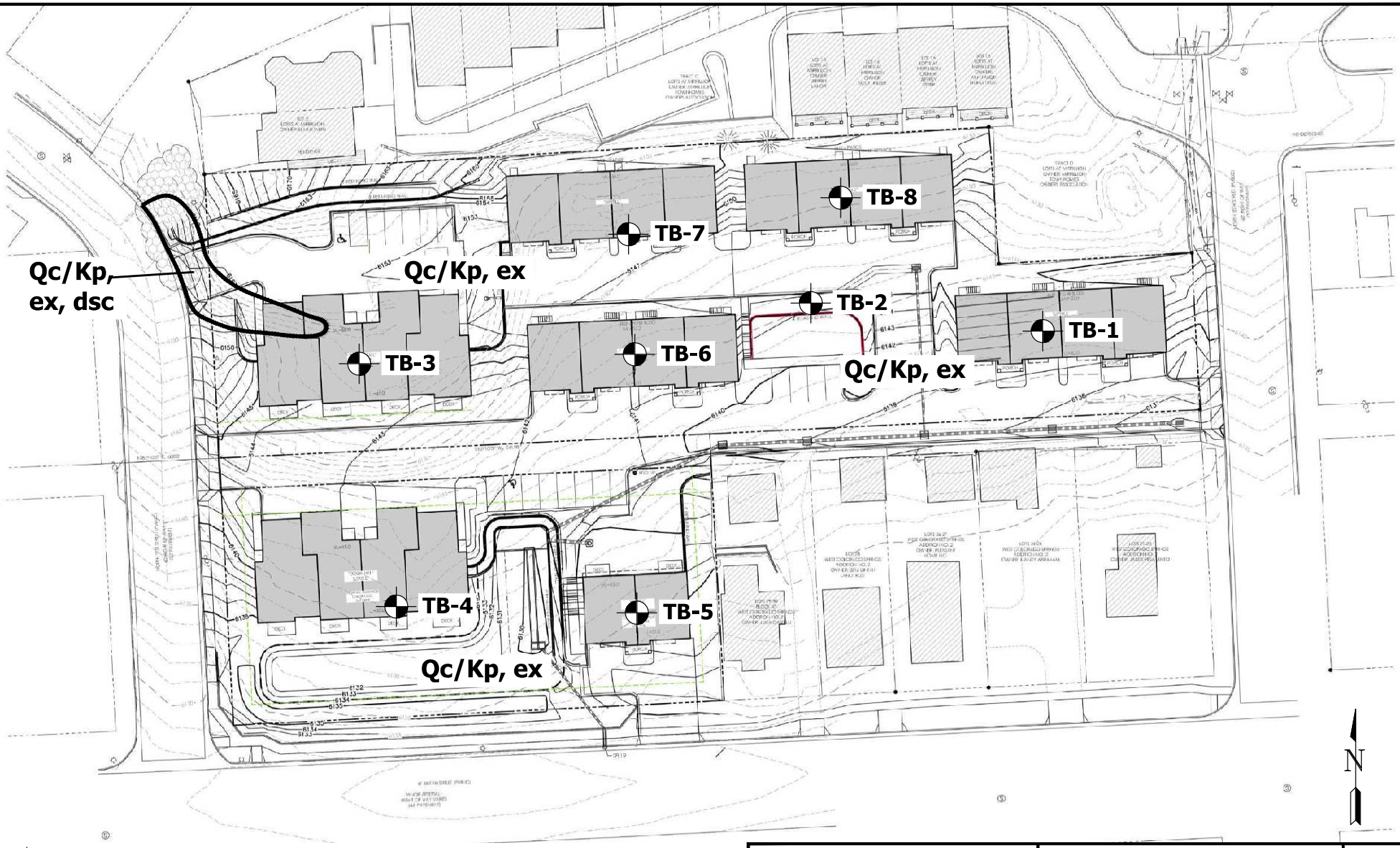
GEOLOGIC MAP OF THE COLORADO SPRINGS QUADRANGLE

W UINTAH STREET & N 21ST STREET

RM3, INC.

JOB NO. 221101

FIG. 4



Legend:

Qc/Kp - Colluvium of Quaternary Age overlying the Pierre Shale Formation of Cretaceous Age: sheetwash and residual soil deposits overlying marine deposited claystone and shale

ex - expansive soils

dsc - downslope creep

ENTECH ENGINEERING, INC.

GEOLOGY / ENGINEERING MAP

W UINTAH STREET & N 21ST STREET
RM3, INC.

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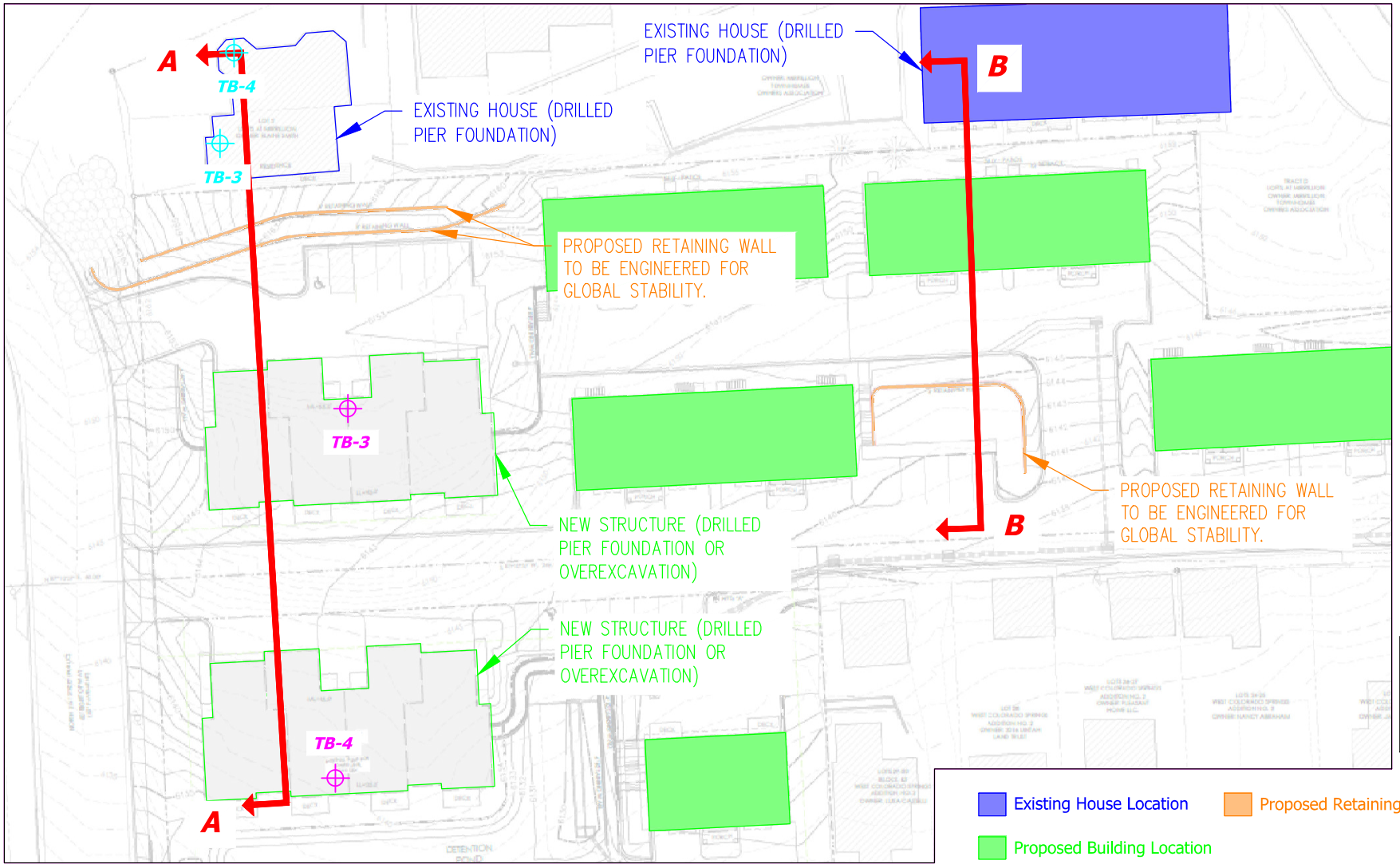
FIG. 5



NOTE: THIS SHEET CONTAINS COLORED LINEWORK & MUST BE PRINTED IN COLOR TO UNDERSTAND.

Existing House Location

Proposed Retaining Wall Location

Proposed Building Location

SLOPE STABILITY SECTION

TB- approximate test boring location and number (Entech Job No. 221101)

TB- approximate test boring location and number (Entech Job No. 46992)

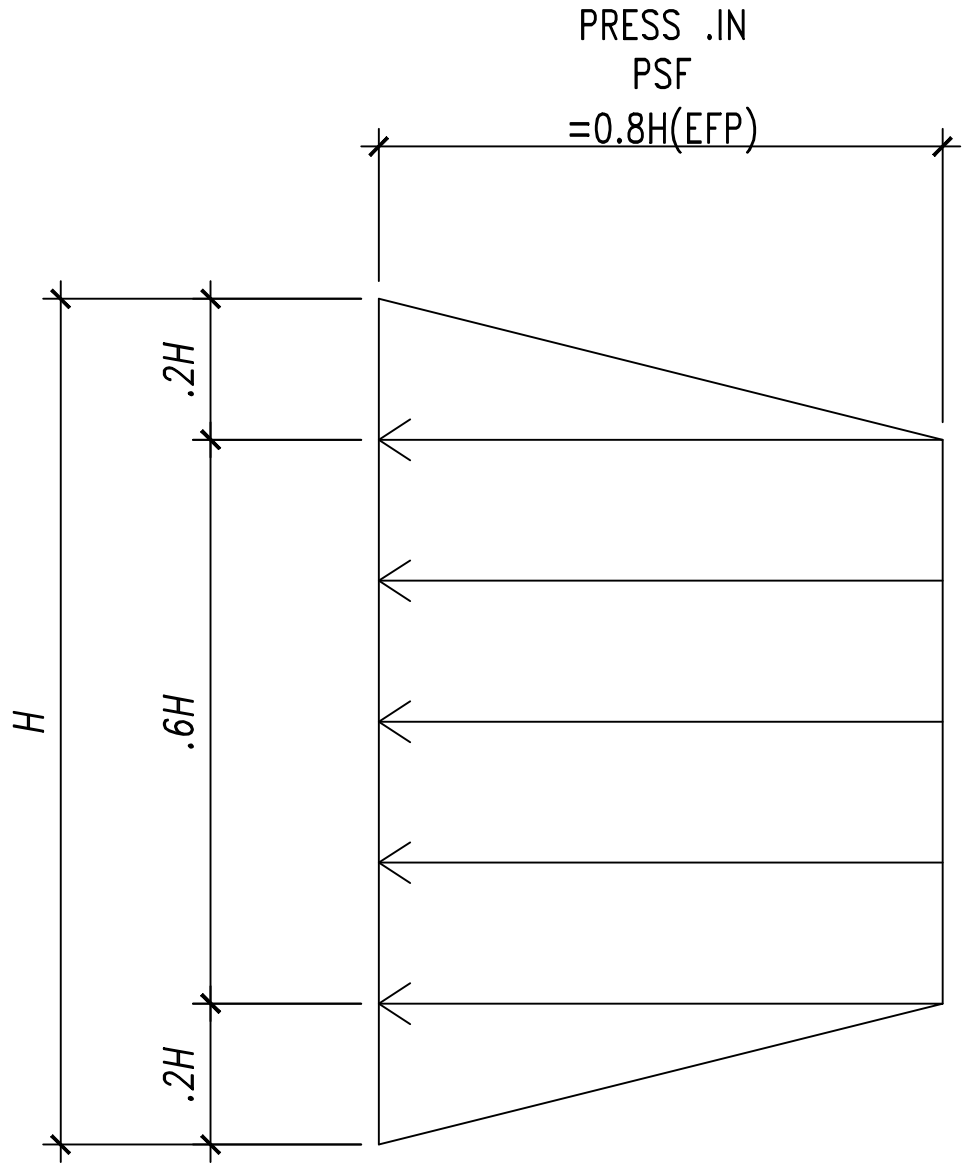
ENTECH ENGINEERING, INC.

SLOPE SECTION MAP

W UINTAH STREET & N 21ST STREET
RM3, INC.

JOB NO. 221101

7



PRESSURE DISTRIBUTION

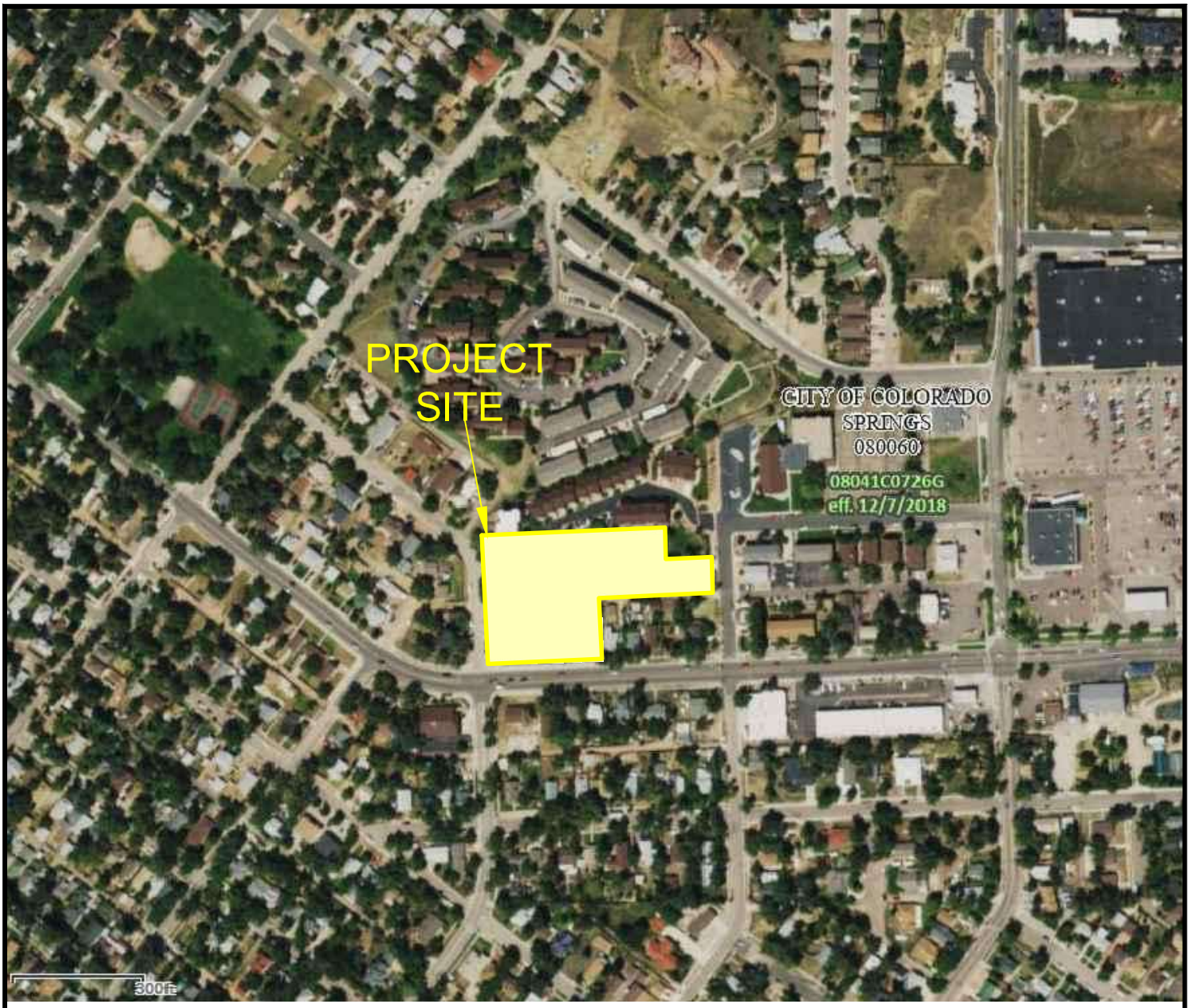
ENTECH ENGINEERING, INC.

LATERAL PRESSURE DIAGRAM

W UINTAH STREET & N 21ST STREET
RM3, INC.

JOB NO.
221101

FIG. 8



Flood Hazard Zones

- 1% Annual Chance Flood Hazard
- Regulatory Floodway
- Special Floodway
- Area of Undetermined Flood Hazard
- 0.2% Annual Chance Flood Hazard
- Future Conditions 1% Annual Chance Flood Hazard
- Area with Reduced Risk Due to Levee
- Area with Risk Due to Levee

N

ENTECH ENGINEERING, INC.

FEMA FLOODPLAIN MAP

W UINTAH STREET & N 21ST STREET
RM3, INC.

JOB NO.
221101

FIG. 9

APPENDIX A: Site Photographs

1

Looking east the north-central portion of the site.

May 13, 2024

2

Looking west the north-central portion of the site.

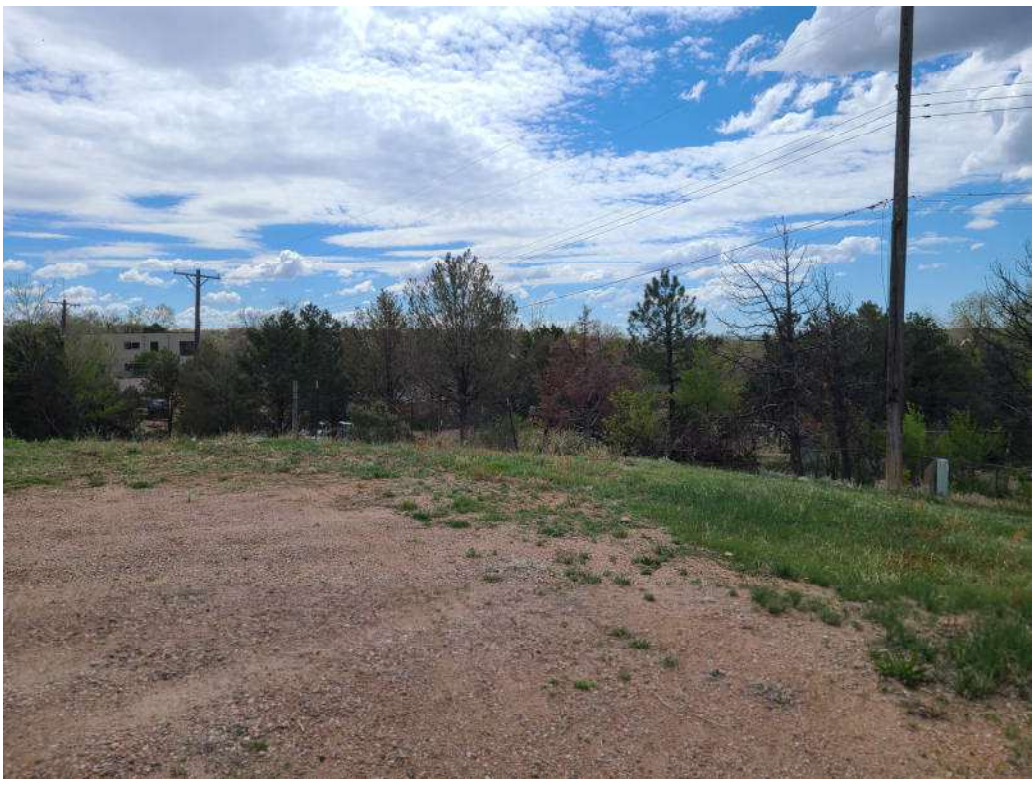
May 13, 2024

Job No. 221101

3

Looking south from the western portion of the site.

May 13, 2024



4

Looking southeast from the western portion of the site.

May 13, 2024

Job No. 221101

APPENDIX B: Test Boring Logs

TABLE B-1

DEPTH TO BEDROCK

TEST BORING	DEPTH TO BEDROCK (ft.)
1	19
2	9
3	9
4	9
5	7
6	3
7	3
8	4

TEST BORING 1
DATE DRILLED 5/16/2022

REMARKS

DRY TO 23', 5/27/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	CLAY, WITH SAND, BROWN, VERY STIFF to HARD, MOIST		24	10.7	1
5			39	16.3	1
10			23	14.7	1
15			20	18.7	1
20	CLAYSTONE, WEAK, BROWN, HIGHLY WEATHERED (CLAY, SLIGHTLY SANDY, HARD, MOIST)		50	19.6	2
25			50/11"	20.0	2

TEST BORING 2
DATE DRILLED 5/16/2022

REMARKS

DRY TO 18', 5/27/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	CLAY, SLIGHTLY SANDY, VERY STIFF, MOIST		24	8.4	1
5			28	16.6	1
10	CLAYSTONE, WEAK, BROWN, HIGHLY WEATHERED (CLAY, SLIGHTLY SANDY, HARD, MOIST)		50	16.8	2
15			31	19.8	2
20			50/11"	17.9	2

ENTECH ENGINEERING, INC.

TEST BORING LOGS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO. 221101

FIG. B-1

TEST BORING 3
DATE DRILLED 5/16/2022

REMARKS

DRY TO 17', 5/27/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
CLAY, WITH SAND, BROWN, VERY STIFF, MOIST					
			26	13.5	1
5			29	14.1	1
CLAYSTONE, WEAK, BROWN, HIGHLY WEATHERED (CLAY, SLIGHTLY SANDY, HARD, MOIST)					
10			50	15.7	2
15			50/11"	13.9	2
20			50/6"	13.4	2

TEST BORING 4
DATE DRILLED 5/16/2022

REMARKS

DRY TO 18.5', 5/27/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
CLAY, WITH SAND, BROWN, VERY STIFF, MOIST					
			18	12.1	1
5			21	11.5	1
CLAYSTONE, WEAK, BROWN, HIGHLY WEATHERED (CLAY, SLIGHTLY SANDY, HARD, MOIST)					
10			50	14.6	2
15			50/9"	16.2	2
20			50/9"	12.8	2

ENTECH ENGINEERING, INC.

TEST BORING LOGS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO. 221101

FIG. B-2

TEST BORING 5
DATE DRILLED 5/10/2024

REMARKS

DRY 17.5', 5/14/24

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			33	14.3	1
5			42	16.0	1
10			50/10"	16.4	2
15			50/10"	16.6	2
20			50/9"	16.5	2

CLAY, SLIGHTLY SANDY, BROWN to OLIVE, HARD, MOIST

CLAYSTONE, VERY WEAK, OLIVE BROWN, HIGHLY WEATHERED (CLAY, SLIGHTLY SANDY, HARD, MOIST)

TEST BORING 6
DATE DRILLED 5/10/2024

REMARKS

DRY 19', 5/14/24

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			28	13.3	1
5			50/10"	13.4	2
10			50/10"	14.7	2
15			50/9"	16.9	2
20			50/9"	16.7	2

CLAY, SLIGHTLY SANDY, OLIVE, VERY STIFF, MOIST

CLAYSTONE, VERY WEAK, OLIVE BROWN, HIGHLY WEATHERED (CLAY, SLIGHTLY SANDY, HARD, MOIST)

ENTECH ENGINEERING, INC.

TEST BORING LOGS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO. 221101

FIG. B-3

TEST BORING 7
DATE DRILLED 5/10/2024

REMARKS

DRY 20', 5/14/24

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			31	13.9	1
5			50/11"	18.7	2
10			50/10"	18.3	2
15			50/10"	18.9	2
20			50/10"	18.7	2

CLAY, SLIGHTLY SANDY, BROWN to OLIVE, HARD, MOIST

CLAYSTONE, VERY WEAK, OLIVE BROWN, HIGHLY WEATHERED (CLAY, SLIGHTLY SANDY, HARD, MOIST)

SHALE, VERY WEAK, DARK GRAY, HIGHLY WEATHERED (CLAY, SLIGHTLY SANDY, HARD, MOIST)

TEST BORING 8
DATE DRILLED 5/10/2024

REMARKS

DRY 19.5', 5/14/24

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			26	19.0	1
5			50	18.6	2
10			50/7"	17.4	2
15			50/9"	17.2	2
20			50/10"	18.0	2

CLAY, SLIGHTLY SANDY, BROWN to OLIVE, HARD, MOIST

CLAYSTONE, VERY WEAK, OLIVE BROWN, HIGHLY WEATHERED (CLAY, SLIGHTLY SANDY, HARD, MOIST)

SHALE, VERY WEAK, OLIVE BROWN to DARK GRAY, HIGHLY WEATHERED (CLAY, SLIGHTLY SANDY, HARD, MOIST)

ENTECH ENGINEERING, INC.

TEST BORING LOGS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO. 221101

FIG. B-4

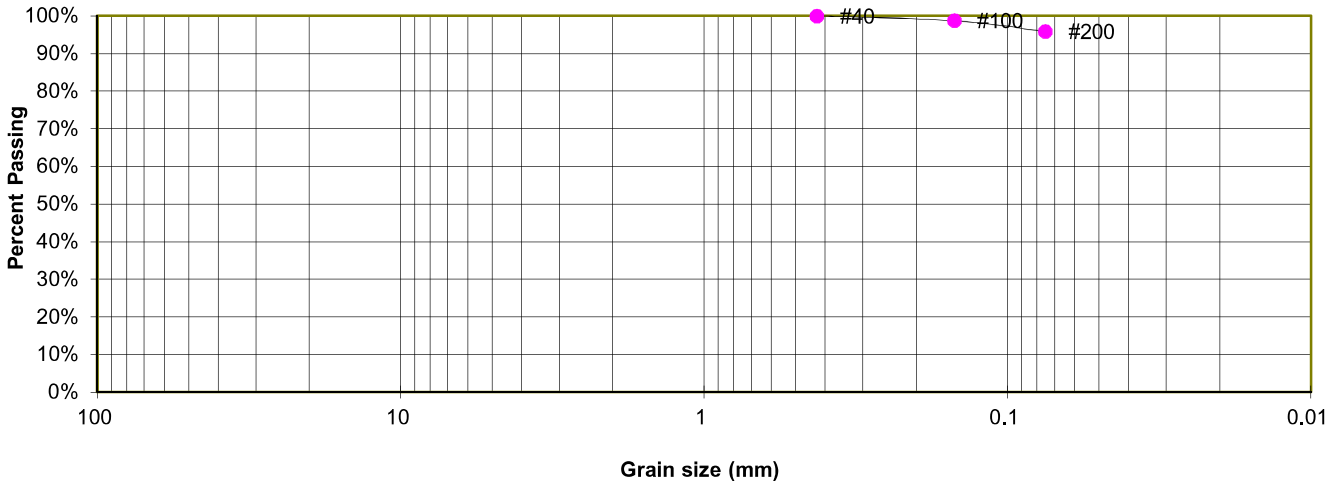
APPENDIX C: Laboratory Test Results

TABLE C-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	2	2-3	14.5	101.9	95.9	64	24	40	0.27	6.4	CH	CLAY, SLIGHTLY SANDY
1	4	5	12.6	111.8	78.0					5.4	CL	CLAY, WITH SAND
1	5	5	14.8	113.8	90.3	42	25	17	<0.01	4.4	CL	CLAY, SLIGHTLY SANDY
1	8	2-3			95.2						CL	CLAY, SLIGHTLY SANDY
2	1	20	22.1	101.4	96.7	60	26	34	<0.01	2.6	CH	CLAYSTONE (CLAY, SLIGHTLY SANDY)
2	3	10	16.1	108.1	97.2					5.9	CL	CLAYSTONE (CLAY, SLIGHTLY SANDY)
2	6	10	14.5	101.6	96.6	56	23	33	0.14	1.7	CH	CLAYSTONE (CLAY, SLIGHTLY SANDY)
2	7	15			98.4				0.25		CL	SHALE (CLAY, SLIGHTLY SANDY)

Project: Uintah and 21s
Client: RM3
Job No: 221101

TEST BORING	2	SOIL DESCRIPTION	CLAY, SLIGHTLY 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"	
4	
10	
20	
40	100.0%
100	98.7%
200	95.9%

ATTERBERG LIMITS

Plastic Limit	24
Liquid Limit	64
Plastic Index	40

SOIL CLASSIFICATION

USCS CLASSIFICATION: CH

ENTECH ENGINEERING, INC.

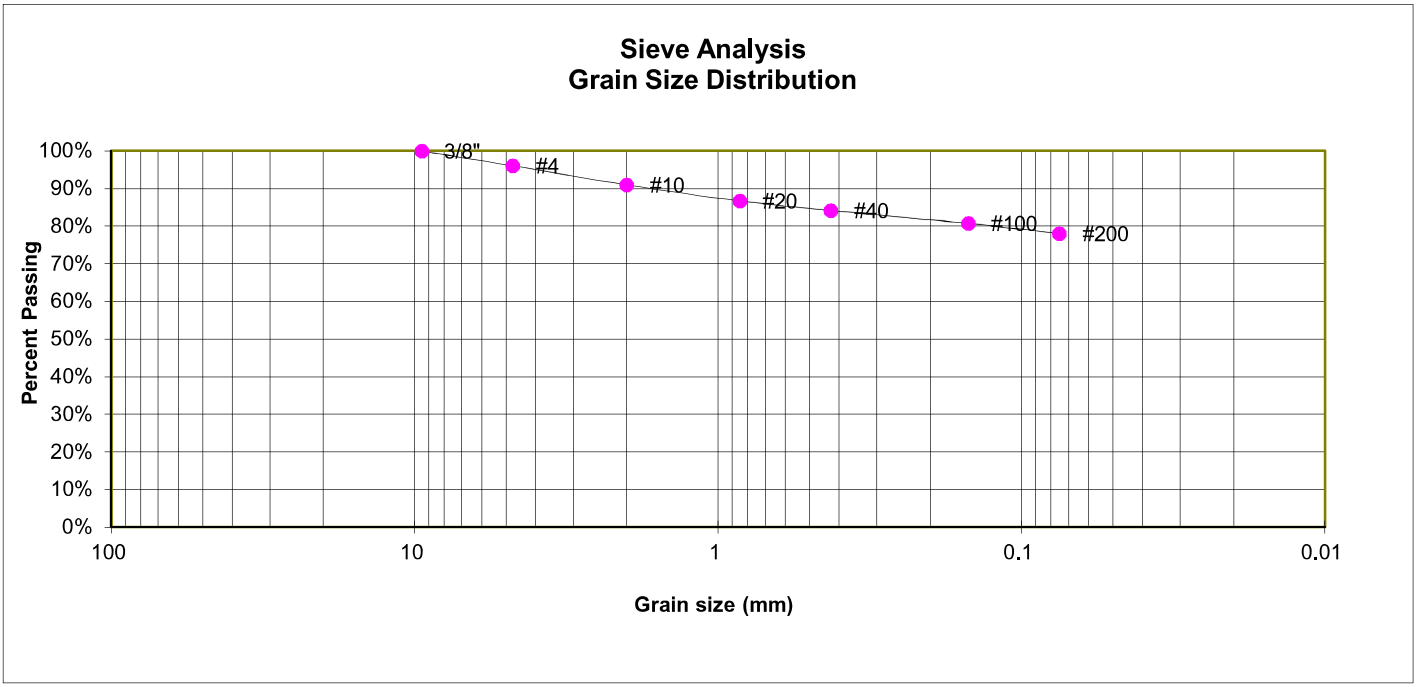
LABORATORY TEST RESULTS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO.
221101

FIG. C-1

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



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.1%
10	91.0%
20	86.7%
40	84.2%
100	80.7%
200	78.0%

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

ENTECH ENGINEERING, INC.

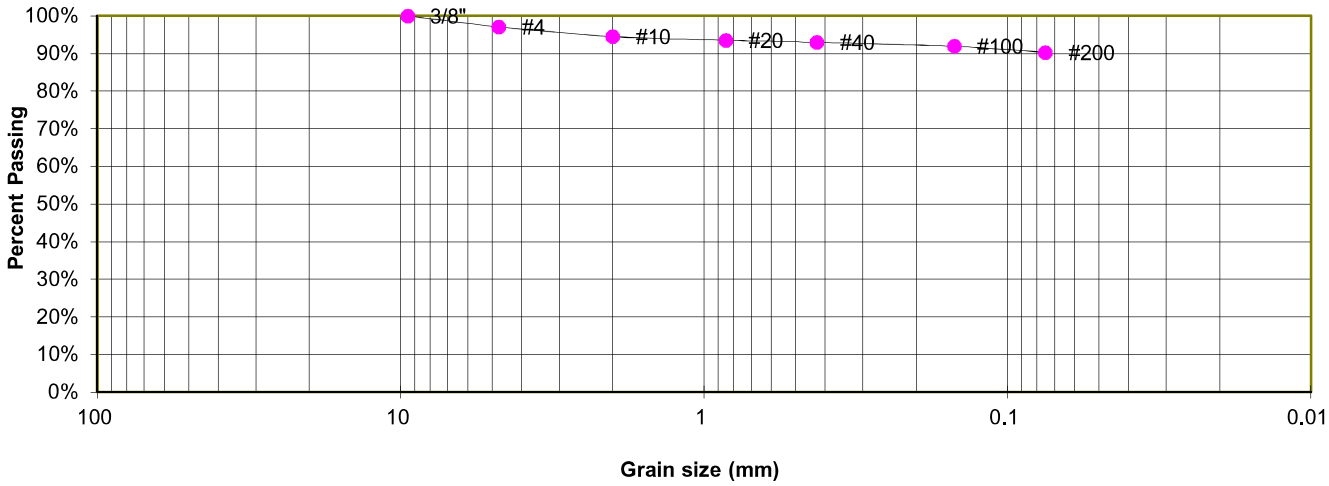
LABORATORY TEST RESULTS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO. 221101

FIG. C-2

TEST BORING	5	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"	100.0%
4	97.1%
10	94.5%
20	93.5%
40	93.0%
100	91.9%
200	90.3%

ATTERBERG LIMITS

Plastic Limit	25
Liquid Limit	42
Plastic Index	17

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

ENTECH ENGINEERING, INC.

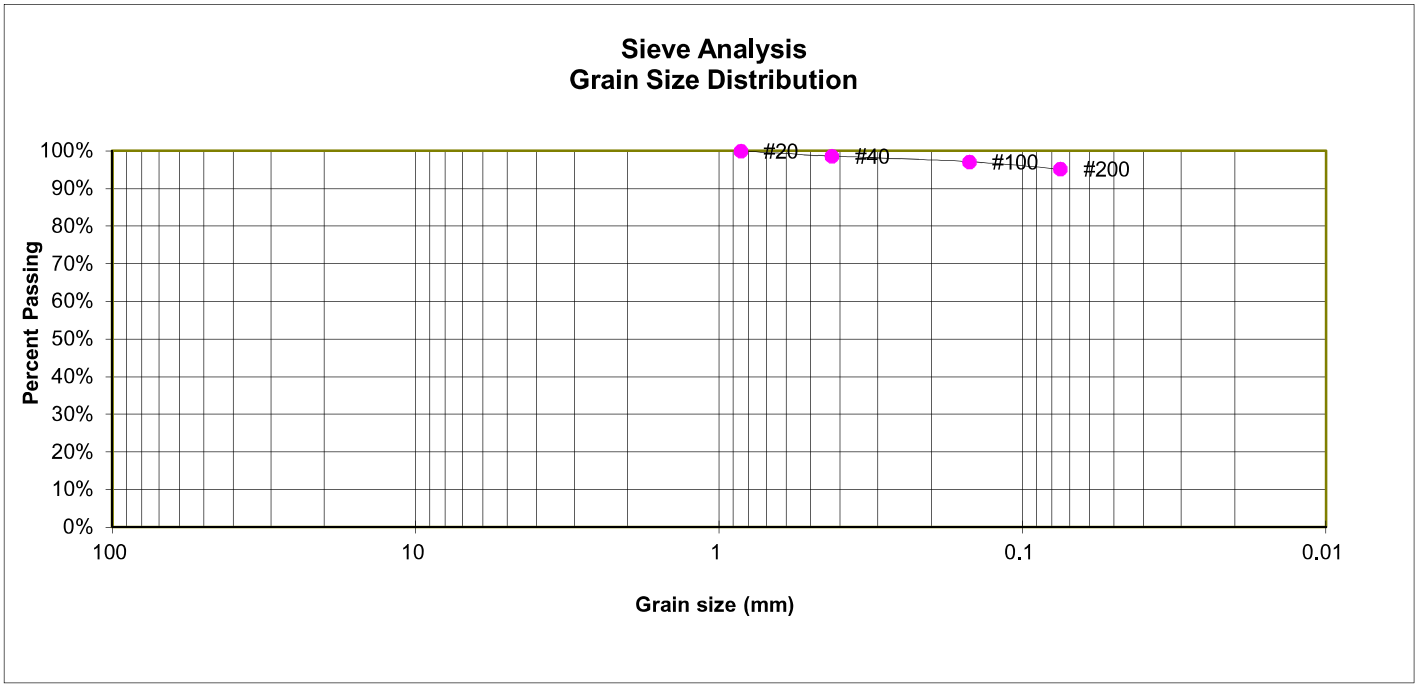
LABORATORY TEST RESULTS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO. 221101

FIG. C-3

TEST BORING	8	SOIL DESCRIPTION	CLAY, SLIGHTLY 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"	
4	
10	
20	100.0%
40	98.6%
100	97.1%
200	95.2%

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

ENTECH ENGINEERING, INC.

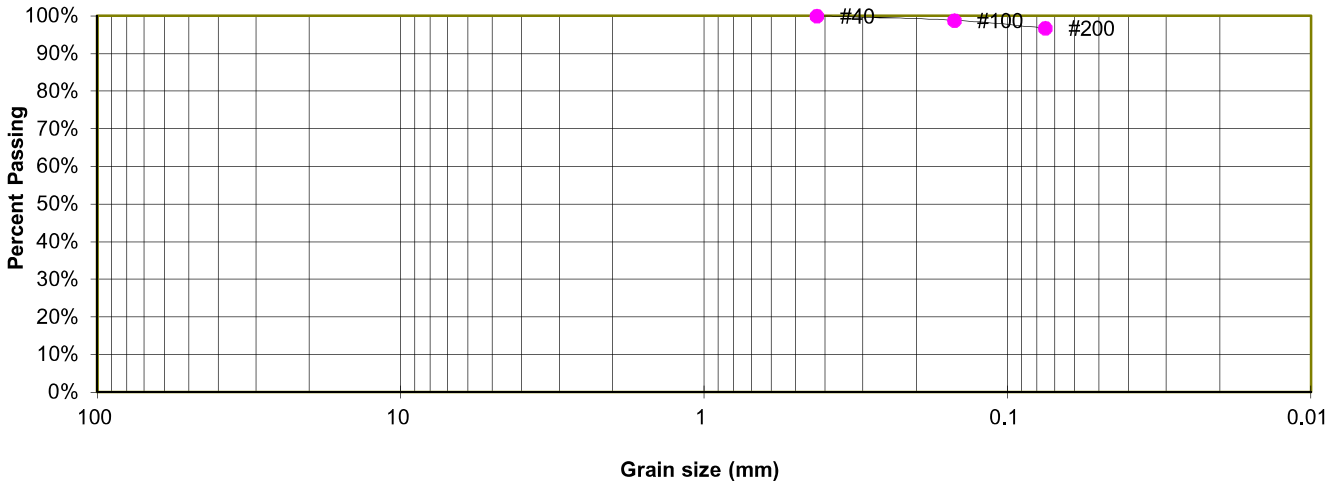
LABORATORY TEST RESULTS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO. 221101

FIG. C-4

TEST BORING	1	SOIL DESCRIPTION	CLAYSTONE (CLAY, SLIGHTLY SANDY)
DEPTH (FT)	20	SOIL TYPE	2



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	
40	100.0%
100	98.8%
200	96.7%

ATTERBERG LIMITS

Plastic Limit	26
Liquid Limit	60
Plastic Index	34

SOIL CLASSIFICATION

USCS CLASSIFICATION: CH

ENTECH ENGINEERING, INC.

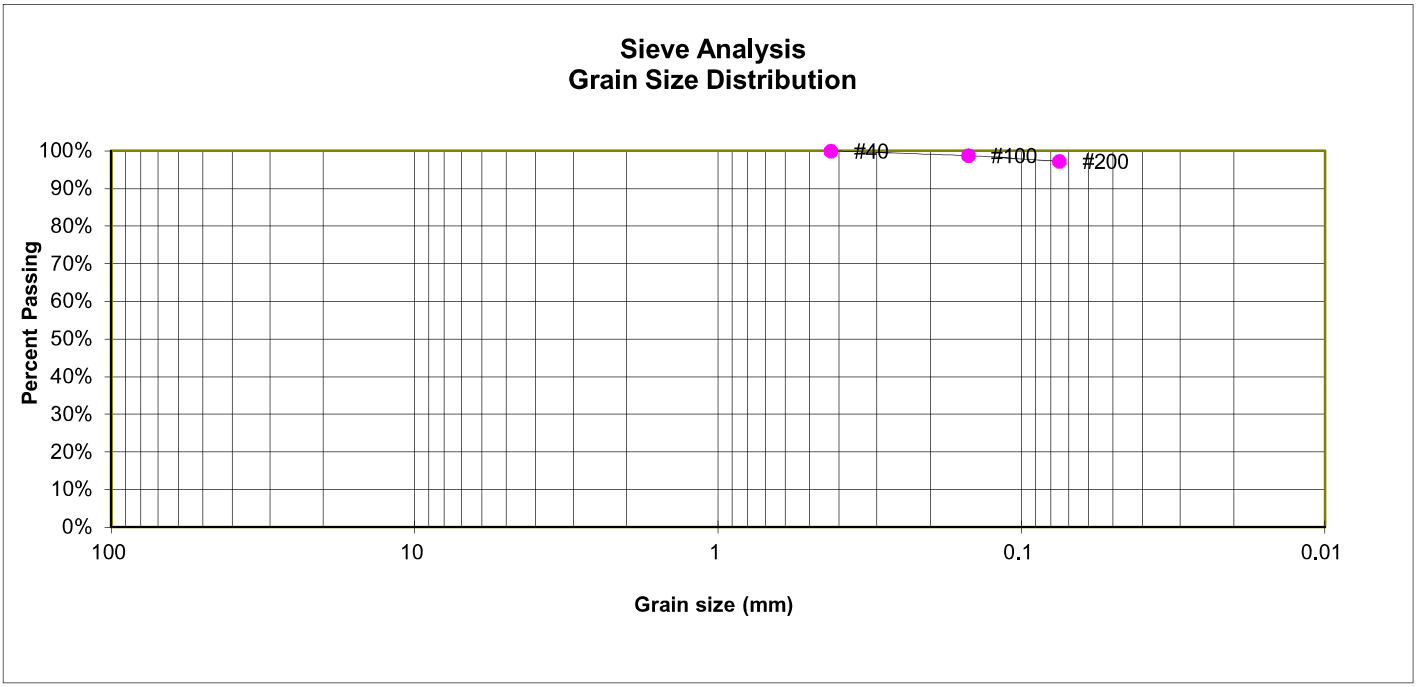
LABORATORY TEST RESULTS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO. 221101

FIG. C-5

TEST BORING	3	SOIL DESCRIPTION	CLAYSTONE (CLAY, SLIGHTLY SANDY)
DEPTH (FT)	10	SOIL TYPE	2



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	
40	100.0%
100	98.7%
200	97.2%

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

ENTECH ENGINEERING, INC.

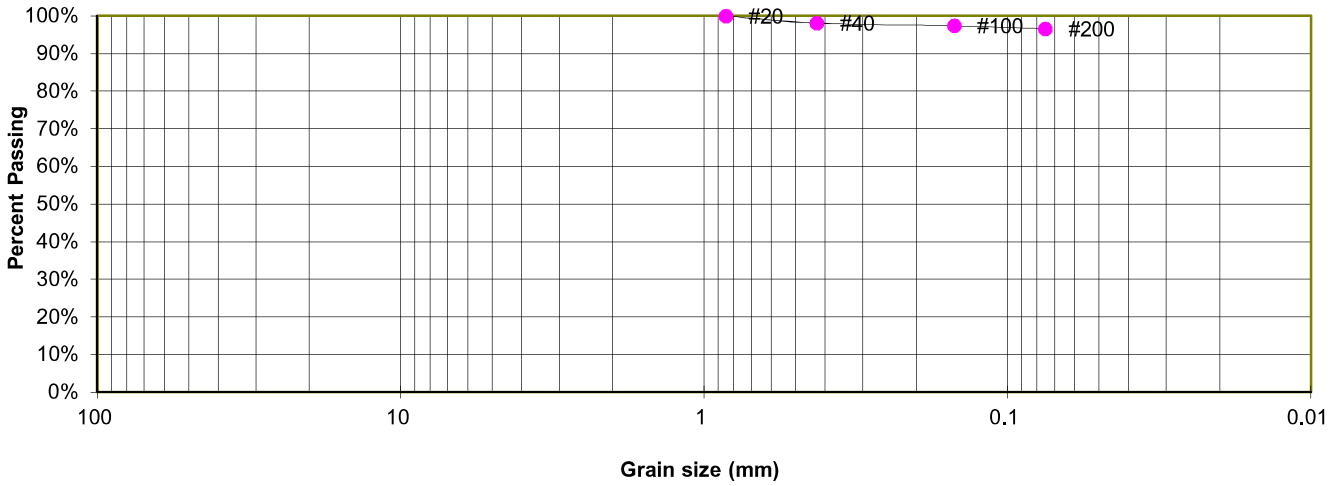
LABORATORY TEST RESULTS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO. 221101

FIG. C-6

TEST BORING	6	SOIL DESCRIPTION	CLAYSTONE (CLAY, SLIGHTLY SANDY)
DEPTH (FT)	10	SOIL TYPE	2



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	100.0%
40	98.1%
100	97.4%
200	96.6%

ATTERBERG LIMITS

Plastic Limit	23
Liquid Limit	56
Plastic Index	33

SOIL CLASSIFICATION

USCS CLASSIFICATION: CH

ENTECH ENGINEERING, INC.

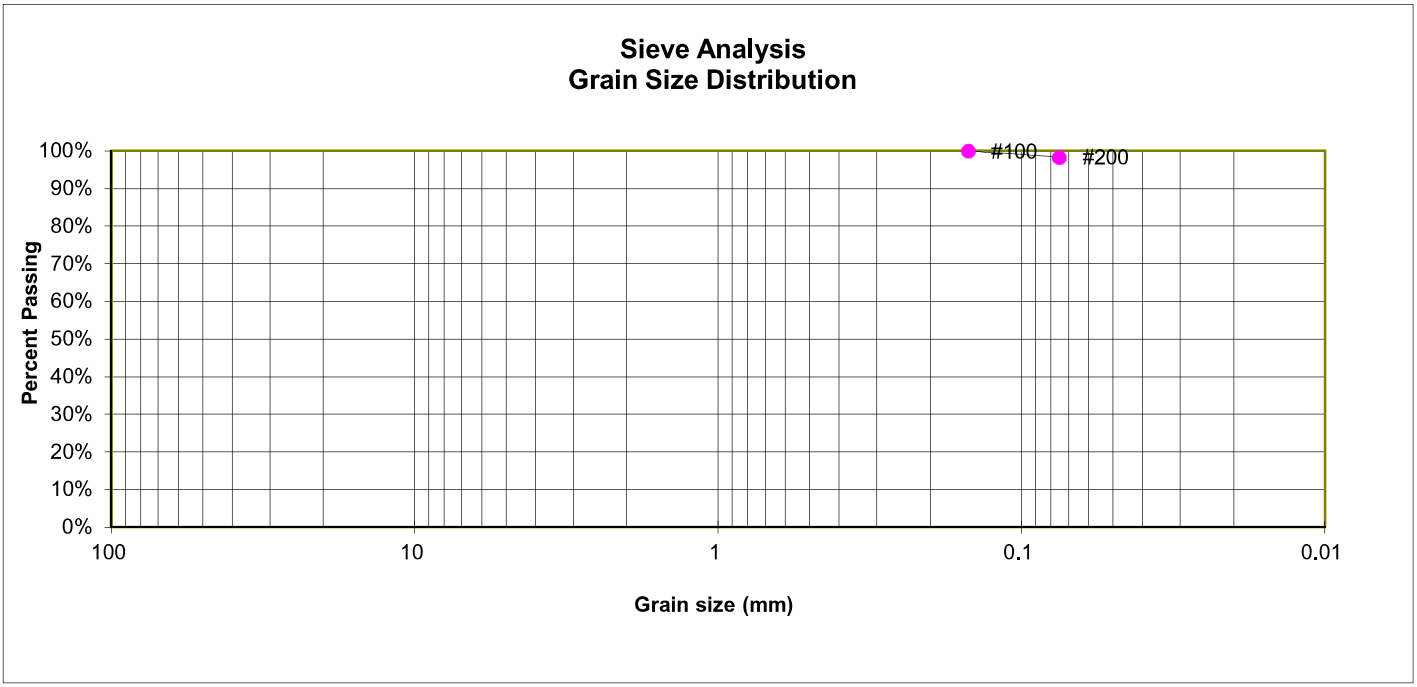
LABORATORY TEST RESULTS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO. 221101

FIG. C-7

TEST BORING	7	SOIL DESCRIPTION	SHALE (CLAY, SLIGHTLY SANDY)
DEPTH (FT)	15	SOIL TYPE	2



GRAIN SIZE ANALYSIS

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

SOIL CLASSIFICATION

USCS CLASSIFICATION: CL

ENTECH ENGINEERING, INC.

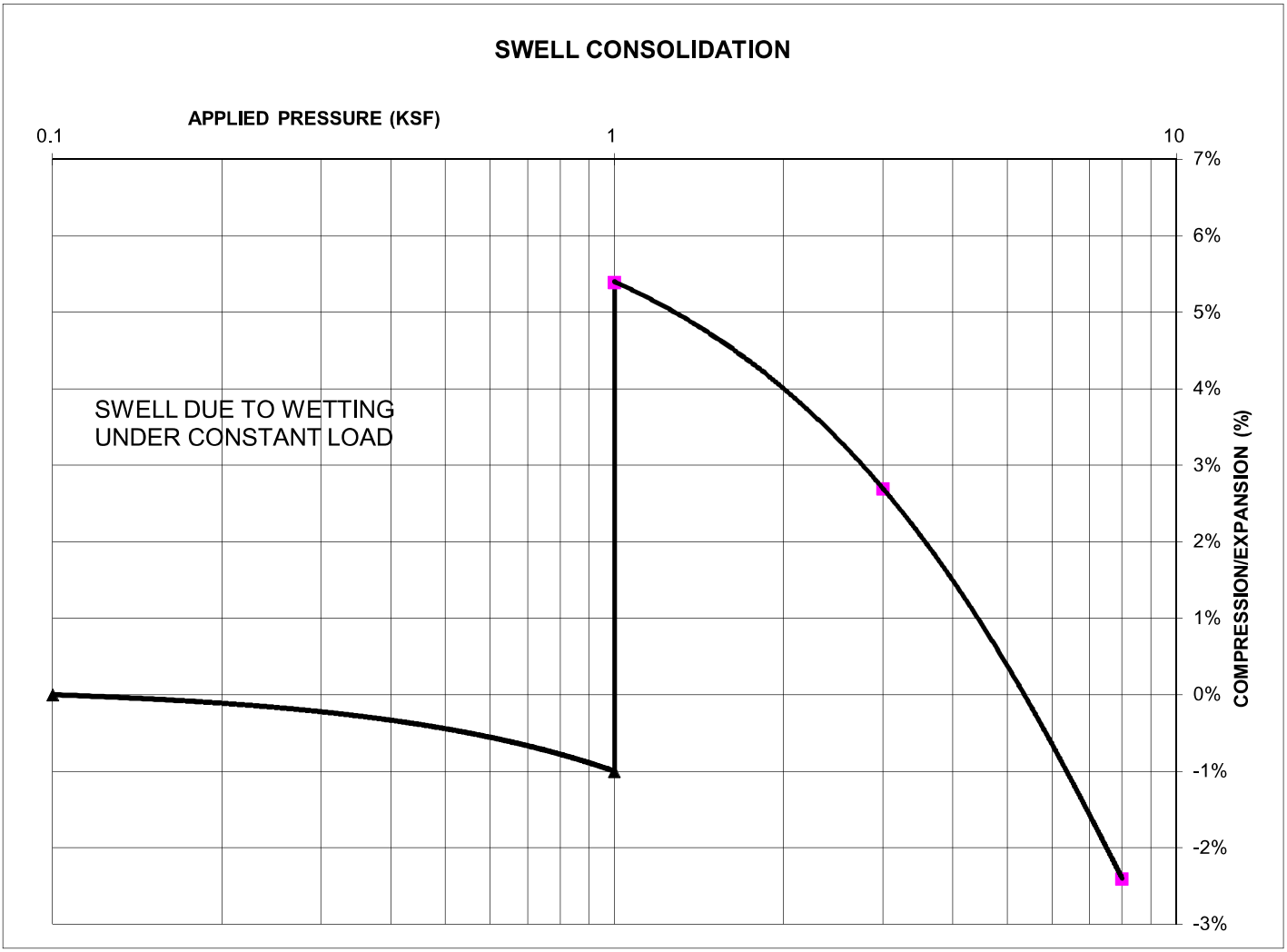
LABORATORY TEST RESULTS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO. 221101

FIG. C-8

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



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF): 102
NATURAL MOISTURE CONTENT: 14.5%
SWELL/COLLAPSE (%): 6.4%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO.
221101

FIG. C-9

TEST BORING	4	SOIL DESCRIPTION	CLAY, SANDY
DEPTH (FT)	5	SOIL TYPE	1

SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF): 112
NATURAL MOISTURE CONTENT: 12.6%
SWELL/COLLAPSE (%): 5.4%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO.
221101

FIG. C-10

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

SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF): 114
NATURAL MOISTURE CONTENT: 14.8%
SWELL/COLLAPSE (%): 4.4%

ENTECH ENGINEERING, INC.

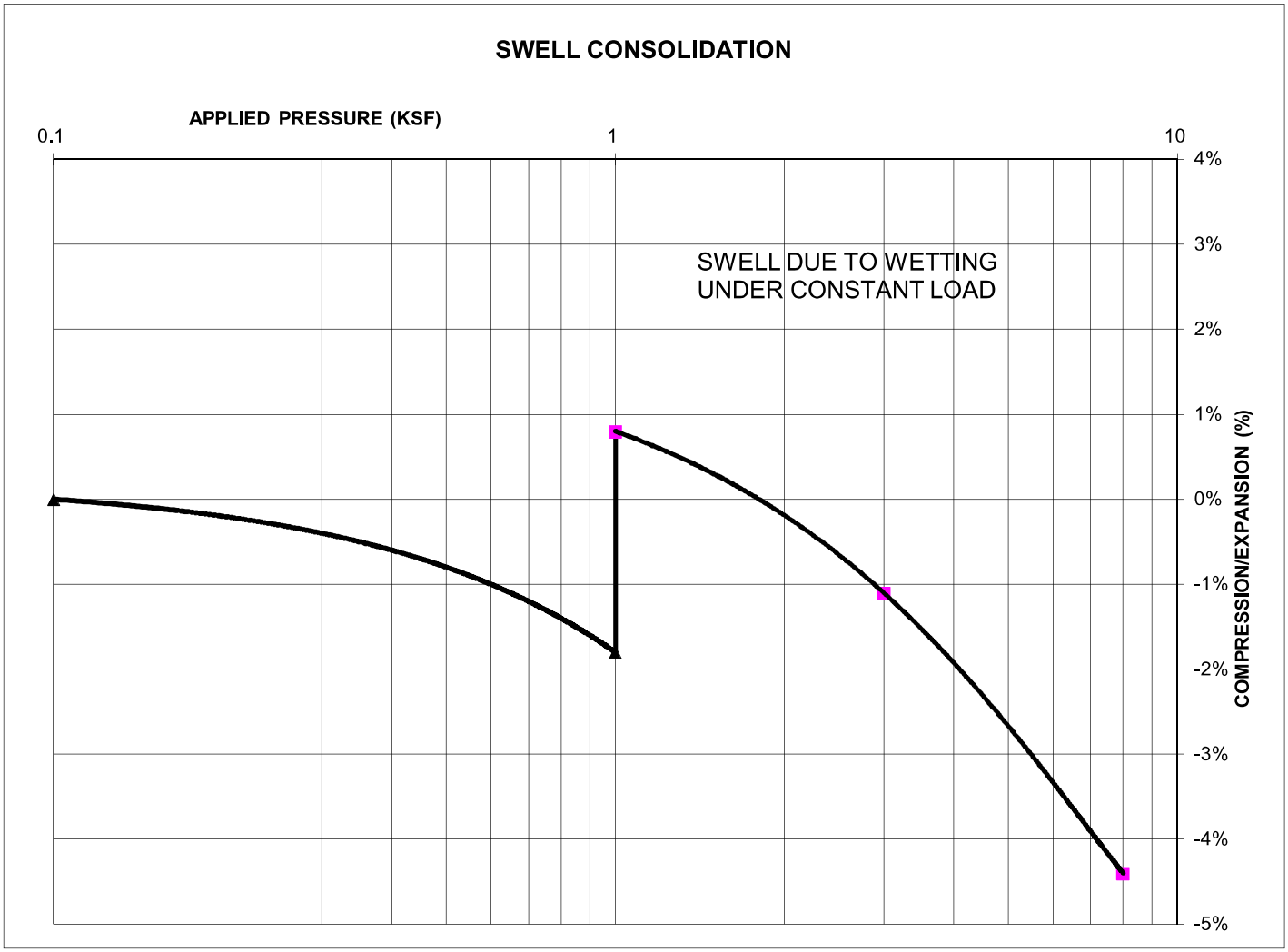
SWELL TEST RESULTS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO. 221101

FIG. C-11

TEST BORING	1	SOIL DESCRIPTION	CLAYSTONE, SANDY
DEPTH (FT)	20	SOIL TYPE	2



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF): 101
NATURAL MOISTURE CONTENT: 22.1%
SWELL/COLLAPSE (%): 2.6%

ENTECH ENGINEERING, INC.

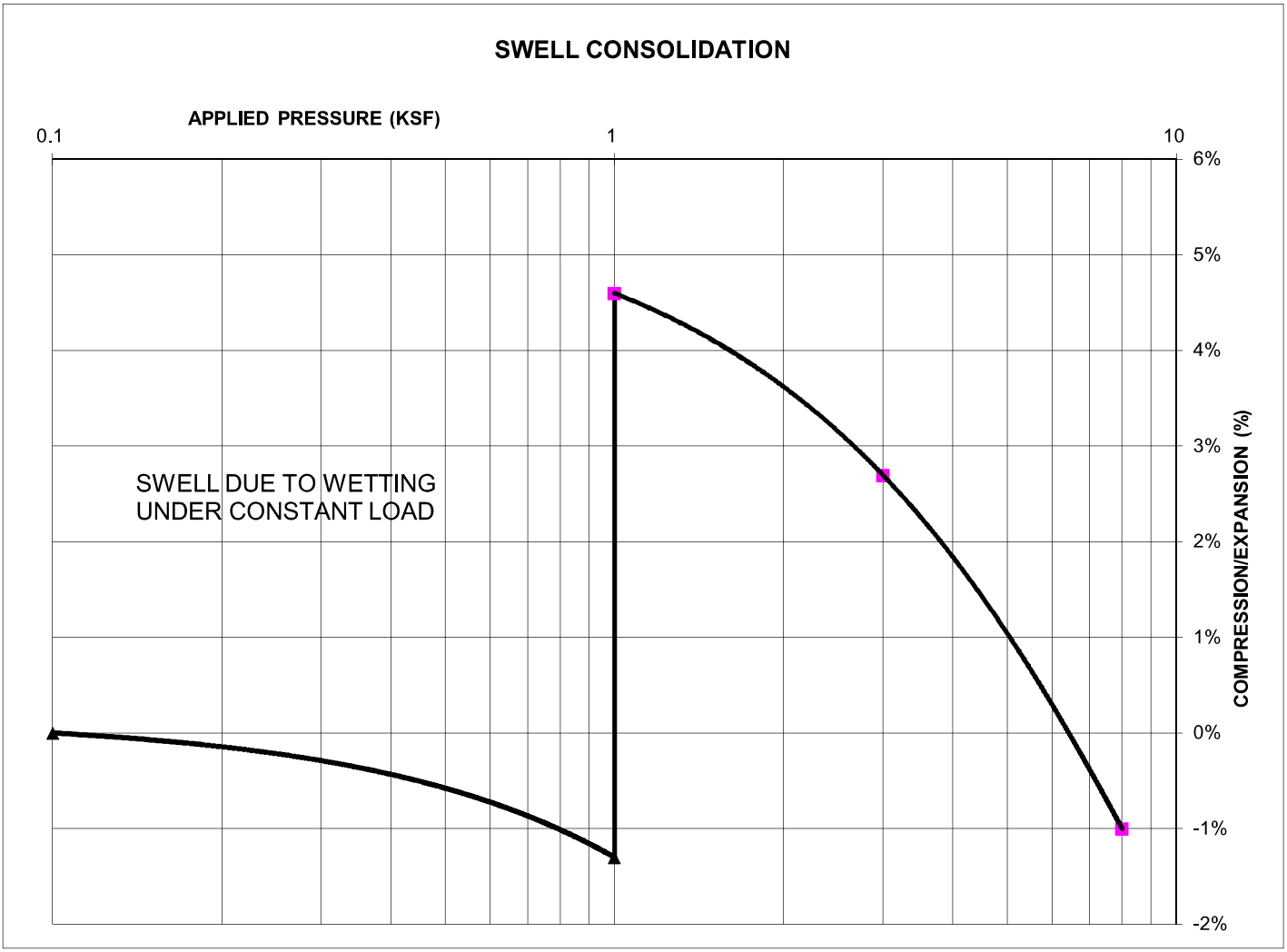
SWELL TEST RESULTS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO.
221101

FIG. C-12

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



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF): 108
NATURAL MOISTURE CONTENT: 16.1%
SWELL/COLLAPSE (%): 5.9%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO. 221101

FIG. C-13

TEST BORING	6	SOIL DESCRIPTION	CLAYSTONE (CLAY, SLIGHTLY SAND
DEPTH (FT)	10	SOIL TYPE	2

SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF): 102
NATURAL MOISTURE CONTENT: 14.5%
SWELL/COLLAPSE (%): 1.7%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

WEST UINTAH STREET AND 21ST STREET
RM3

JOB NO.
221101

FIG. C-14

ENTECH ENGINEERING, INC.

APPENDIX D: Colorado Geological Survey Review Letter, dated August 9, 2022, CGS Unique No. EP-0004

(This review was based on a previous development plan)

COLORADO GEOLOGICAL SURVEY

1801 Moly Road
Golden, Colorado 80401

Karen Berry
State Geologist

August 9, 2022

Caleb Jackson
Planning and Community Development
City of Colorado Springs
30 S. Nevada Ave, Suite 701
Colorado Springs, CO 80901

Location:
SE ¼ of NE ¼ of Section 11,
T14S, R67W of the 6th PM
38.8483°, -104.8531°

Subject: **Uintah Apartments ZC CP – Apartment Zone Change, Concept Plan;**
City of Colorado Springs, El Paso County, CO;
City File Nos. CPC ZC 22-00117, CP 22-00118; CGS Unique No. EP-23-0004

Dear Caleb:

The Colorado Geological Survey (CGS) has reviewed the referral. Documents submitted included: Request for review (City of Colorado Springs, 7.15.22, and 7.21.22), Application (7.21.22), Concept Plan (MVE, 5.13.22), and Geologic Hazard Investigation (Entech, 7.1.22). Additional materials referenced by Entech were also considered in this review. We understand that a platted parcel zone change is sought for a proposed multi-family residential development with 56 rental units within three (3) buildings, each 3-stories in height. A single lot will be replatted and the existing residences and other buildings removed. We visited the site on 8.7.22 and offer the following comments and recommendations.

CGS has no objection to the zone change. However, it is not clear from the submittal that the concept plan is feasible. For instance, the application states p. 1, *"...the existing topography will allow the buildings to be set into the existing slopes."* A series of retaining walls, two at 6 feet each, are shown on the concept plan and depicted on the slope stability cross sections provided by Entech. These drawings also show existing drilled piers beneath the adjacent Lofts at Mirrillion (project name at the time of their submittal). The potential impacts on the adjoining property in the areas of proposed retaining walls require identification, evaluation, and recommendations. This can and should be addressed preliminarily now at the concept plan level. No additional subsurface information is needed in this preliminary analysis.

CGS concurs with Entech p. 7 that additional investigation *"...will be required when development and grading plans are finalized."* And p. 8 that *"Significant mitigation measures will be required for this site.* However, it would be prudent for the city to require additional analysis to be conducted now, with the current information, to demonstrate the constructability of the concept plan. For instance, Entech states p. 5, "*Factors of safety were calculated using the Modified Bishop Method for Circular Failures."* They present factors of safety of 1.6 and 1.9 for proposed conditions with overexcavation, stiffened foundations, drilled piers and retaining walls. We cannot come to the same conclusion about the validity of the calculated safety factors as the consultant. For example, a complete slope stability analysis should include the calculation of safety factors for existing conditions, with both circular and block failure geometries, proposed cuts, proposed mitigation with walls, and demonstrated sensitivity to soil strength values. This will aid in determining the extent of the wall system and the potential impacts on the adjacent property. This analysis can be done with existing data and is necessary to lead others to the same conclusions assumed by the consultant about the overall slope stability and viability of the project plan.

Entech states that their slope stability analysis is p.5 *"with water sensitivity."* Their cross sections have a hypothetical horizontal groundwater level some depth below the site. This does not demonstrate sensitivity to the effects of groundwater. Groundwater in the hills along "The Mesa" in Colorado Springs, where this site occurs, will

follow fractures and gravel or sand lenses in the overlying colluvium and, after heavy precipitation events, will "perch" along the bedrock interface. The bedrock surface may be horizontal where it is overlain by alluvium (not the case here). It is more typical that this interface is sloping. The Pierre Shale and overlying material derived from the bedrock, such as colluvium and landslides, continually weaken because of weathering brought on by water and air. Water sensitivity includes variation in soil strength from weathering due to water. The site materials will weaken with time and evaluating "sensitivity" to moisture requires lowering the soil strength and depicting a realistic groundwater table.

Additional evidence that soil strengths are not static for each given material type is provided in Entech's report. Entech's boring (TH-1) encountered 19 feet of clay with a weathered zone at about 14 feet. This indicates landslide material. Colluvium derived from Pierre Shale is not 19 feet thick in this region without the added influence of landslides and the boring log's description of a weathered zone accompanied by lower blow counts in this material also indicates landslide material. Past buried landslides exist at this site, and residual (weaker) soil strengths will be present.

The concept plan requires cuts into the natural slope adjacent to an existing building. The cuts are in an area underlain by the Pierre Shale, bedrock known for its stability problems, particularly when cut into as planned here**. CGS recommends that the concept plan not be approved until the mitigation design for the cut slopes is validated by a complete but preliminary analysis** as outlined in this letter. For instance, Entech states, p.5, *"Strength values for the materials on this site can vary widely."*

- Strength values have not been varied in the analysis. The analysis of existing conditions, the proposed cuts, and the portrayal of mitigation (walls) should include variations of strength values. This will demonstrate the reliability of the calculated safety factors when choosing the wall design.
- Sensitivity to the effects of groundwater requires lowered strength values in areas that can become saturated even over short periods (such as multi-day precipitation events). Groundwater in this area does not occur as a flat line and typically follows the topography of the slope and can perch within the slope.
- Rotational and block failures require evaluation as both are common with the Pierre Shale.
- Factors of safety for the existing conditions and planned cuts should be analyzed independently of planned mitigation.
- A preliminary evaluation and discussion of types of retaining walls required by site conditions should be provided by the consultant. This will aid in planning for the cost and constructability of the project.
- Potential impacts on adjacent properties must be preliminarily evaluated and discussed.

Thank you for the opportunity to comment on this project. If you have questions or require further review, please email jlovekin@mines.edu.

Sincerely,

Jonathan R. Lovekin, P.G.
Senior Engineering Geologist

APPENDIX E: Slope Stability Analysis

TABLE E-1A

SUMMARY OF SLOPE STABILITY ANALYSIS

CLIENT RM3, Inc.
PROJECT Sun Mountain Townhomes
JOB NO. 221101

Figure #	Fdn Type	Analysis	Water Table	Claystone Cohesion	F.O.S.	Description
E-1 (A-A')	Exist.	Circular	High	500 psf	4.5	Existing site analyzed with circular failure surface. Existing Drilled piers at maximum spacing of 10 feet on center with depths of 20 feet. Nominal loads of 50psf for dead load of building at grade surface are provided for analysis. Elevated water table.
E-2 (A-A')	Exist.	Block	High	500 psf	5.2	Existing site analyzed with block failure surface. Existing Drilled piers at maximum spacing of 10 feet on center with depths of 20 feet. Nominal loads of 50psf for dead load of building at grade surface are provided for analysis. Elevated water table.
E-3 (A-A')	Overexcavation	Circular	Low	700 psf	3.0	Proposed site analyzed with circular failure surface. Existing Drilled piers at maximum spacing of 10 feet on center with depths of 20 feet. Nominal loads of 50psf for dead load of building at grade surface are provided for analysis. Overexcavation of proposed buildings.
E-4 (A-A')	Drilled Piers	Circular	Low	700 psf	3.0	Proposed site analyzed with circular failure surface. Existing Drilled piers at maximum spacing of 10 feet on center with depths of 20 feet. Nominal loads of 50psf for dead load of building at grade surface are provided for analysis. Drilled pier foundation for proposed buildings with minimum depth 25 feet.
E-5 (A-A')	Overexcavation	Block	Low	700 psf	2.5	Proposed site analyzed with block failure surface. Existing Drilled piers at maximum spacing of 10 feet on center with depths of 20 feet. Nominal loads of 50psf for dead load of building at grade surface are provided for analysis. Overexcavation of proposed buildings.
E-6 (A-A')	Drilled Piers	Block	Low	700 psf	2.5	Proposed site analyzed with block failure surface. Existing Drilled piers at maximum spacing of 10 feet on center with depths of 20 feet. Nominal loads of 50psf for dead load of building at grade surface are provided for analysis. Drilled pier foundation for proposed buildings with minimum depth 25 feet.
E-7 (A-A')	Overexcavation	Circular	High	500 psf	2.3	Proposed site analyzed with circular failure surface. Existing Drilled piers at maximum spacing of 10 feet on center with depths of 20 feet. Nominal loads of 50psf for dead load of building at grade surface are provided for analysis. Overexcavation of proposed buildings. Elevated water table.
E-8 (A-A')	Drilled Piers	Circular	High	500 psf	2.3	Proposed site analyzed with circular failure surface. Existing Drilled piers at maximum spacing of 10 feet on center with depths of 20 feet. Nominal loads of 50psf for dead load of building at grade surface are provided for analysis. Drilled pier foundation for proposed buildings with minimum depth 25 feet. Elevated water table
E-9 (A-A')	Overexcavation	Block	High	500 psf	2.0	Proposed site analyzed with block failure surface. Existing Drilled piers at maximum spacing of 10 feet on center with depths of 20 feet. Nominal loads of 50psf for dead load of building at grade surface are provided for analysis. Overexcavation of proposed buildings. Elevated water table.
E-10 (A-A')	Drilled Piers	Block	High	500 psf	2.0	Proposed site analyzed with block failure surface. Existing Drilled piers at maximum spacing of 10 feet on center with depths of 20 feet. Nominal loads of 50psf for dead load of building at grade surface are provided for analysis. Drilled pier foundation for proposed buildings with minimum depth 25 feet. Elevated water table.

Note: Slope stability analysis was conducted utilizing the GSTABL7 (2-dimensional, limit equilibrium program) w/ Stedwin user interface. Soil descriptions shown on the cross-sections correlate to soil labels (in black/green for surface boundary lines) below soil boundary lines. Soil boundary lines are labeled above the line (in red). Piezometric surfaces associated with soil types are labeled upgradient of the associated surface. Additional information on the analysis may be found in the GStabl7 with Stedwin program manual.

TABLE E-1B

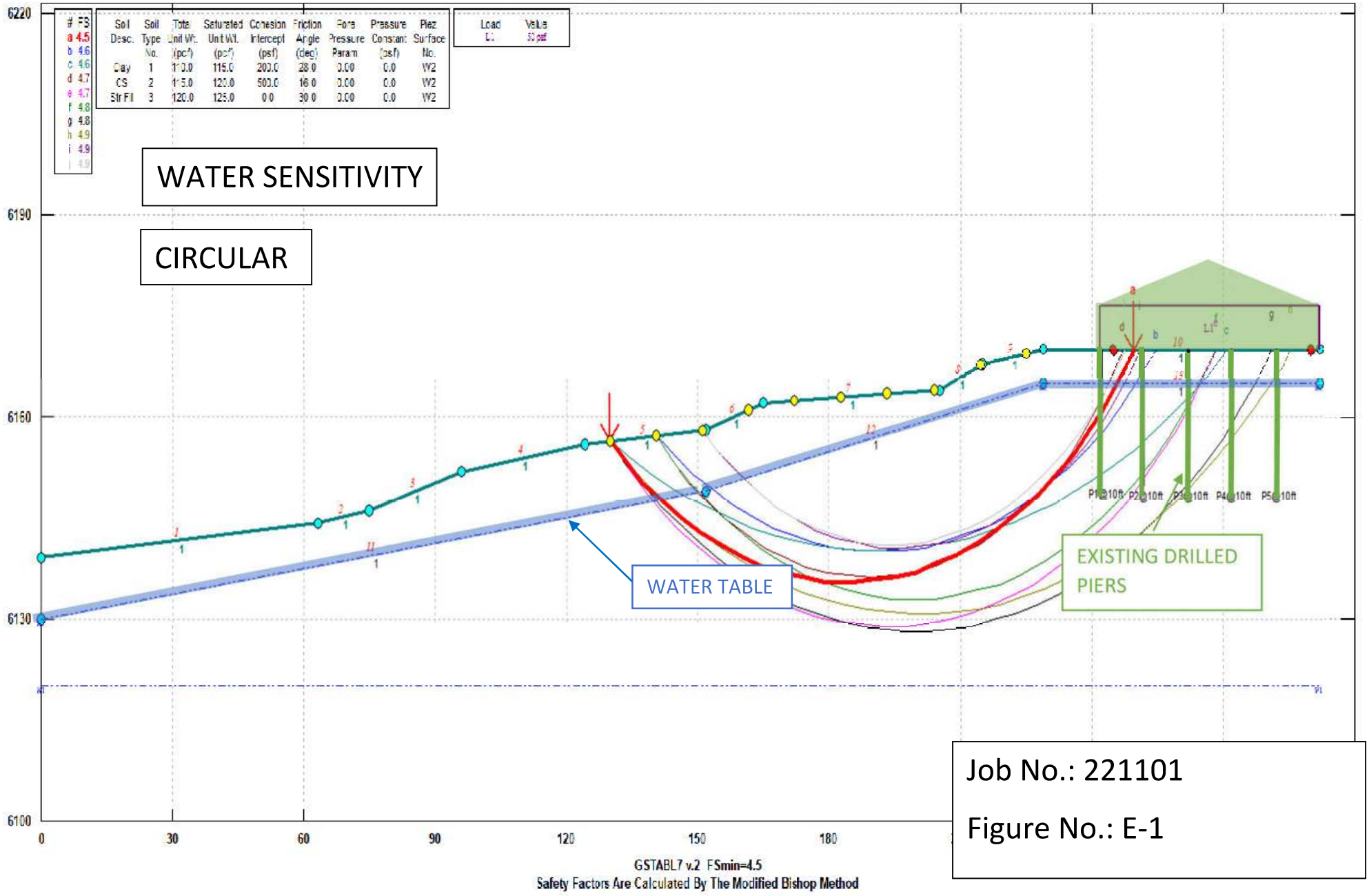
SUMMARY OF SLOPE STABILITY ANALYSIS

CLIENT RM3, Inc.
PROJECT Sun Mountain Townhomes
JOB NO. 221101

Figure #	Fdn Type	Analysis	Water Table	Claystone Cohesion	F.O.S.	Description
E-11 (B-B')	Exist.	Circular	High	500 psf	4.7	Existing site analyzed with circular failure surface. Existing Drilled piers at maximum spacing of 10 feet on center with depths of 20 feet. Nominal loads of 50psf for dead load of building at grade surface are provided for analysis. Elevated water table.
E-12 (B-B')	Overexcavation	Circular	High	500 psf	2.3	Proposed site analyzed with circular failure surface. Existing Drilled piers at maximum spacing of 10 feet on center with depths of 20 feet. Nominal loads of 50psf for dead load of building at grade surface are provided for analysis. Overexcavation of proposed buildings. Elevated water table.
E-13 (B-B')	Drilled Piers	Circular	High	500 psf	2.7	Proposed site analyzed with circular failure surface. Existing Drilled piers at maximum spacing of 10 feet on center with depths of 20 feet. Nominal loads of 50psf for dead load of building at grade surface are provided for analysis. Drilled pier foundation for proposed buildings with minimum depth 25 feet. Elevated water table

Note: Slope stability analysis was conducted utilizing the GSTABL7 (2-dimensional, limit equilibrium program) w/ Stedwin user interface. Soil descriptions shown on the cross-sections correlate to soil labels (in black/green for surface boundary lines) below soil boundary lines. Soil boundary lines are labeled above the line (in red). Piezometric surfaces associated with soil types are labeled upgradient of the associated surface. Additional information on the analysis may be found in the GStabl7 with Stedwin program manual.

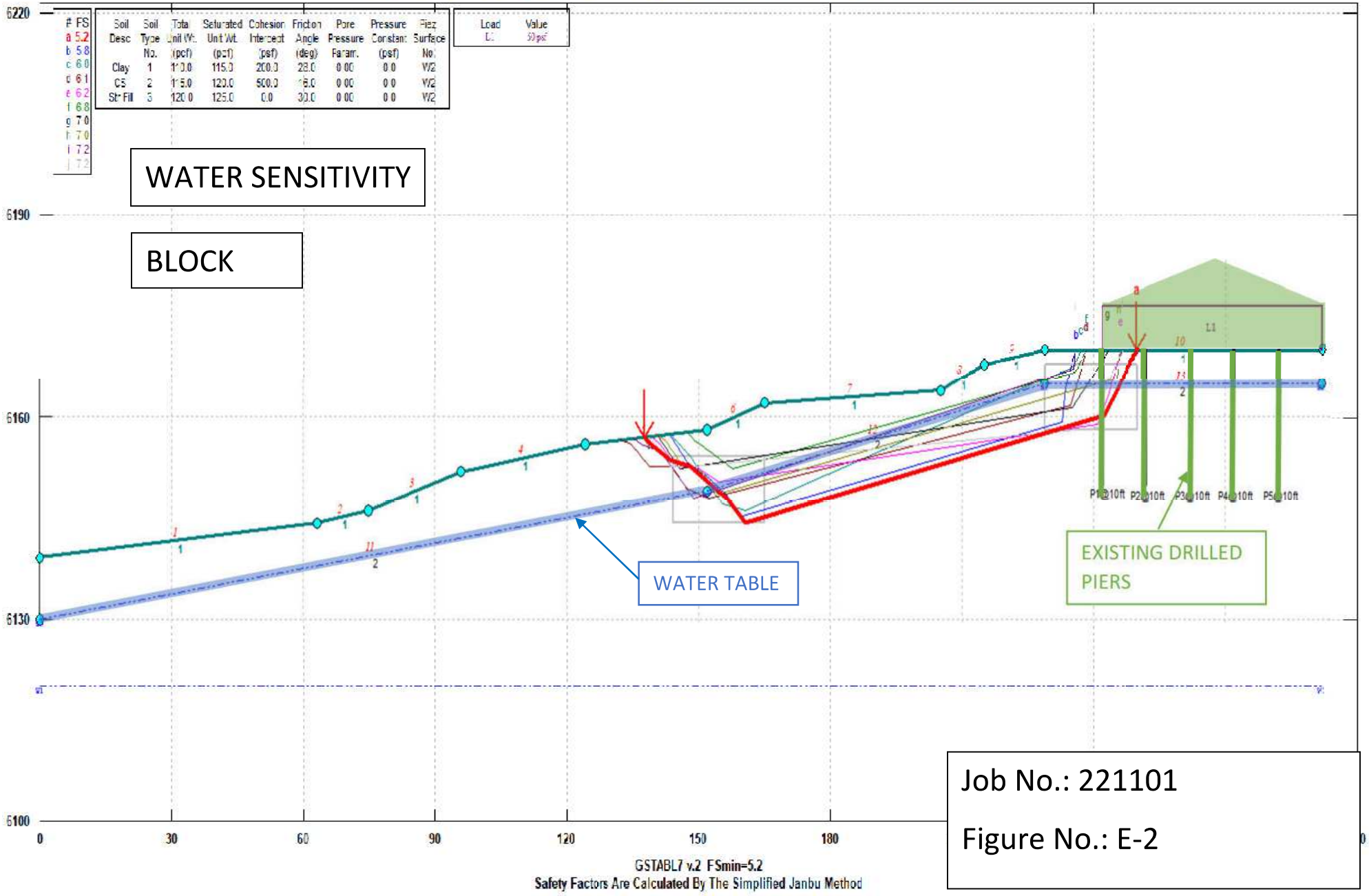
RM3 – SUN MOUNTAIN TOWNHOMES– A-A - EXISTING



Job No.: 221101

Figure No.: E-1

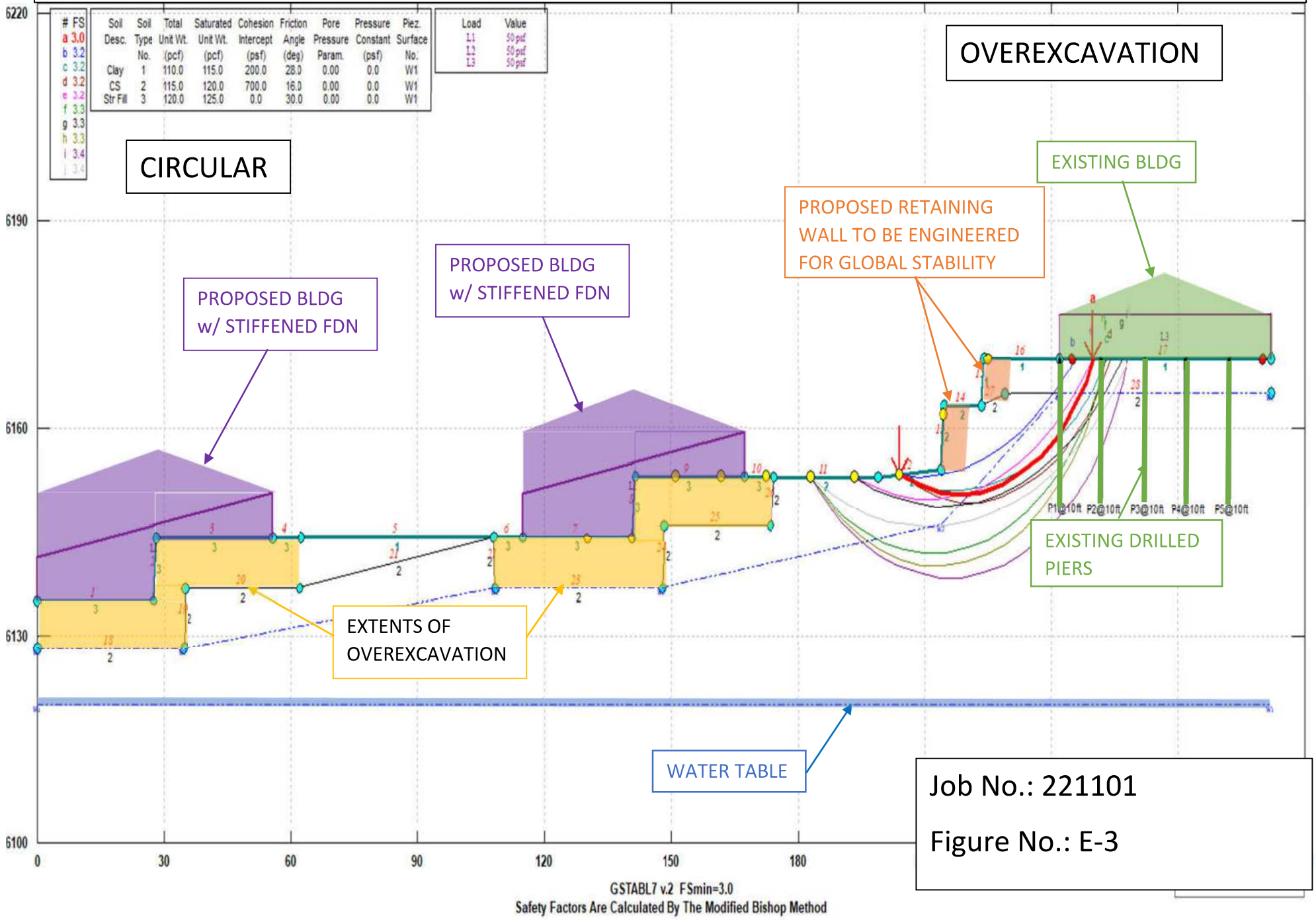
RM3 – SUN MOUNTAIN TOWNHOMES – A-A - EXISTING



Job No.: 221101

Figure No.: E-2

RM3 – SUN MOUNTAIN TOWNHOMES – A-A - PROPOSED



Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Clay	1	110.0	115.0	200.0	28.0	0.00	0.0	W1
CS	2	115.0	120.0	700.0	16.0	0.00	0.0	W1
Str Fill	3	120.0	125.0	0.0	30.0	0.00	0.0	W1

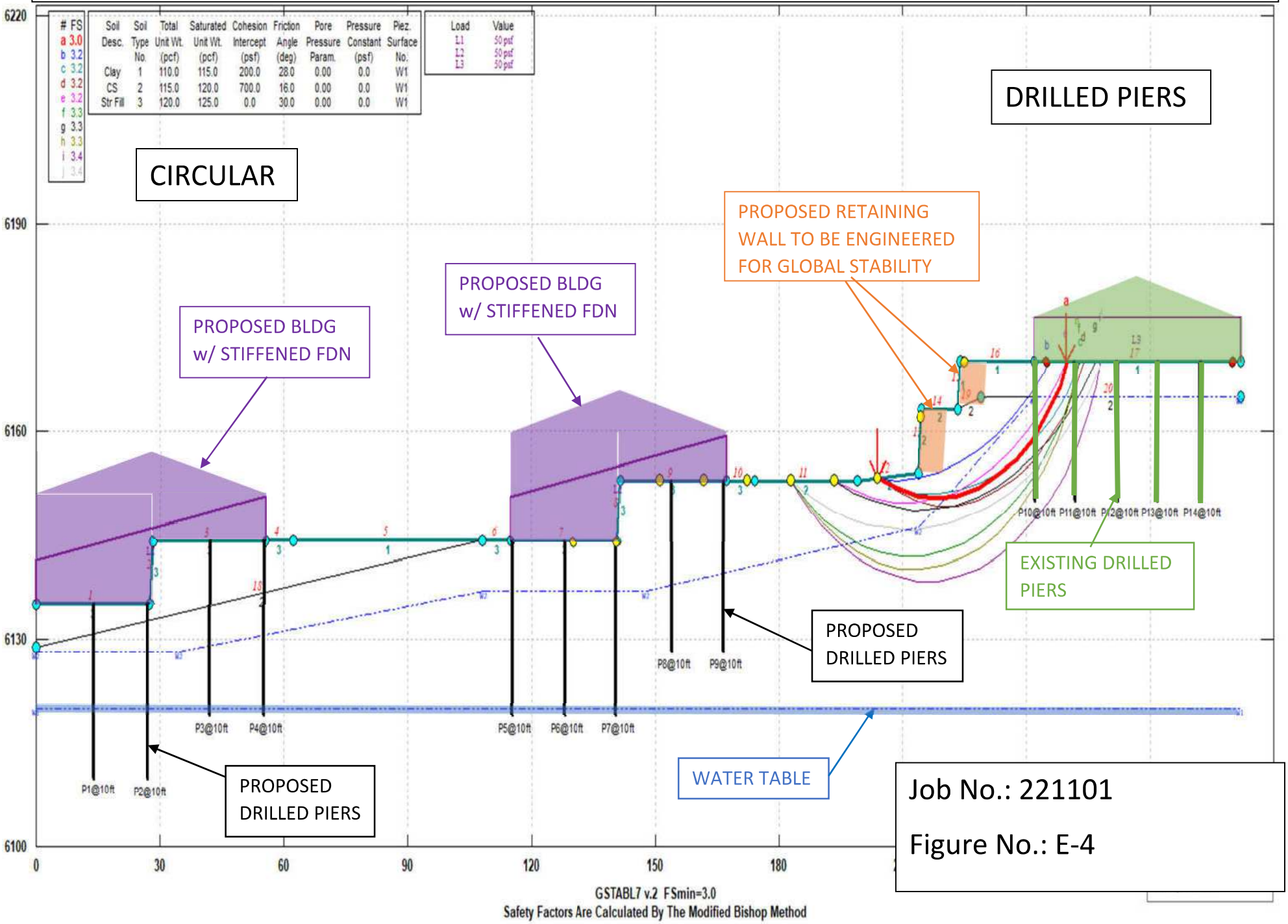
Load	Value
L1	50 psf
L2	50 psf
L3	50 psf

#	FS
a	3.0
b	3.2
c	3.2
d	3.2
e	3.2
f	3.3
g	3.3
h	3.3
i	3.4

Job No.: 221101

Figure No.: E-3

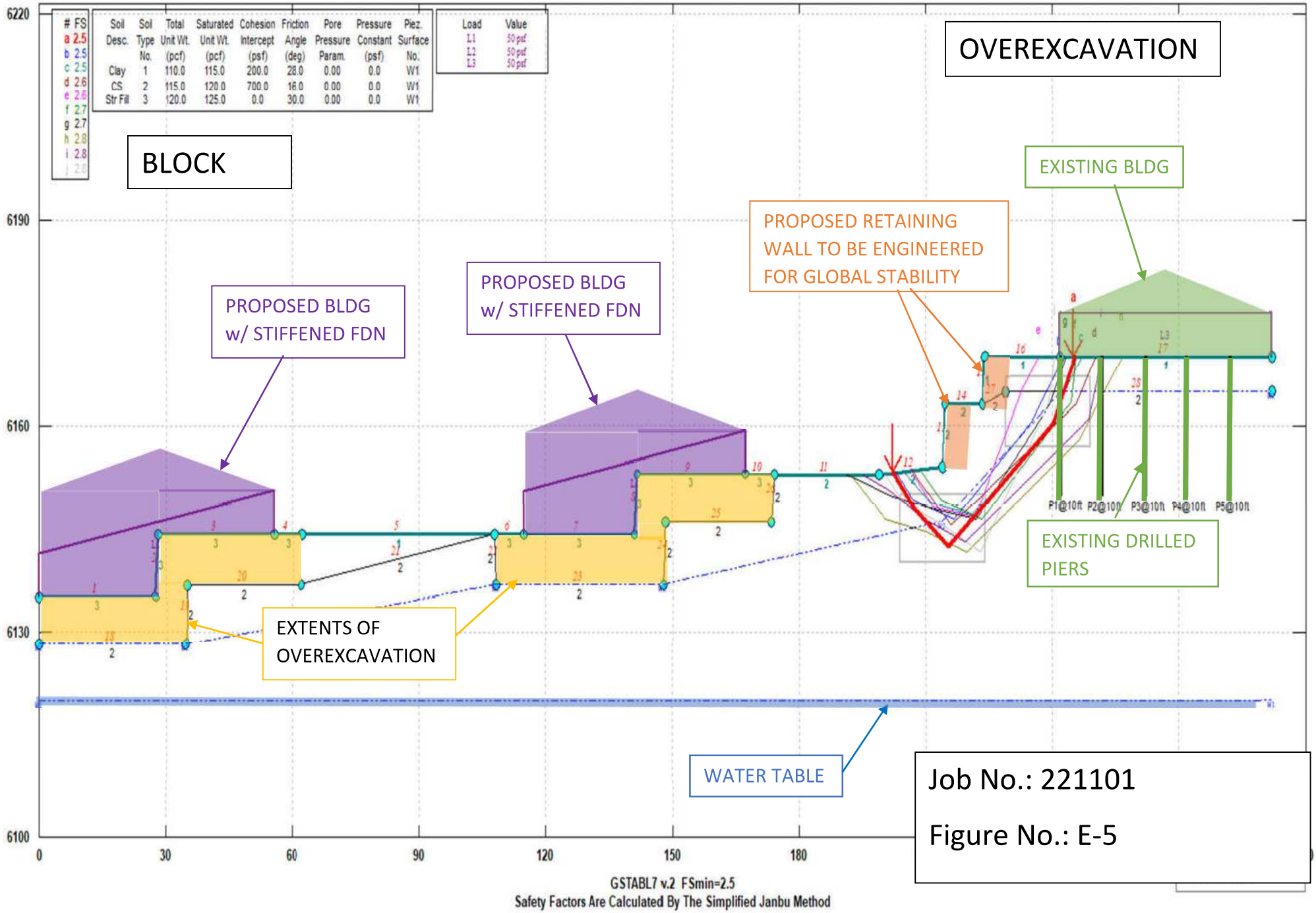
RM3 – SUN MOUNTAIN TOWNHOMES – A-A - PROPOSED



Job No.: 221101

Figure No.: E-4

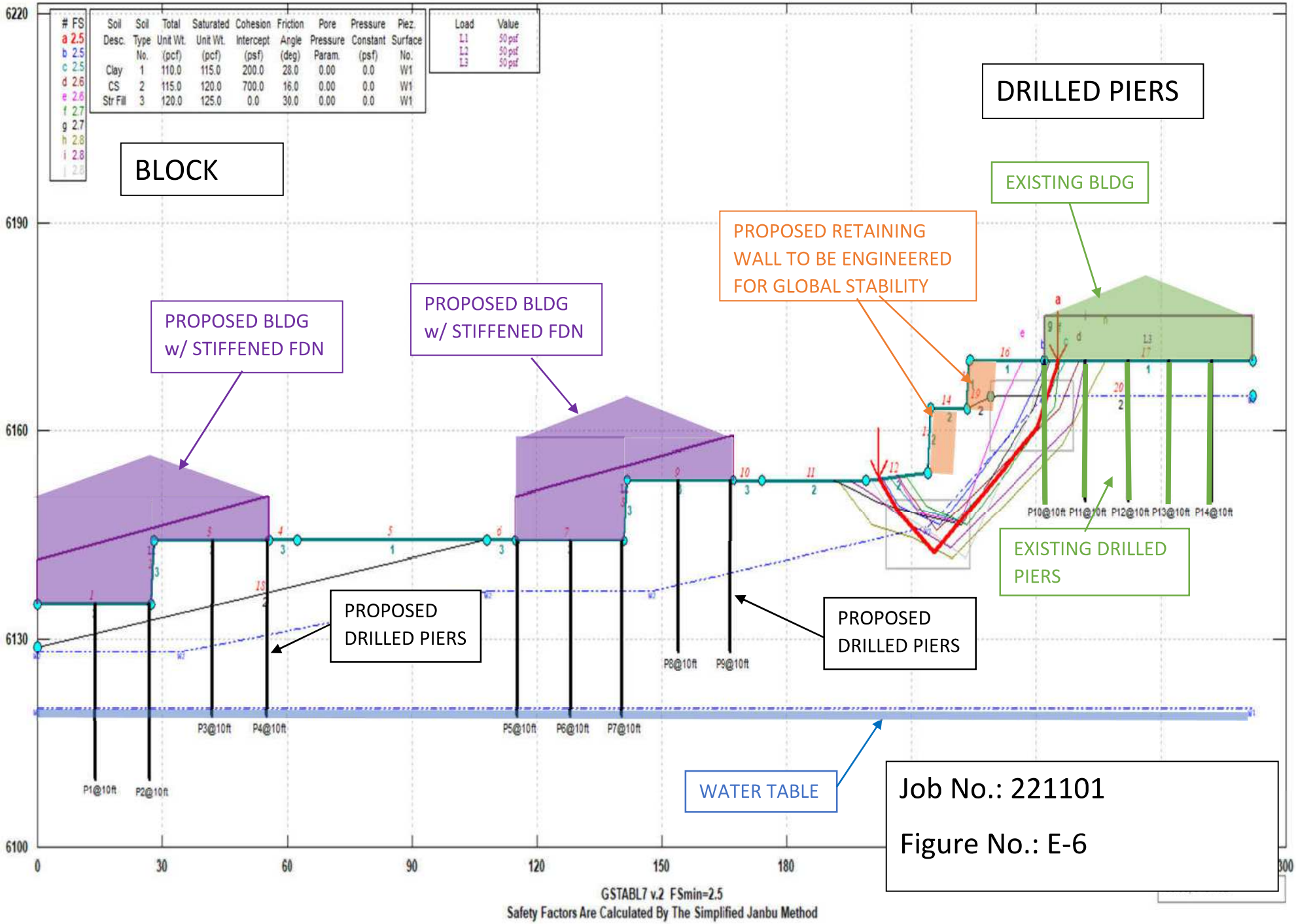
RM3 – SUN MOUNTAIN TOWNHOMES – A-A - PROPOSED



Job No.: 221101

Figure No.: E-5

RM3 – SUN MOUNTAIN TOWNHOMES – A-A - PROPOSED



Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Clay	1	110.0	115.0	200.0	28.0	0.00	0.0	W1
CS	2	115.0	120.0	700.0	16.0	0.00	0.0	W1
Str Fill	3	120.0	125.0	0.0	30.0	0.00	0.0	W1

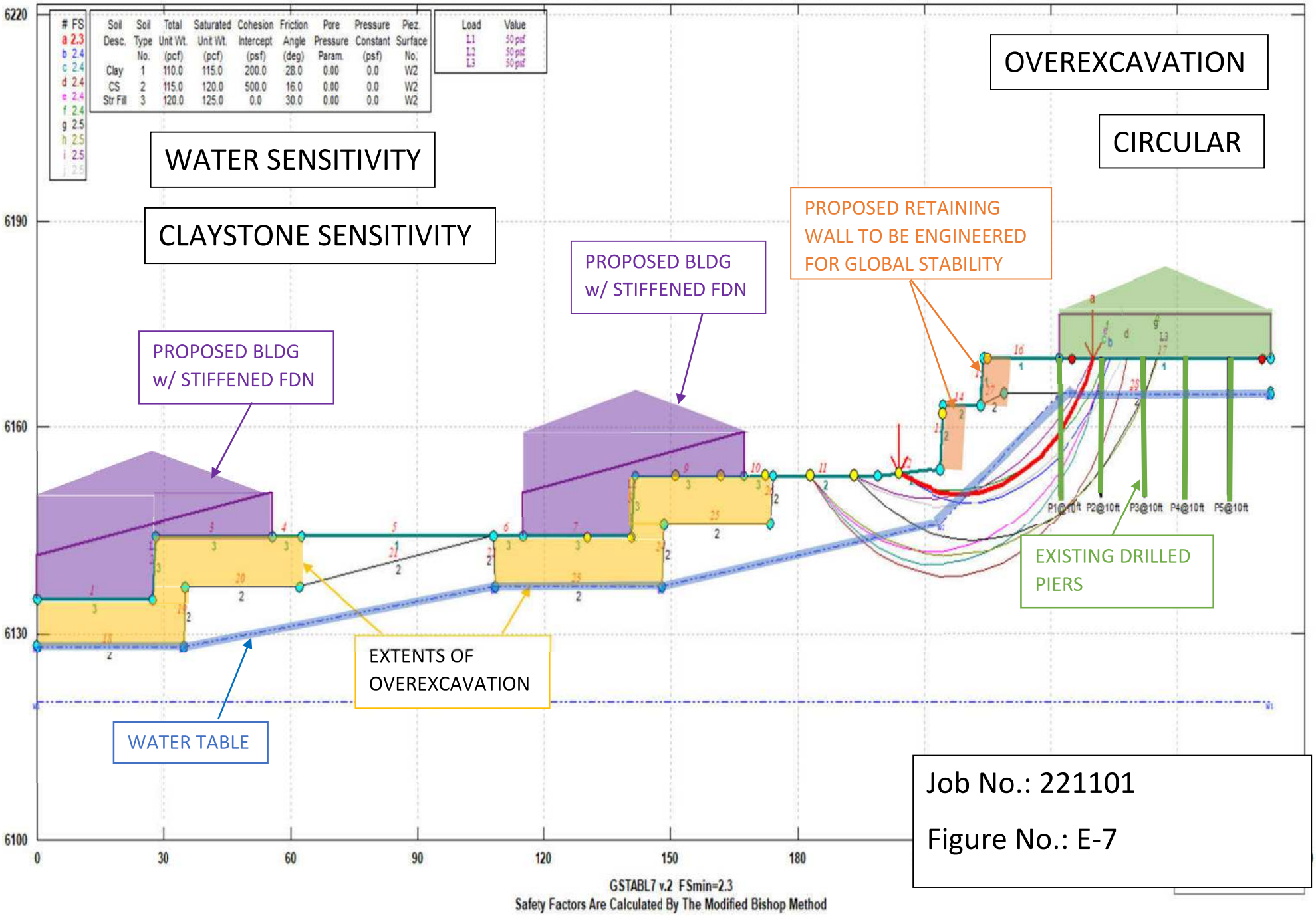
Load	Value
L1	50 psf
L2	50 psf
L3	50 psf

#	FS
a	2.5
b	2.5
c	2.5
d	2.6
e	2.6
f	2.7
g	2.7
h	2.8
i	2.8
j	2.8

Job No.: 221101

Figure No.: E-6

RM3 – SUN MOUNTAIN TOWNHOMES – A-A - PROPOSED



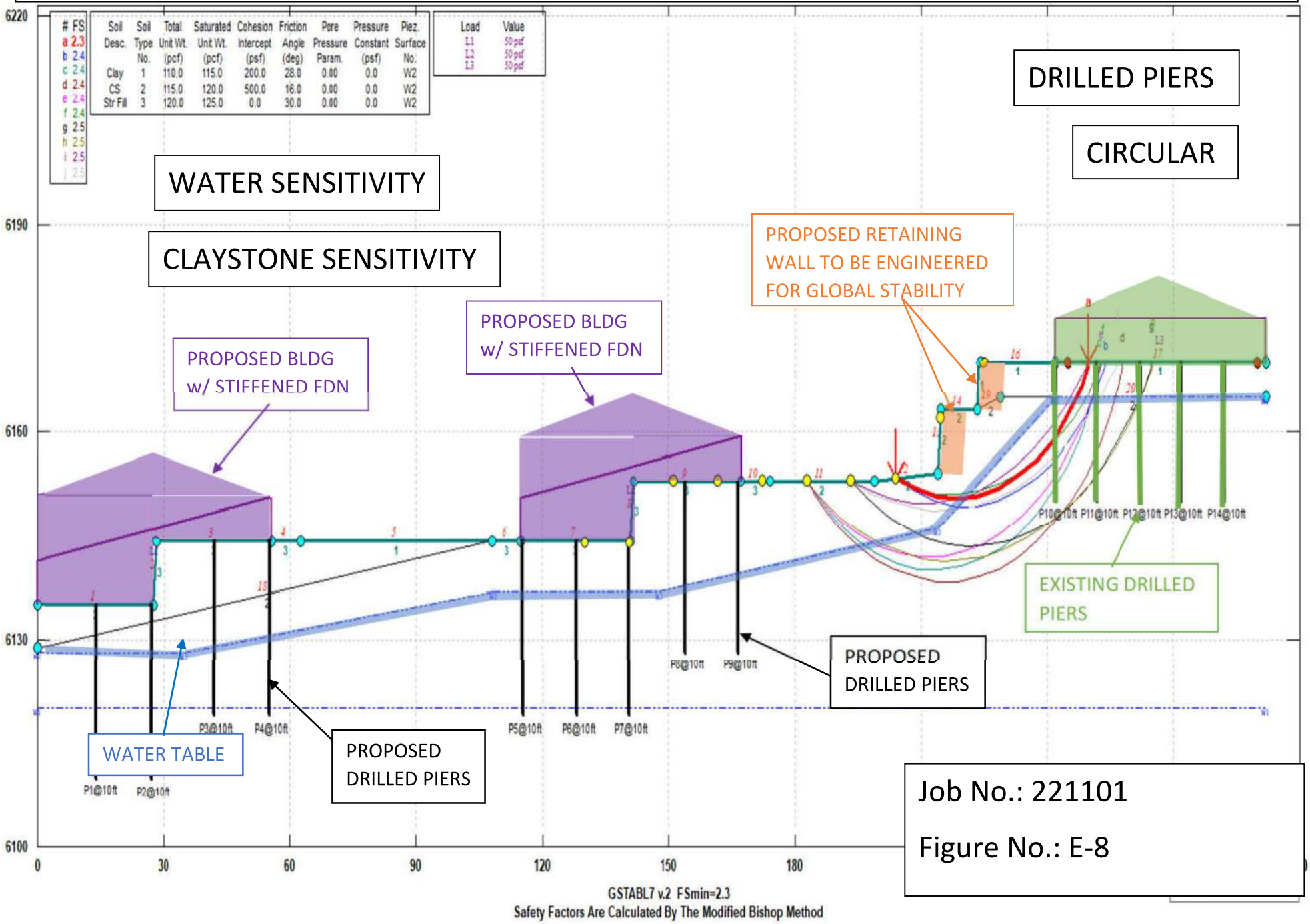
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Clay	1	110.0	115.0	200.0	28.0	0.00	0.0	W2
CS	2	115.0	120.0	500.0	16.0	0.00	0.0	W2
Str Fill	3	120.0	125.0	0.0	30.0	0.00	0.0	W2

Load	Value
L1	50 psf
L2	50 psf
L3	50 psf

Job No.: 221101

Figure No.: E-7

RM3 – SUN MOUNTAIN TOWNHOMES – A-A - PROPOSED



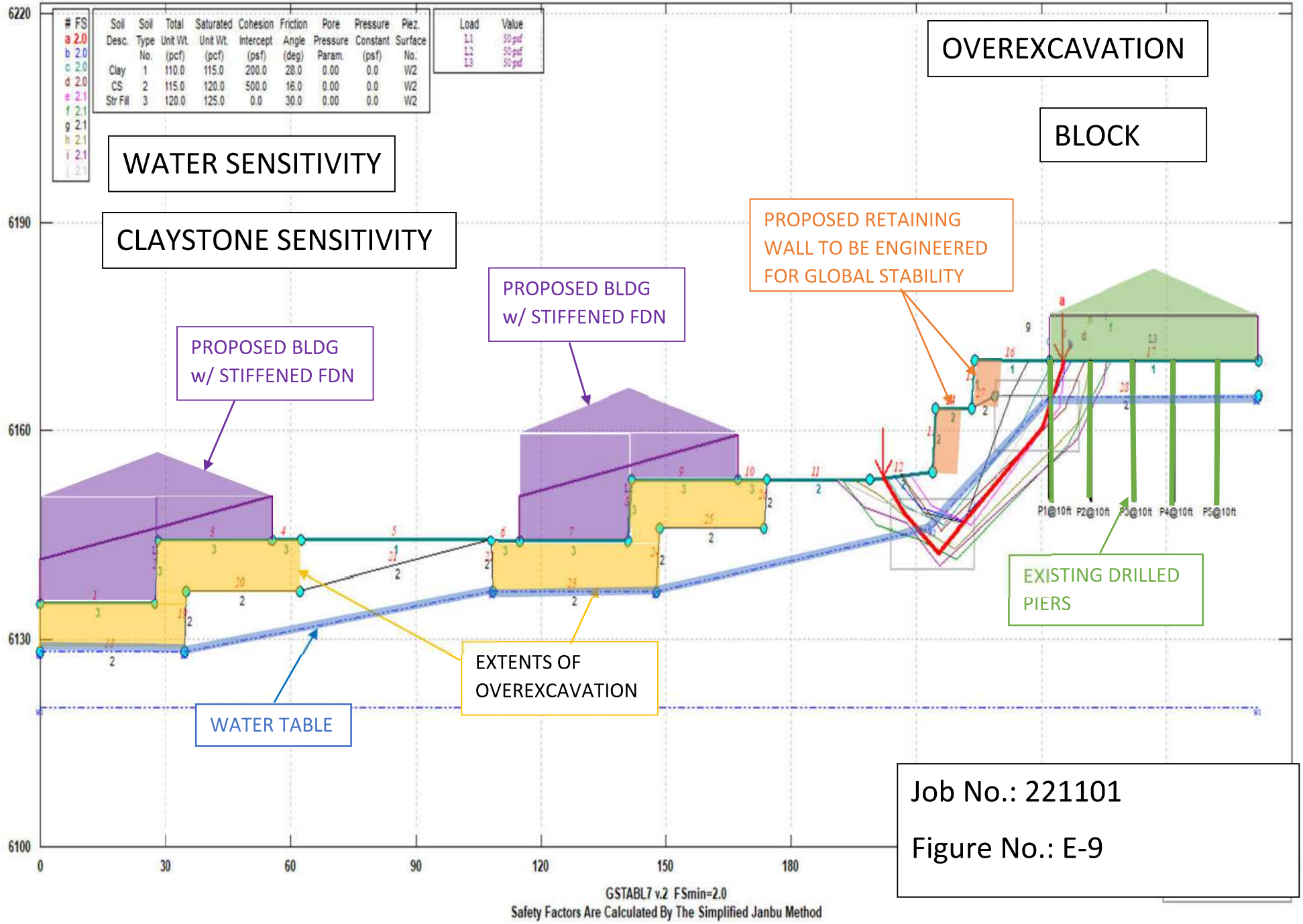
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Clay	1	110.0	115.0	200.0	28.0	0.00	0.0	W2
CS	2	115.0	120.0	500.0	16.0	0.00	0.0	W2
Str Fill	3	120.0	125.0	0.0	30.0	0.00	0.0	W2

Load	Value
L1	50 psf
L2	50 psf
L3	50 psf

Job No.: 221101

Figure No.: E-8

RM3 – SUN MOUNTAIN TOWNHOMES – A-A - PROPOSED



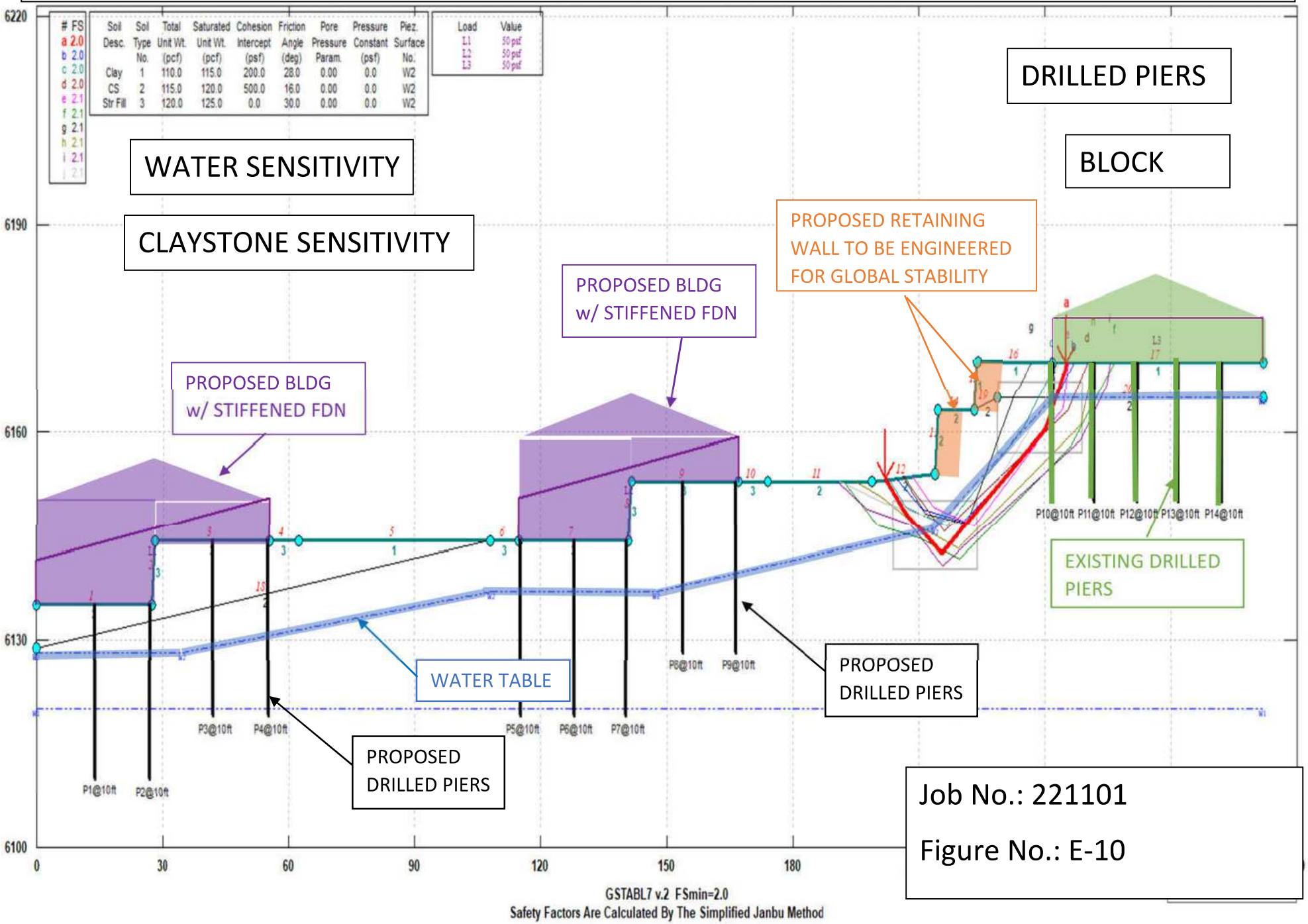
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Clay	1	110.0	115.0	200.0	28.0	0.00	0.0	W2
CS	2	115.0	120.0	500.0	16.0	0.00	0.0	W2
Str Fill	3	120.0	125.0	0.0	30.0	0.00	0.0	W2

Load	Value
L1	50 psf
L2	50 psf
L3	50 psf

Job No.: 221101

Figure No.: E-9

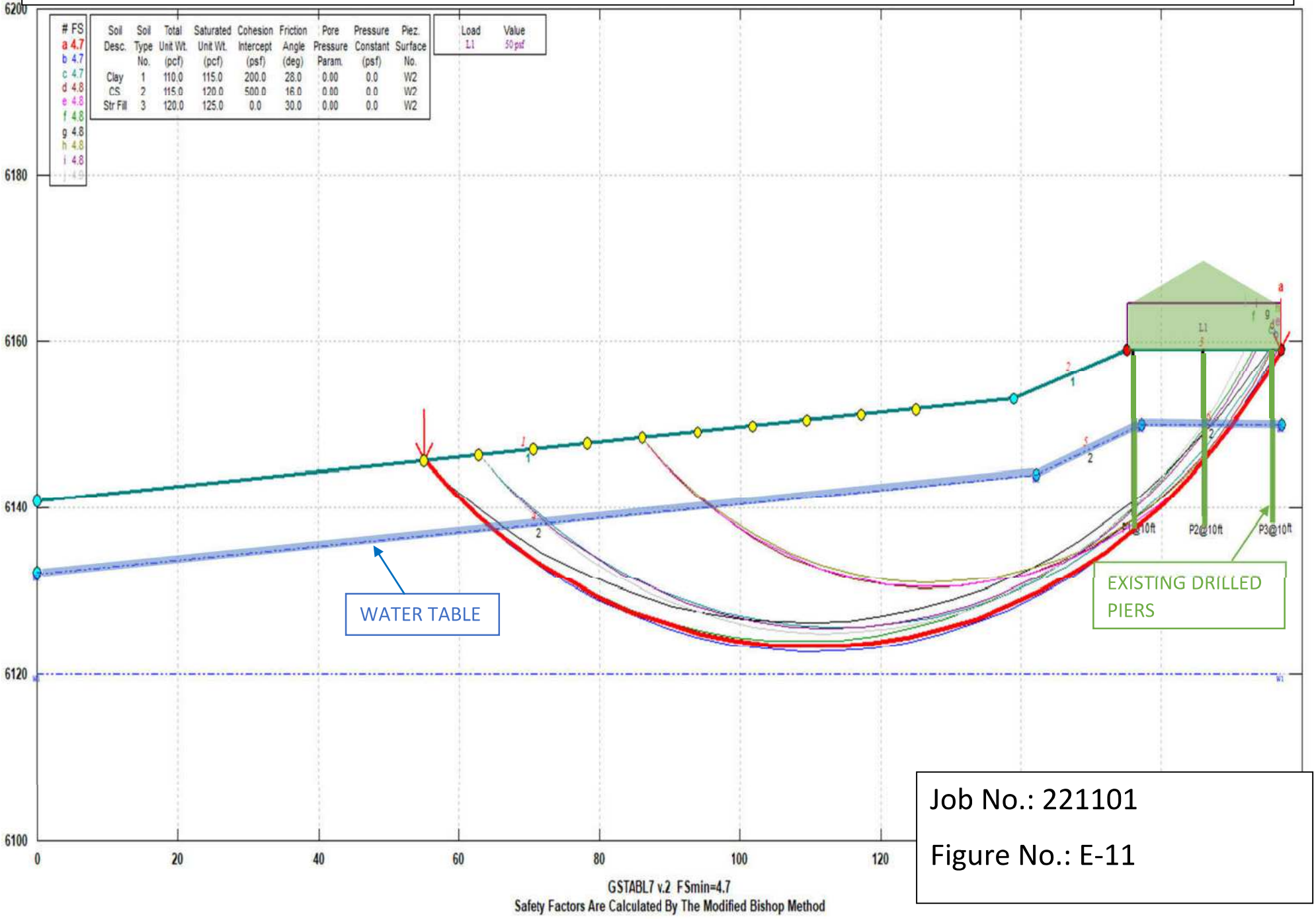
RM3 – SUN MOUNTAIN TOWNHOMES – A-A - PROPOSED



Job No.: 221101

Figure No.: E-10

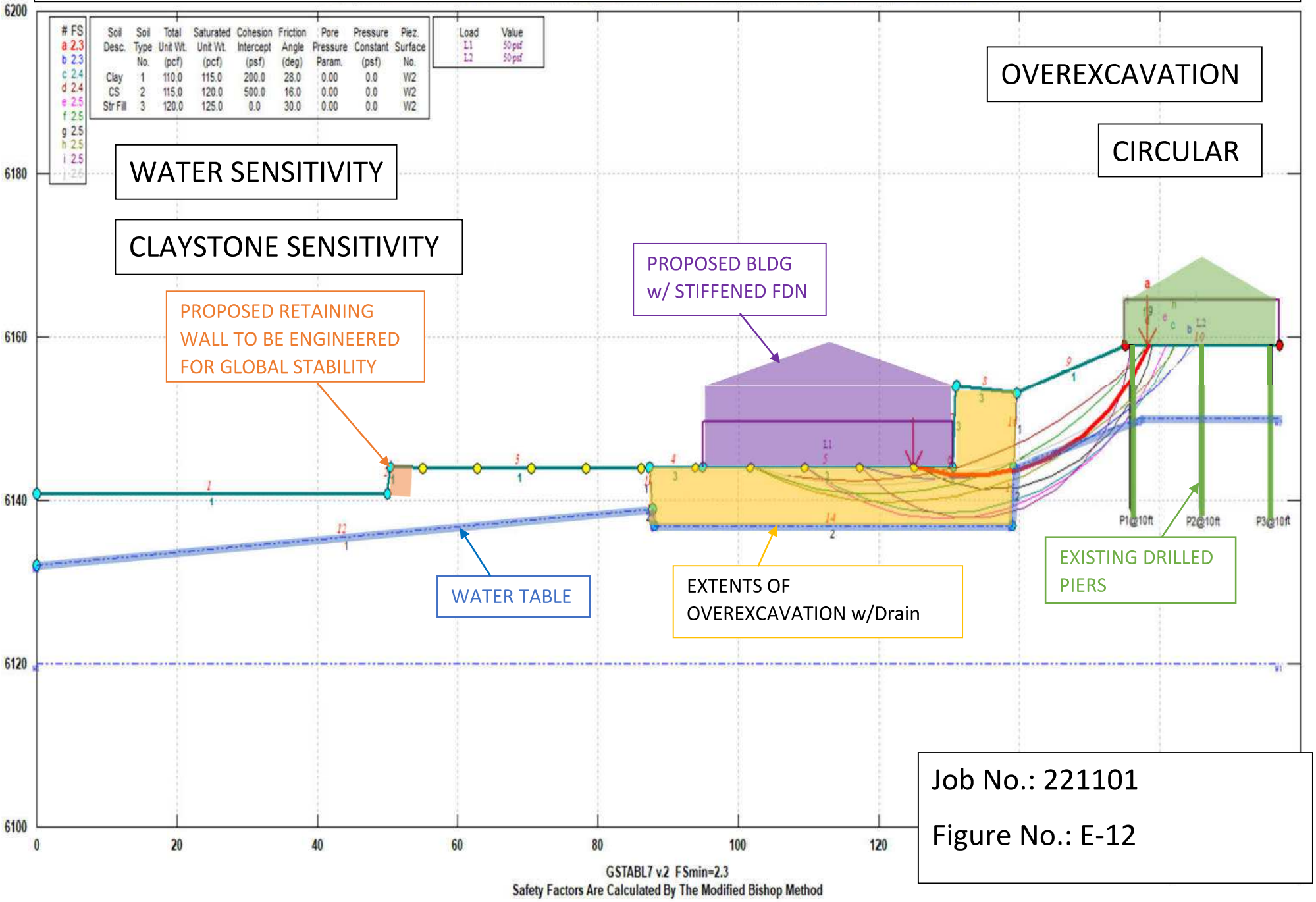
RM3 – SUN MOUNTAIN TOWNHOMES – B-B - EXISTING



Job No.: 221101

Figure No.: E-11

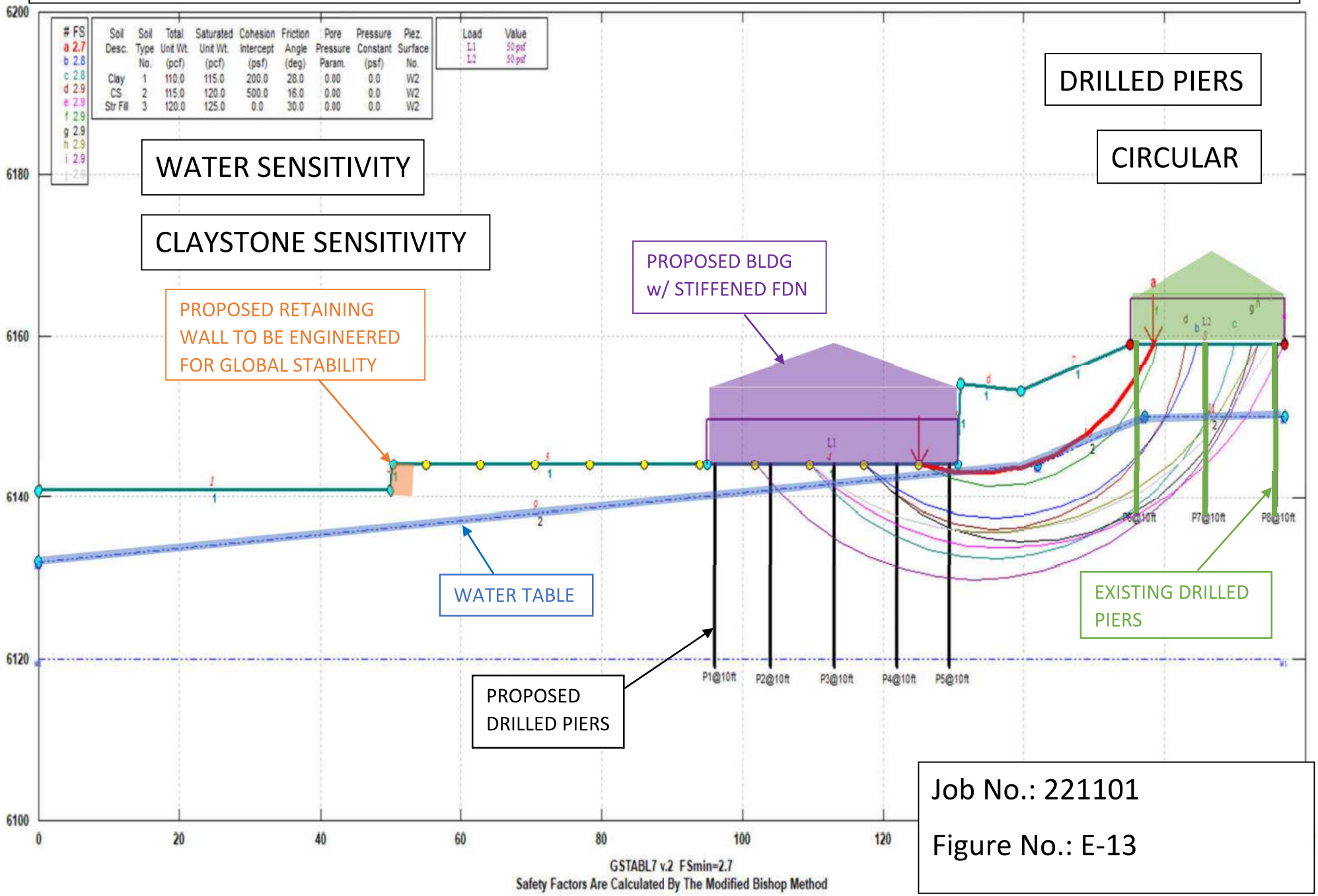
RM3 – SUN MOUNTAIN TOWNHOMES – B-B - PROPOSED



Job No.: 221101

Figure No.: E-12

RM3 – SUN MOUNTAIN TOWNHOMES – B-B - PROPOSED



Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Clay	1	110.0	115.0	200.0	28.0	0.00	0.0	W2
CS	2	115.0	120.0	500.0	16.0	0.00	0.0	W2
Str Fill	3	120.0	125.0	0.0	30.0	0.00	0.0	W2

Load	Value
L1	50 psf
L2	50 psf

Job No.: 221101

Figure No.: E-13

APPENDIX F: Entech Response to Colorado Geological Survey Review Letter, dated July 30, 2024, CGS Unique No. EP25-0003

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

September 4, 2024

RM3, Inc.
50 Polo Pony Drive
Colorado Springs, CO 80906

Attn: René Mondejar

Re: Colorado Geological Survey Review
Geologic Hazard Investigation
Parcel Nos. 74111-24-137 & 74111-04-206
Sun Mountain Townhomes
West Uintah Street and North 21st Street
Colorado Springs, Colorado
Entech Job No. 221101

Ref: Colorado Geological Survey Review, July 30, 2024, Sun Mountain Townhomes, Colorado Springs, El Paso County, CO City of Colorado Springs No. STM-REV24-0906; CGS Unique No. EP-25-0003.

Dear Mr. Mondejar:

Colorado Geological Survey (CGS) provided review comments to the original apartment plan for the above referenced site. The project plans were significantly changed. A new geologic hazard report has been prepared for the new townhome development plan.

The previous CGS Comments were considered and addressed in the revised stability analysis completed for the new development plan. A copy of the original CGS review is included with the updated geologic hazard report.

CGS COMMENTS AND ENTECH ENGINEERING, INC. RESPONSES

CGS Comments:

Entech has addressed many of the development concerns outlined in our review of a previous concept plan at this location. The city ordinance requires an evaluation and discussion of potential impacts to adjacent properties, and we recommend that the city require this before approval of the development plan for the Uintah Townhomes. This should include an evaluation and discussion of any potential impacts from the planned retaining walls to the adjacent Lot 2 of the Lofts at Mirrillion or potential impacts from the project to Lots 13, 14, 15, and 16 of the Lofts at Mirrillion.

Before the development plan is approved, CGS recommends

- *The city require an amendment to the Geologic Hazard Assessment that includes an evaluation and discussion of potential impacts to adjacent properties, as outlined in this letter and required by the city ordinance.*

As conditions of approval, once the geologic hazard assessment is amended, CGS recommends the city require additional site investigations.

- *For each building location, as recommended by Entech.*
- *Not just for the buildings but also for the retaining walls, including an analysis of site-specific global stability of the retaining wall system based on a subsurface investigation at the wall location.*

Entech Response:

Analysis of the existing conditions on this site have been provided. Based on the proposed development plan and deep foundation on the structures located north of the development, the proposed grading and construction plans will not impact the stability of the adjacent structures.

The foundation designs for the existing buildings north of the site for the Lofts at Mirrillion were completed by Entech Engineering, Inc. Records of observation of the piers are included in Appendix A.

Our report (in agreement with CGS) states that:

- Retaining walls constructed on this site should be designed by a qualified engineer for global stability. This office may be contacted to design the retaining walls. Mechanically stabilized earth walls consisting of concrete/masonry block facing units with geogrid tiebacks are recommended for construction on this site.
- Additional site investigations will be completed for each building location and retaining walls to include additional test borings and site-specific global slope stability analysis once development plans are generated.

The results of the stability analysis show that the factors of safety of 1.5 or greater is achieved with either the overexcavation or drilled pier approach for the buildings.

We trust this has provided you with the information you required. If you have any questions or need additional information, please do not hesitate to contact us.

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: 09/04/24

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

LLL/amn

F:\AA Projects\2022\221101-RM3 Inc-21st St&Uintah Street-220,320-PSSI,Geohaz\09-Reports\cgs response\221101 CGS Response 8.30.24.docx

COLORADO GEOLOGICAL SURVEY

1801 Moly Road
Golden, Colorado 80401

Matthew L. Morgan
State Geologist

July 30, 2024

Joel Dagnillo
Engineering Development Review
2880 International Circle, #200-7
Colorado Springs, CO 80910

Location:
SE ¼ of NE ¼ of Section 11
T14S, R67W of the 6th PM
38.8484°, -104.8538°

Subject: **Sun Mountain Townhomes**
Colorado Springs, El Paso County, CO
STM-REV24-0906; CGS Unique No. EP-25-0003

Joel,

The Colorado Geological Survey (CGS) has reviewed the referral for residential development (townhomes) with a disturbed area of approximately 2.52 acres. We received the Development Plan (MVE, Project 51516, July 2, 2024) and the Geologic Hazard Assessment (Entech, Job Number 221101, July 1, 2024). We reviewed the previous application for apartments at this site (August 9, 2022, and February 16, 2023). These earlier review letters for the development of this property are considered part of this review.

Entech has addressed many of the development concerns outlined in our review of a previous concept plan at this location. The city ordinance requires an evaluation and discussion of potential impacts to adjacent properties, and we recommend that the city require this before approval of the development plan for the Uintah Townhomes. This should include an evaluation and discussion of any potential impacts from the planned retaining walls to the adjacent Lot 2 of the Lofts at Mirrillion or potential impacts from the project to Lots 13, 14, 15, and 16 of the Lofts at Mirrillion.

Entech states p.8, "Additional detailed site investigation is recommended at each building location prior to construction. Any special mitigation should be determined at that time." They also state, "The proposed grading plan with engineered retaining walls and mitigation of expansive soils is appropriate for the site. Mitigation measures/approaches required for each building will be provided once building locations and grading are finalized." We recommend that the city require these additional detailed site investigations in the future as a condition of approval. A site-specific investigation should also be required by the city for the planned retaining walls as part of the subsurface investigation for the global stability of the walls to determine "Any special mitigation…" that may be needed for the walls and any potential impacts they will have on the existing structure and its deep foundation at Lot 2 of the Lofts at Mirrillion. Site-specific investigations for Lots 9, 10, 11, and 12 should also be required to discuss potential impacts on Lots 13, 14, 15, and 16 of the Lofts at Mirrillion.

Before the development plan is approved, CGS recommends

- The city require an amendment to the Geologic Hazard Assessment that includes an evaluation and discussion of potential impacts to adjacent properties, as outlined in this letter and required by the city ordinance.

As conditions of approval, once the geologic hazard assessment is amended, CGS recommends the city require additional site investigations

- For each building location, as recommended by Entech.
- Not just for the buildings but also for the retaining walls, including an analysis of site-specific global stability of the retaining wall system based on a subsurface investigation at the wall location.

Thank you for the opportunity to comment on this project. If you have questions or require further review, please email me at jlovekin@mines.edu.

Sincerely,

Jonathan R. Lovekin, P.G.
Senior Engineering Geologist

APPENDIX A: Lofts at Mirrillion – Entech Density Testing, Excavation Observations, Drilled Pier Observations

ENTECH
ENGINEERING, INC.

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

May 1, 2007
Revised May 11, 2007

Summit Builders
P.O. Box 601
Palmer Lake, CO 80133-0601

Attn: Dennis Stern

Re: Density Testing – Structural Fill
1343-1355 Mirrillion Heights
Colorado Springs, Colorado
Report No. 1, Tests 1-22

Dear Mr. Stern:

As requested, personnel of Entech Engineering, Inc. have performed additional density testing at the above referenced site. Initially, the excavation was overexcavated and four feet of structural fill was placed. It was later determined that the final grade was two feet too low. Rather than place two additional feet of structural fill, the contractor chose to remove the existing four feet of structural fill and place two feet of on-site compacted soils, followed by the four feet of structural fill.

The density testing on this site was performed on March 28 through April 30, 2007. The density testing indicates that the native and structural fill placed at the depths noted has been adequately compacted. Results of the density tests along with a moisture density relation curve are attached with this letter.

We trust that this has provided you with the information you required. Should you have any questions or need further information, please do not hesitate to contact us.

Respectfully submitted,

ENTECH ENGINEERING, INC.

Daniel P. Stegman

Reviewed by:

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

DPS/mf

Encl.

Entech Job No. 91327
3MSW/DEN/2007/91327sf revised 2

Client:	Summit Builders	**Entech Job #:**	91327	**Proctor Value Key:**	**M = modified, ASTM D-1557**
Project:	1343-1355 Mirrillion Heights	**Tested By:**	R. Smith		**S = standard, ASTM D-698**
Subject:	Structural Fill	**Report Date:**	05-08-2007		**T = AASHTO, T-180**

Test #	Test Location	Testing Date	Percent Compaction	Percent Required	Percent Moisture	Soil Type	Proctor Type/Value	Pass/Fail ☑ = Fail
1	8' north and 12' west of the southeast corner of building, 2' below grade.	3/28/07	94	90	7.4	SP	M - 139.4 @ 6.1	☐
2	10' north and 34' west of the southeast corner of building, 2' below grade.	3/28/07	100	90	6.7	SP	M - 139.4 @ 6.1	☐
3	10' south and 72' west of the northeast corner of building, 2' below grade.	3/28/07	99	90	6.8	SP	M - 139.4 @ 6.1	☐
4	14' south and 14' east of the northwest corner of building, 2' below grade.	3/28/07	96	90	6.6	SP	M - 139.4 @ 6.1	☐
5	10' south and 10' west of the northeast corner of building, at grade.	3/29/07	97	90	7.9	SP	M - 139.4 @ 6.1	☐
6	38' west and 12' south of the northeast corner of building, at grade.	3/29/07	97	90	5.7	SP	M - 139.4 @ 6.1	☐
7	12' north and 36' east of the southwest corner of building, at grade.	3/29/07	95	90	7.1	SP	M - 139.4 @ 6.1	☐
8	12' south and 10' east of the northwest corner of building, at grade.	3/29/07	98	90	7.3	SP	M - 139.4 @ 6.1	☐
9	20' north and 15' west of the southeast corner of building, 4' below grade.	4/23/07	99	95	22.8	CH	S - 99.0 @ 22.0	☐
10	23' north and 45' west of the southeast corner of building, 4' below grade.	4/23/07	98	95	22.3	CH	S - 99.0 @ 22.0	☐

Comments:

Scope of Observation: PERIODIC; ☐ CONTRACTOR'S OR CLIENT'S REPRESENTATIVE ADVISED

All dimensions are approximate. Cl. = Centerline

ENTECH
ENGINEERING, INC.
505 Elkton Drive
Colorado Springs, CO 80907
(719) 531-5599 • (719) 531-5238 (fax)

FIELD DENSITY RESULTS

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

Client:	Summit Builders	**Entech Job #:**	91327	**Proctor Value Key:**	**M = modified, ASTM D-1557**
Project:	1343-1355 Mirrillion Heights	**Tested By:**	R. Smith		**S = standard, ASTM D-698**
Subject:	Structural Fill	**Report Date:**	05-08-2007		**T = AASHTO, T-180**

Test #	Test Location	Testing Date	Percent Compaction	Percent Required	Percent Moisture	Soil Type	Proctor Type/Value	Pass/Fail ☑ = Fail
11	15' north and 15' west of the southeast corner of building, 2' below grade.	4/26/07	92	90	6.6	SM	M - 142.4 @ 5.7	☐
12	30' north and 50' west of the southeast corner of building, 2' below grade.	4/26/07	97	90	6.6	SM	M - 142.4 @ 5.7	☐
13	40' east and 10' south of the northwest corner of building, 4' below grade.	4/26/07	98	95	22.2	CH	S - 99.0 @ 22.0	☐
14	6' south and 10' west of the northwest corner of building, 4' below grade.	4/26/07	98	95	22.1	CH	S - 99.0 @ 22.0	☐
15	6' south and 40' east of the northwest corner of building, 2' below grade.	4/26/07	95	90	7.4	SM	M - 142.4 @ 5.7	☐
16	15' south and 7' east of the northwest corner of building, 2' below grade.	4/26/07	90	90	7.2	SM	M - 142.4 @ 5.7	☐
17	24' north and 6' west of the southeast corner of building, at grade.	4/30/07	90	90	6.5	SM	M - 142.4 @ 5.7	☐
18	32' north and 44' west of the southeast corner of building, at grade.	4/30/07	92	90	7.6	SM	M - 142.4 @ 5.7	☐
19	22' north and 58' west of the southeast corner of building, at grade.	4/30/07	92	90	4.5	SM	M - 142.4 @ 5.7	☐
20	28' north and 12' east of the southwest corner of building, at grade.	4/30/07	93	90	4.6	SM	M - 142.4 @ 5.7	☐

Comments:

Scope of Observation: PERIODIC; ☐ CONTRACTOR'S OR CLIENT'S REPRESENTATIVE ADVISED

All dimensions are approximate. Cl. = Centerline

ENTECH
ENGINEERING, INC.
505 Elkton Drive
Colorado Springs, CO 80907
(719) 531-5599 • (719) 531-5238 (fax)

FIELD DENSITY RESULTS

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

Client:	Summit Builders	**Entech Job #:**	91327	**Proctor Value Key:**	**M = modified, ASTM D-1557**
Project:	1343-1355 Mirrillion Heights	**Tested By:**	R. Smith		**S = standard, ASTM D-698**
Subject:	Structural Fill	**Report Date:**	05-08-2007		**T = AASHTO, T-180**

Test #	Test Location	Testing Date	Percent Compaction	Percent Required	Percent Moisture	Soil Type	Proctor Type/Value	Pass/Fail ☑ = Fail
21	Walkout, 4' north and 28' east of the southwest corner of building, at grade.	4/30/07	94	90	5.9	SM	M - 142.4 @ 5.7	☐
22	Walkout, 8' north and 32' west of the southeast corner of building, at grade.	4/30/07	98	90	5.5	SM	M - 142.4 @ 5.7	☐

Comments:

Scope of Observation: PERIODIC; ☐ CONTRACTOR'S OR CLIENT'S REPRESENTATIVE ADVISED

All dimensions are approximate. Cl. = Centerline

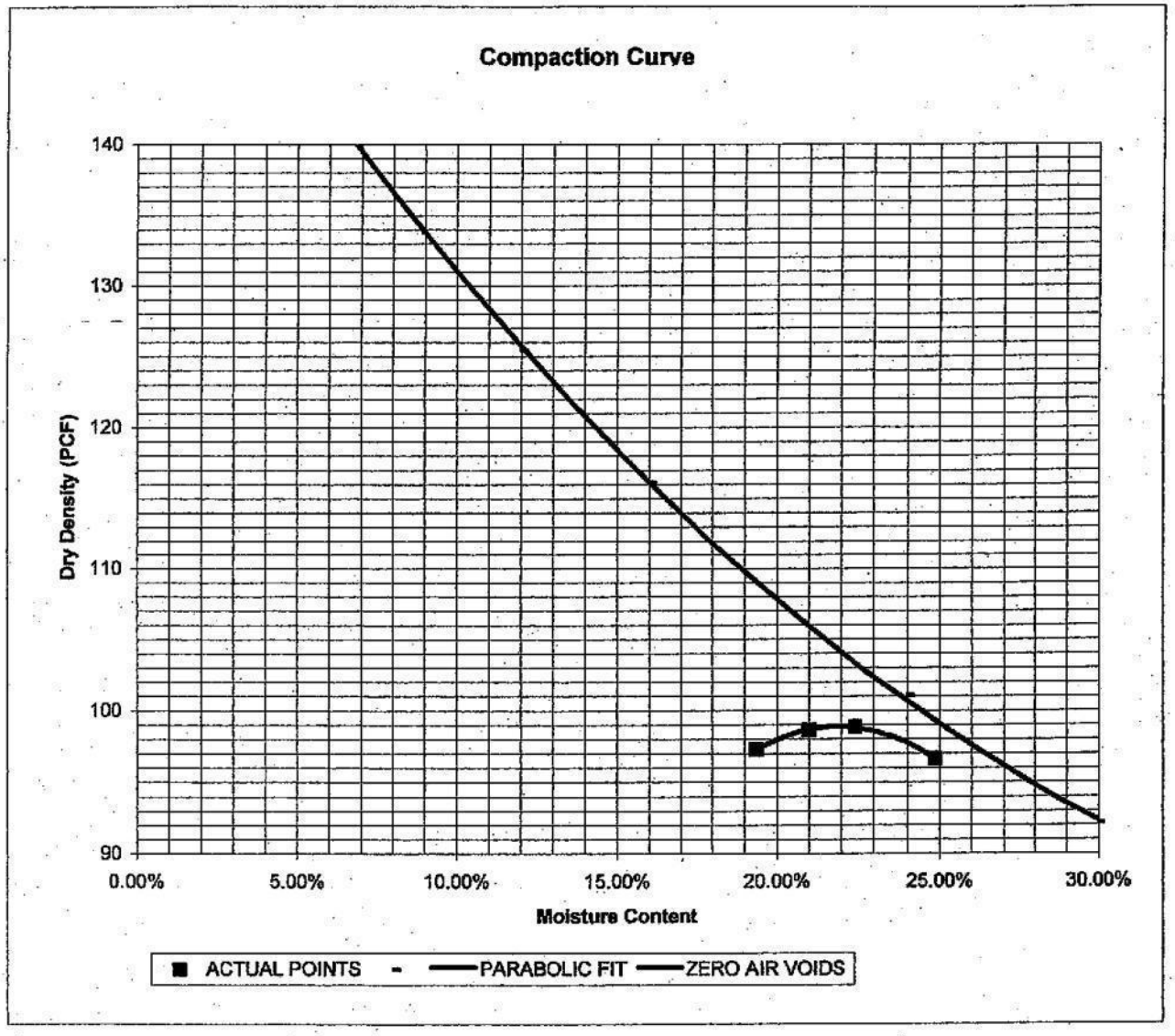
ENTECH
ENGINEERING, INC.
505 Elkton Drive
Colorado Springs, CO 80907
(719) 531-5599 • (719) 531-5238 (fax)

FIELD DENSITY RESULTS

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

PROJECT	1343-1355 MIRRILLION HTS	CLIENT	SUMMIT BUILDERS
SAMPLE LOCATION	EAST STOCKPILE	JOB NO.	91327
SOIL DESCRIPTION	CLAYSTONE, GRAY BROWN	DATE	04/23/07

IDENTIFICATION	CH	COMPACTION TEST #	1
TEST DESIGNATION / METHOD	ASTM D-698-A	TEST BY	SR
MAXIMUM DRY DENSITY (PCF)	99	OPTIMUM MOISTURE	22.0%



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

MOISTURE DENSITY RELATION

DRAWN:	DATE:	CHECKED:	DATE:

JOB NO.:

FIG NO.:

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

May 7, 2007

Summit Builders
PO Box 601
Palmer Lake, Colorado 80133

Attn: Dennis Stern

Re: Excavation Observation
1343-1355 Mirrillion Heights
Colorado Springs, Colorado

Dear Mr. Stern:

Personnel of Entech Engineering, Inc. have observed the excavation at the site referenced above. The specific findings for this site are presented in this letter.

Eight test borings were placed at the above referenced site by Entech Engineering, Inc. The results are presented in our report dated May 22, 2002, Job No. 46992.

The following recommendations are based on conditions observed on March 28 and 29, 2007. Entech Engineering, Inc. should be notified if any changes in conditions are encountered or if the excavation depth or location should change.

Soil types observed in the foundation excavation were found to consist of claystone. A maximum allowable bearing capacity of 25,000 psf and a minimum load pressure of 15,000 psf, based on end area, is recommended for deep foundation members. A skin friction value of 2500 psf is recommended for the portion of the pier in unweathered bedrock. The upper four feet of weathered bedrock should be ignored for skin friction. A negative skin friction of 450 psf is recommended for the portion of the piers in fill. An equivalent hydrostatic fluid pressure (in the active state) of 55 pcf is recommended for the soils on this site.

A drilled pier foundation system is recommended for this site. The foundation should be constructed according to the design performed by Entech Engineering, Inc. for the above-referenced site, dated April 25, 2002, revised March 6, 2007, Entech Job No. 16634. Reinforcing in the foundation walls should be placed according to the referenced design, using the above soil parameters.

A subsurface drain is recommended for the entire structure. This includes foundation walls between the basement and a crawlspace or garage. Typical drain details are included with this letter.

Floor slabs placed on expansive clays should be expected to experience movement. Removal and replacement of clay soils is recommended to minimize slab movement. Floor slabs on grade, if any should be separated from structural portions of the building and allowed to float freely. Interior partitions must be constructed in such a manner that they do not transmit floor slab movement to the roof or overlying floor. Backfill placed below floor slabs should be compacted to a minimum of 90% of its maximum Modified Proctor Dry Density, ASTM D- 1557.

Recommendations regarding drainage, concrete, etc. contained in the Subsurface Soil Investigation performed by Entech Engineering, Inc. remain valid and should be followed.

We trust that this report has provided you with the information you required. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Reviewed by:

Daniel P. Stegman

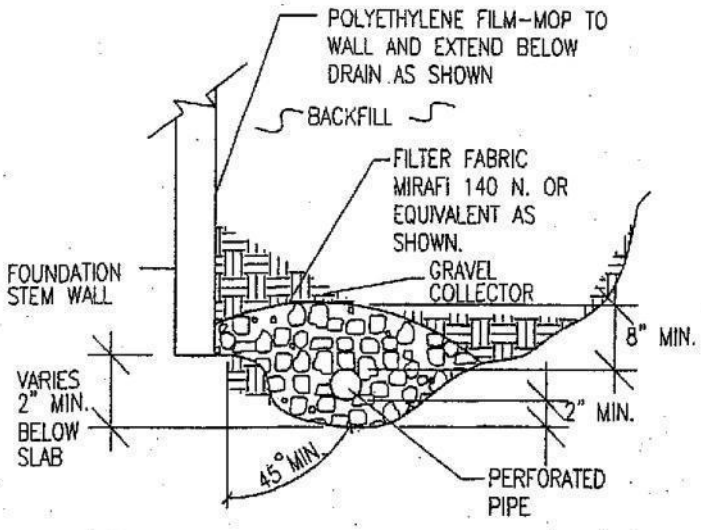
Joseph C. Goode, Jr., P.E.
President

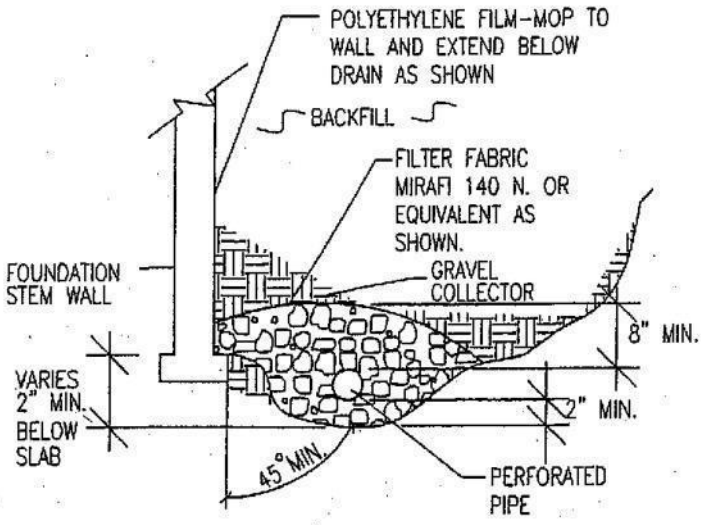
COLORADO REGISTERED JOSEPH COLLIN GOODE JR. 23725 PROFESSIONAL ENGINEER

DPS/mf

Encl.

Entech Job No. 91327
2MSW/let/2007/91327excav





NOTES:

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

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

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

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

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

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

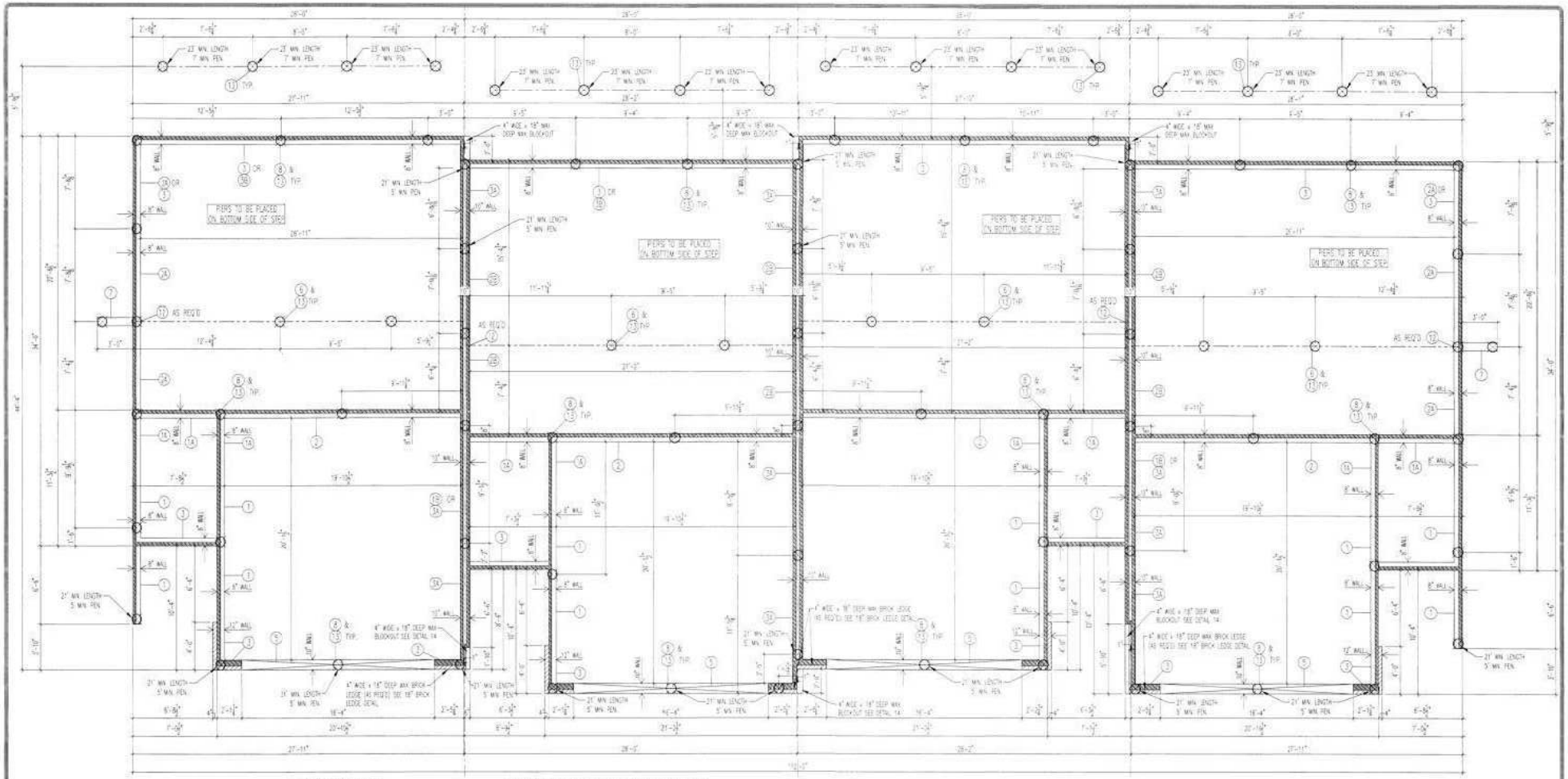
ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

EXTERIOR PERIMETER DRAIN DETAIL

DRAWN: M. VAN KAMPEN	DATE:	DESIGNED:	CHECKED:

JOB NO.:

FIG NO.:



FOUNDATION PLAN

1/4" = 1'-0"

LEGEND

- FOUNDATION WALL W/ MUD SILL & BRICK LEDGE
- FOUNDATION WALL W/ MUD SILL
- BEAM
- CENTER LINE
- DETAIL REFERENCE
- 10"ø PIER

GENERAL FOUNDATION NOTES:

- Use dimensions from the architectural plans, except for foundation components.
- All miscellaneous details shall be in accordance with instructions from manufacturer or designer.
- Reinforcing should be continuous around the building, as shown. Minimum lap of reinforcing should be 30 bar diameters.
- All foundation pads must be formed to the proper dimension.
- Floor slabs must be separated from all structural portions of building with an expansion joint a minimum of ½" thickness. All nonbearing partitions above floor slabs must be constructed with a minimum ½" gap at the bottom to permit vertical movement of floor slabs.
- Stairways should not be constructed as rigid connections between floors, but should allow floor slabs to move vertically.
- Door jambs should not be built tight to slabs on grade.
- Mechanically compact all interior backfill to 95% maximum Modified Proctor Dry Density, ASTM D-1557. All exterior backfill should be mechanically compacted to 90% of maximum Modified Proctor Dry Density, ASTM D-1557.
- Walls having backfill on both the interior and exterior faces should have the backfill on either side brought up approximately together. Otherwise, where possible, no exterior backfill should be placed until the floor slab and floor joists are in place or the wall is otherwise properly braced.
- Minimum recommended design strength of foundation concrete shall be 3000 psi.
- Foundation forms should remain in place a minimum of three (3) days.
- A gravel pad beneath floor slabs is not recommended.
- Planters, if any, should be well sealed and drained.
- Slope backfill away from the building a minimum of 5% for the first 10 feet. Carry roof drains across the backfilled areas. Do not allow water to stand or pond near the building. Do not flood the backfill.

NOTE:
ALL PIERS TO HAVE MIN. LENGTH OF 20ft. WITH 4' MIN. PENETRATION INTO BEDROCK UNLESS NOTED OTHERWISE.

PIERS TO BE PLACED ON BOTTOM SIDE OF STEP

- This design has been completed in accordance with pertinent standards, recommended design soil parameters, and accepted engineering design procedures, and is based on the best information available at the time of completion. The design is intended to minimize differential movement resulting from the heaving of expansive soil induced by seasonal moisture changes. It must be recognized that foundation components, and in particular, floor slabs and other flatwork, will undergo movement. Adherence to those advice isolating floor slabs from columns, walls, partitions, or other structural components is extremely important if damage to the superstructure is to be minimized. Any subsequent owners should be apprised of the expansive soil condition, if any, and advised to maintain good practices in the future with regard to surface and subsurface drainage, framing of partitions above floor slabs, drywall and finish work above floor slabs, etc.
- All reinforcing bars are to consist of #4, grade 60 steel unless otherwise noted.
- #5, grade 40 reinforcing bars may be used in place of #4, grade 60 reinforcing bars, if desired.

Standard Designation	SI Designation
#4, Grade 60	#13, Grade 420 MPa
#5, Grade 40	#16, Grade 300 MPa

- Reinforcing must remain continuous above all windows and doors. Bundle bars at recesses.
- Verify top of foundation elevations and top of wall steps with Builder prior to placing concrete.
- Verify foundation dimension and pad locations with architectural plans prior to setting forms or placing concrete.
- Verify mudsill locations with architectural plans prior to setting forms or placing concrete.
- Step foundation walls per grade per Step Notes 8, 10, and 11.

SOILS NOTES:

- The foundation excavation must be observed by Entech Engineering, Inc. prior to placing forms or concrete to verify that the design is appropriate for the site.
- The foundation was designed according to the building plans by Lunara Design Group LLC., dated August 24, 2006, Project No. 05120, and the soils by Entech Engineering Inc., dated May 22, 2000, Job No. 48992.

VERIFY ALL DIMENSIONS WITH ARCHITECTURAL PLANS PRIOR TO SETTING FORMS OR PLACING CONCRETE.

MODIFICATIONS TO THIS DESIGN MAY BE REQUIRED.

DRILLED PIER SPECIFICATIONS

- The drilled piers must be drilled vertical, ± 2% tolerance from vertical is allowed.
- Type II Cement should be used in all concrete. A minimum 28 day compressive strength of 3000 psi is required. A 5-7 inch slump should used for the drilled piers at a minimum compressive strength of 3000 psi.
- The bottom of the drilled piers should be cleaned.
- No concrete should be placed in over 6" of water. If more than 6" of water is present, pumping of the drilled pier will be required prior to placement of the concrete.
- A minimum depth of 20' w/ 4' min. embedment is required for all piers unless otherwise specified on the foundation plans. If casing is required during the drilling operation, it should be pulled as the concrete is being placed to permit the complete filling of all voids in the sidewalls of the pier excavation.
- Concrete should be poured the same day the piers are drilled.
- Door jambs should not be built tight to slabs on grade.
- Sonotubes may be required in the top portion of the drilled pier to prevent mushrooming.
- The amount of reinforcing required in each pier is shown on the plan. Spacers should be used to keep the steel cages off the edges of the drilled piers.

STATE OF COLORADO P.E. NO. - 36159

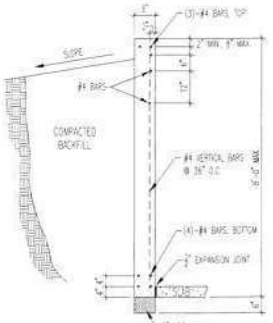
REVISIONS	BY:
UPDATE PLAN 14SEP07	JJM
REVISED PIER WALLS 12NOV07	JJM
REVISED DETAILS 29MAY07	JJM

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

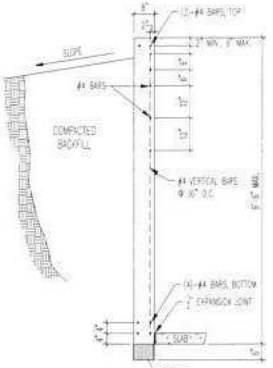
FOUNDATION PLAN
4 UNIT TOWNHOME
1343, 1347, 1351, & 1355 MERRILLION HEIGHTS
COLORADO SPRINGS, CO
FOR: SUMMIT BUILDERS

G 32984
G 32985
G 32986
G 32988

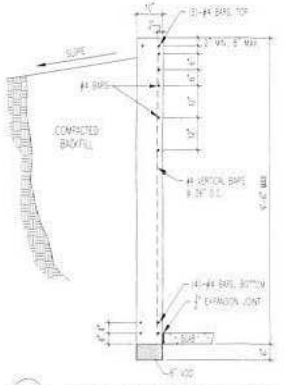
DRAWN BY: J. MEIFFRENNY	
DESIGNED BY: T. POIRIER	
CHECKED BY:	
DATE: 1SEP06	
SCALE: AS SHOWN	
JOB NO.: 84456	
SHEET NO.	1 OF 2 SHEETS



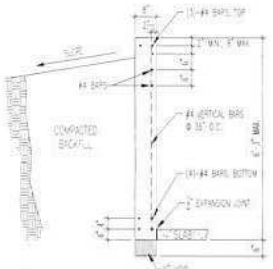
1 FULL BASEMENT WALL REINFORCING DETAIL



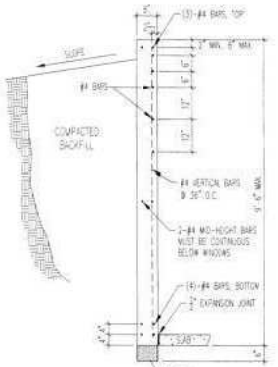
1A HIGH BASEMENT WALL REINFORCING DETAIL AT STEPDOWN CONDITIONS



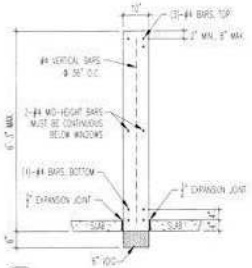
1B HIGH BASEMENT WALL REINFORCING DETAIL AT STEPDOWN CONDITIONS



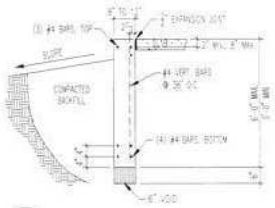
2 FULL BASEMENT WALL REINFORCING DETAIL



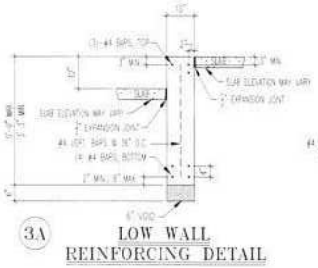
2A HIGH BASEMENT WALL REINFORCING DETAIL AT STEPDOWN CONDITIONS



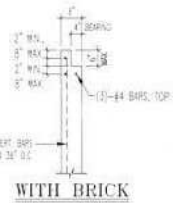
2B HIGH BASEMENT WALL REINFORCING DETAIL AT STEPDOWN CONDITIONS



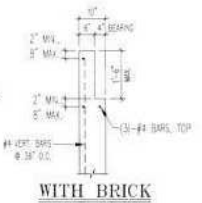
3 LOW WALL REINFORCING DETAIL



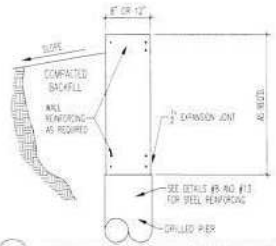
3A LOW WALL REINFORCING DETAIL



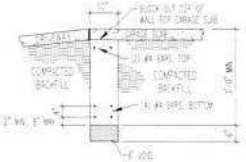
WITH BRICK
AS REQ'D



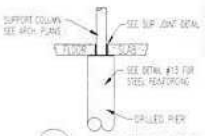
WITH BRICK 18" STEP
AS REQ'D



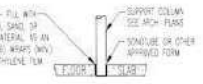
4 TYPICAL CONCRETE PIER BENEATH STEM WALL REINFORCING DETAIL



5 LOW WALL BELOW GARAGE DOOR REINFORCING DETAIL



6 INTERIOR CONCRETE PIER REINFORCING DETAIL



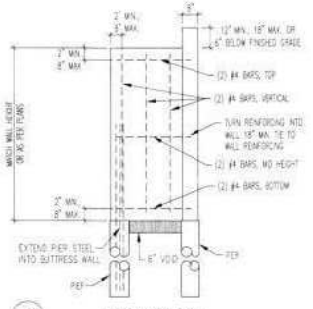
SLIP JOINT DETAIL

REVISIONS	BY:
UPDATE PLANS 11SEP07	JJM
REVISED DETAIL 3A 12MAR07	JJM
REVISED DETAILS 23MAY07	JJM

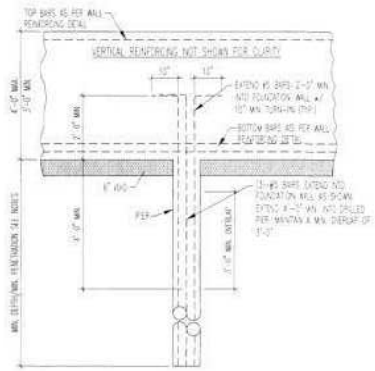
ENTECH ENGINEERING, INC
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

FOUNDATION DETAILS
4 UNIT TOWNHOME
1343, 1347, 1351, & 1355 MIRRILLION HEIGHTS
COLORADO SPRINGS, CO
FOR: SUMMIT BUILDERS

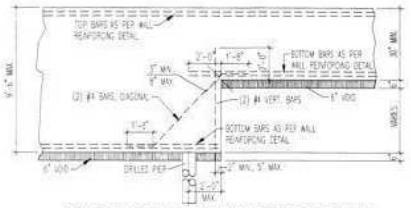
DRAWN BY:	J. MEIERSENRF
DESIGNED BY:	T. POWER
CHECKED BY:	
DATE:	12SEP06
SCALE:	NTS
JOB NO.	04456
SHEET NO.	2
OF	2 SHEETS



7 BUTTRESS REINFORCING DETAIL

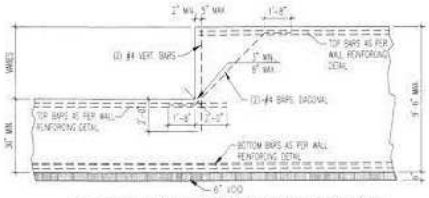


8 PIER/ WALL CONNECTION REINFORCING DETAIL



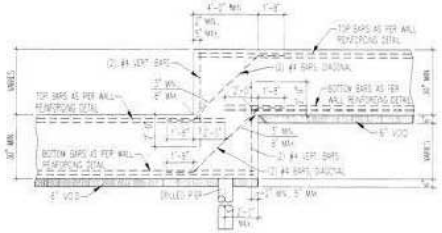
WALL STEP GREATER THAN 6'-0" SHOULD BE REVIEWED.
VERTICAL WALL REINFORCING NOT SHOWN FOR CLARITY.

9 FOUNDATION STEP AT BOTTOM REINFORCING DETAIL
AS REQUIRED



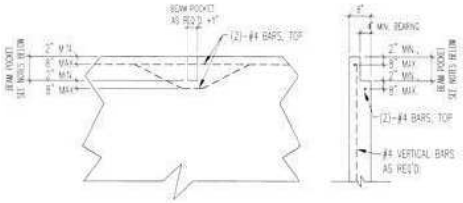
WALL STEP GREATER THAN 6'-0" SHOULD BE REVIEWED.
VERTICAL WALL REINFORCING NOT SHOWN FOR CLARITY.

10 FOUNDATION STEP AT TOP REINFORCING DETAIL
AS REQUIRED



WALL STEP GREATER THAN 6'-0" SHOULD BE REVIEWED.
VERTICAL WALL REINFORCING NOT SHOWN FOR CLARITY.

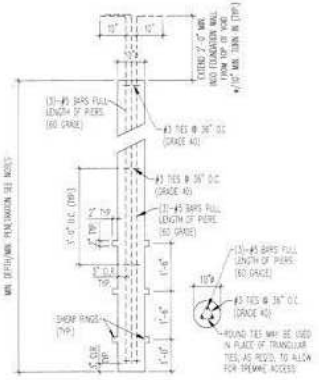
11 FOUNDATION STEP AT TOP AND BOTTOM REINFORCING DETAIL
AS REQUIRED



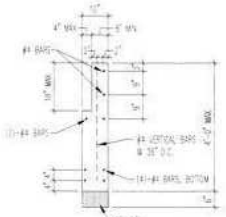
VERTICAL REINFORCING NOT SHOWN FOR CLARITY

12 LOW WALL BEAM POCKET REINFORCING DETAIL

NOTES:
-ALL BEAM POCKETS SHALL HAVE A MINIMUM BEARING OF 4".
-DEPTH OF BEAM POCKET = DEPTH OF BEAM + 1".
-REDUCE BEAM POCKET DEPTH ALLOWING FOR MULTIPLE SILLS, FIELD VERIFY.
-WIDTH OF BEAM POCKET = WIDTH OF BEAM +1"



13 10"ø DRILLED PIER REINFORCING DETAIL



14 LOW WALL @ BLOCKOUT REINFORCING DETAIL

REVISIONS	BY:
UPDATE PLAN 14APR07	JJM
REVISED DETAILS 20MAY07	JJM

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

FOUNDATION DETAILS
4 UNIT TOWNHOME
1343, 1347, 1351, & 1355 MIRRILLION HEIGHTS
COLORADO SPRINGS, CO
FOR: MISSION DEVELOPMENT

DRAWN BY:	T. MEIERHENRY
DESIGNED BY:	T. POIRIER
CHECKED BY:	
DATE:	1SEP06
SCALE:	NTS
JOB NO.:	04456
SHEET NO.	2a OF 2 SHEETS

December 20, 2005

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

Mission Development
3580 Rialto Heights, Apartment 168
Colorado Springs, Colorado 80907

Attn: Ben Gill

Re: Drilled Pier Observation
1386-1390 Mirrillion Heights
Colorado Springs, Colorado

F69229

Dear Mr. Gill:

As requested, personnel of Entech Engineering, Inc. have performed drilled pier observations at the above-referenced site. The drilled pier observations were performed on December 6 and December 9, 2005.

Drilling of the 38 piers for the main duplex structure was observed by personnel of Entech Engineering, Inc. and approved for placement of concrete. The piers were of adequate length and had adequate bearing into bedrock material. The pier holes were cleaned prior to concrete placement. None of the piers required casing. The drilled piers were installed in substantial compliance with the Foundation Plan by Entech Engineering, Inc., dated April 18, 2005, revised July 8, 2005, Job No. 38755. The pier numbers on the pier records correspond with the pier numbers shown on the attached detail. It should be noted that the piers for the decks have not yet been drilled. It is our understanding that they will be drilled at a later date.

We trust that this report has provided you with the information you required. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Carson J. George, E. I.

COLORADO REGISTERED TIMOTHY JAMES POIRIER 36159 PROFESSIONAL ENGINEER

Reviewed by:

Timothy J. Poirier
P. E. #36159

CJG/rs

Encl.

Entech Job No. 38755
2MSW/ltrs/2005/38755dporev

cc: Virgil Mitchell

RECORD OF DRILLED PIER INSTALLATION

PROJECT: Mission Development – 1386-1390 Mirrillion Heights

DATE OF DRILLING: 12/6/05 JOB NUMBER: 38755 NUMBER: _____ SHEET 1 OF 7

PIER NUMBER		1	2	3	4	5	6
DATE OF CONCRETE		12/6/05	12/6/05	12/6/05	12/6/05	12/6/05	12/6/05
PIER DIAMETER		10"	10"	10"	10"	10"	10"
DEPTH OF OVERBURDEN		4'	6'	6'	6'	5'	4'
PENETRATION	REQUIRED	4'	4'	4'	4'	4'	4'
	ACTUAL	16'	14'	14'	14'	15'	16'
TOTAL DEPTH DRILLED		20'	20	20'	20'	20'	20'
REQUIRED MINIMUM LENGTH		20'	20'	20'	20'	20'	20'
REINFORCE	NUMBER AND SIZE	3 - #6's	3 - #6's	3 - #6's	3 - #6's	3 - #6's	3 - #6's
	BAR LENGTH	23'	23'	23'	23'	23'	23'
PLUMBNESS		OK	OK	OK	OK	OK	OK
SHEAR RINGS		3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.
WATER		None	None	None	None	None	None
CASING REQUIRED?		NO	NO	NO	NO	NO	NO

REPRESENTATIVE: G. Steffens

2MSW/form/38755dpo – Mission Development – Mirrillion Heights

RECORD OF DRILLED PIER INSTALLATION

PROJECT: Mission Development – 1386-1390 Mirrillion Heights

DATE OF DRILLING: 12/6/05 and12/9/05 JOB NUMBER: 38755 NUMBER: _____ SHEET 2 OF 7

PIER NUMBER		7	8	9	10	11	12
DATE OF CONCRETE		12/6/05	12/6/05	12/6/05	12/6/05	12/9/05	12/09/5
PIER DIAMETER		10"	10"	10"	10"	10"	10"
DEPTH OF OVERBURDEN		4'	5'	5'	5'	7'	7'
PENETRATION	REQUIRED	5'	4'	5'	5'	7'	6'
	ACTUAL	17'	16'	16'	16'	16'	15'
TOTAL DEPTH DRILLED		21'	21'	21'	21'	23'	22'
REQUIRED MINIMUM LENGTH		21'	21'	21'	21'	23'	22'
REINFORCE	NUMBER AND SIZE	3 - #6's	3 - #6's	3 - #6's	3 - #6's	3 - #6's	3 - #6's
	BAR LENGTH	24'	24'	24'	24'	26'	25'
PLUMBNESS		OK	OK	OK	OK	OK	OK
SHEAR RINGS		3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.
WATER		None	None	None	None	None	None
CASING REQUIRED?		NO	NO	NO	NO	NO	NO

REPRESENTATIVE: G. Steffens

2MSW/form/38755dpo – Mission Development – Mirrillion Heights

RECORD OF DRILLED PIER INSTALLATION

PROJECT: Mission Development – 1386-1390 Mirrillion Heights

DATE OF DRILLING: 12/9/05 JOB NUMBER: 38755 NUMBER: _____ SHEET 3 OF 7

PIER NUMBER		13	14	15	16	17	18
DATE OF CONCRETE		12/9/05	12/9/05	12/9/05	12/9/05	12/9/05	12/09/5
PIER DIAMETER		10"	10"	10"	10"	10"	10"
DEPTH OF OVERBURDEN		7'	7'	7'	7'	9'	9'
PENETRATION	REQUIRED	5'	7'	4'	4'	4'	4'
	ACTUAL	14'	16'	13'	13'	11'	11'
TOTAL DEPTH DRILLED		21'	23'	20'	20'	20'	20'
REQUIRED MINIMUM LENGTH		21'	23'	20'	20'	20'	20'
REINFORCE	NUMBER AND SIZE	3 - #6's	3 - #6's	3 - #6's	3 - #6's	3 - #6's	3 - #6's
	BAR LENGTH	24'	26'	23'	23'	23'	23'
PLUMBNESS		OK	OK	OK	OK	OK	OK
SHEAR RINGS		3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.
WATER		None	None	None	None	None	None
CASING REQUIRED?		NO	NO	NO	NO	NO	NO

REPRESENTATIVE: G. Steffens

2MSW/form/38755dpo – Mission Development – Mirrillion Heights

RECORD OF DRILLED PIER INSTALLATION

PROJECT: Mission Development – 1386-1390 Mirrillion Heights

DATE OF DRILLING: 12/9/05 JOB NUMBER: 38755 NUMBER: _____ SHEET 4 OF 7

PIER NUMBER		19	20	21	22	23	24
DATE OF CONCRETE		12/9/05	12/9/05	12/9/05	12/9/05	12/9/05	12/09/5
PIER DIAMETER		10"	10"	10"	16"	10"	10"
DEPTH OF OVERBURDEN		9'	9'	5'	5'	9'	5'
PENETRATION	REQUIRED	4'	6'	6'	5'	6'	5'
	ACTUAL	11'	13'	17'	16'	13'	16'
TOTAL DEPTH DRILLED		20'	22'	22'	21'	22'	21'
REQUIRED MINIMUM LENGTH		20'	22'	22'	21'	22'	21'
REINFORCE	NUMBER AND SIZE	3 - #6's	3 - #6's	3 - #6's	3 - #6's	3 - #6's	3 - #6's
	BAR LENGTH	23'	25'	25'	24'	25'	24'
PLUMBNESS		OK	OK	OK	OK	OK	OK
SHEAR RINGS		3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.
WATER		None	None	None	None	None	None
CASING REQUIRED?		NO	NO	NO	NO	NO	NO

REPRESENTATIVE: G. Steffens

2MSW/form/38755dpo – Mission Development – Mirrillion Heights

RECORD OF DRILLED PIER INSTALLATION

PROJECT: Mission Development – 1386-1390 Mirrillion Heights

DATE OF DRILLING: 12/9/05 JOB NUMBER: 38755 NUMBER: _____ SHEET 5 OF 7

PIER NUMBER		25	26	27	28	29	30
DATE OF CONCRETE		12/9/05	12/9/05	12/9/05	12/9/05	12/9/05	12/09/5
PIER DIAMETER		10"	10"	10"	10"	10"	10"
DEPTH OF OVERBURDEN		6'	9'	6'	8'	6'	6'
PENETRATION	REQUIRED	4'	6'	5'	6'	4'	4'
	ACTUAL	14'	13'	15'	14'	14'	14'
TOTAL DEPTH DRILLED		20'	22'	21'	22'	20'	20'
REQUIRED MINIMUM LENGTH		20'	22'	21'	22'	20'	20'
REINFORCE	NUMBER AND SIZE	3 - #6's	3 - #6's	3 - #6's	3 - #6's	3 - #6's	3 - #6's
	BAR LENGTH	23'	25'	24'	25'	23'	23'
PLUMBNESS		OK	OK	OK	OK	OK	OK
SHEAR RINGS		3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.
WATER		None	None	None	None	None	None
CASING REQUIRED?		NO	NO	NO	NO	NO	NO

REPRESENTATIVE: G. Steffens

RECORD OF DRILLED PIER INSTALLATION

PROJECT: Mission Development – 1386-1390 Mirrillion Heights

DATE OF DRILLING: 12/9/05 JOB NUMBER: 38755 NUMBER: _____ SHEET 6 OF 7

PIER NUMBER		31	32	33	34	35	36
DATE OF CONCRETE		12/9/05	12/9/05	12/9/05	12/9/05	12/9/05	12/09/5
PIER DIAMETER		10"	10"	10"	10"	16"	16"
DEPTH OF OVERBURDEN		8'	6'	8'	5'	9'	8'
PENETRATION	REQUIRED	6'	4'	6'	4'	7'	6'
	ACTUAL	14'	14'	14'	15'	12'	12'
TOTAL DEPTH DRILLED		22'	20'	22'	20'	21'	20'
REQUIRED MINIMUM LENGTH		22'	20'	22'	20'	21'	20'
REINFORCE	NUMBER AND SIZE	3 - #6's	3 - #6's	3 - #6's	3 - #6's	3 - #6's	3 - #6's
	BAR LENGTH	25'	23'	25'	23'	24'	23'
PLUMBNESS		OK	OK	OK	OK	OK	OK
SHEAR RINGS		3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.	3 @ 18" O.C.
WATER		None	None	None	None	None	None
CASING REQUIRED?		NO	NO	NO	NO	NO	NO

REPRESENTATIVE: G. Steffens

2MSW/form/38755dpo – Mission Development – Mirrillion Heights

RECORD OF DRILLED PIER INSTALLATION

PROJECT: Mission Development – 1386-1390 Mirrillion Heights

DATE OF DRILLING: 12/9/05 JOB NUMBER: 38755 NUMBER: _____ SHEET 7 OF 7

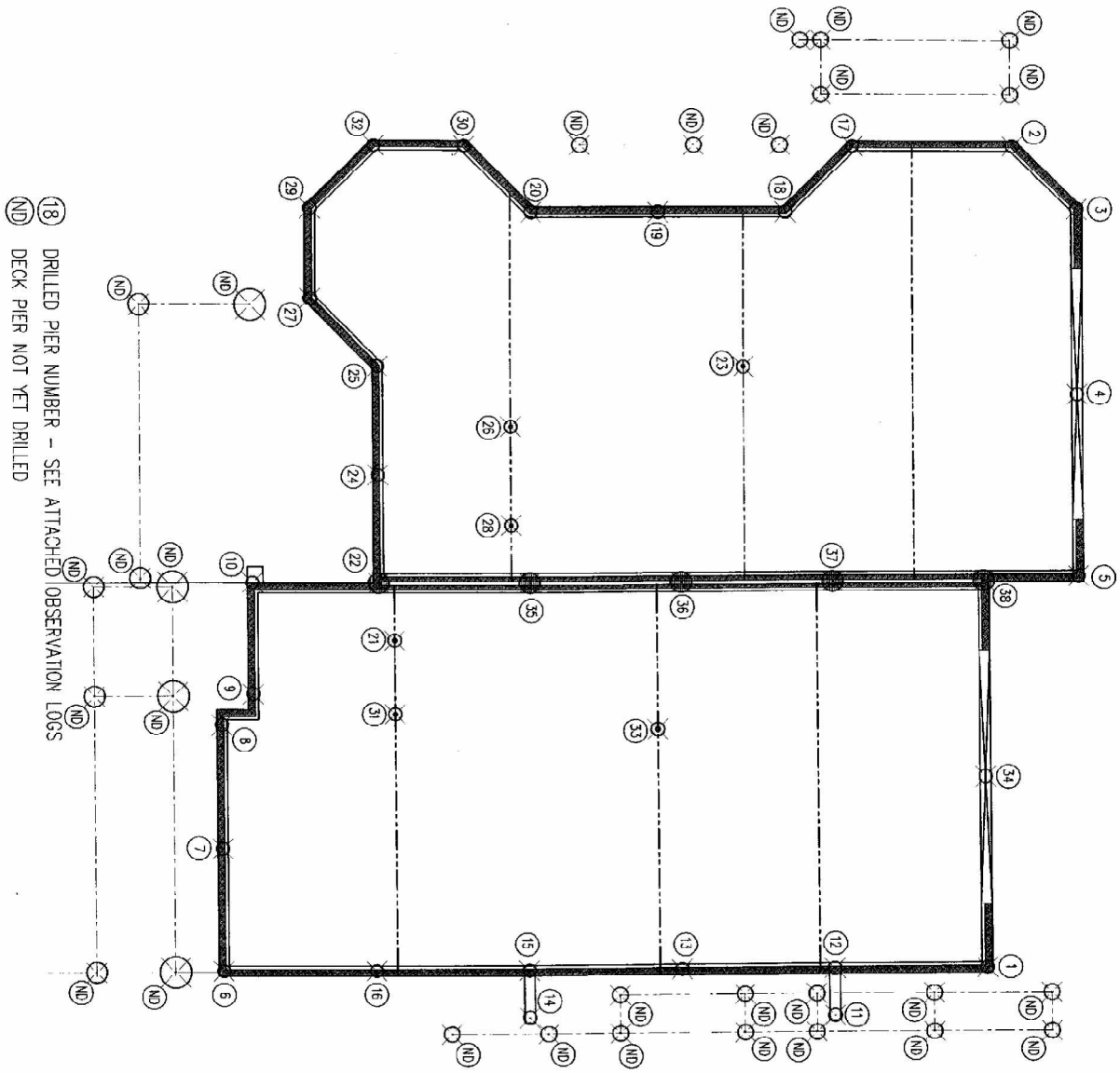
PIER NUMBER		37	38				
DATE OF CONCRETE		12/9/05	12/9/05				
PIER DIAMETER		16"	16"				
DEPTH OF OVERBURDEN		8'	8'				
PENETRATION	REQUIRED	6'	6'				
	ACTUAL	12'	12'				
TOTAL DEPTH DRILLED		20'	20'				
REQUIRED MINIMUM LENGTH		20'	20'				
REINFORCE	NUMBER AND SIZE	3 - #6's	3 - #6's				
	BAR LENGTH	23'	23'				
PLUMBNESS		OK	OK				
SHEAR RINGS		3 @ 18" O.C.	3 @ 18" O.C.				
WATER		None	None				
CASING REQUIRED?		NO	NO				

REPRESENTATIVE: G. Steffens

2MSW/form/38755dpo – Mission Development – Mirrillion Heights

M:\2005\FOUNDATIONS\MISSION\38755(1386 & 1390 MIRRILLION HTS.)PIER LAYOUT.dwg, 12/20/2005 11:12:46 AM, 1:96

M:\2005\FOUNDATIONS\MISSION\38755(1386 & 1390 MIRRILLION HTS.)PIER LAYOUT.DWG (12-20-05 11:12:46AM)



DRAWN BY: R.J. NELSON	
CHECKED BY: C. GEORGE	
DATE: 12/20/05	
SCALE: AS SHOWN	
JOB NO.: 38755	
SHEET NO.: 1 OF 1 SHEETS	

PIER LOCATION PLAN
2 UNIT TOWNHOME
1386 & 1390 MIRRILLION HEIGHTS
COLORADO SPRINGS, CO.
FOR: MISSION DEVELOPMENT

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

REVISIONS	BY:

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

May 7, 2007

Summit Builders
PO Box 601
Palmer Lake, Colorado 80133

Attn: Dennis Stern

Re: Excavation Observation
1343-1355 Mirrillion Heights
Colorado Springs, Colorado

G22924 1343 MIRRILLION HTS
G22925 1347 "
G22927 1351 "
G22928 1355 "

Dear Mr. Stern:

Personnel of Entech Engineering, Inc. have observed the excavation at the site referenced above. The specific findings for this site are presented in this letter.

Eight test borings were placed at the above referenced site by Entech Engineering, Inc. The results are presented in our report dated May 22, 2002, Job No. 46992.

The following recommendations are based on conditions observed on March 28 and 29, 2007. Entech Engineering, Inc. should be notified if any changes in conditions are encountered or if the excavation depth or location should change.

Soil types observed in the foundation excavation were found to consist of claystone. A maximum allowable bearing capacity of 25,000 psf and a minimum load pressure of 15,000 psf, based on end area, is recommended for deep foundation members. A skin friction value of 2500 psf is recommended for the portion of the pier in unweathered bedrock. The upper four feet of weathered bedrock should be ignored for skin friction. A negative skin friction of 450 psf is recommended for the portion of the piers in fill. An equivalent hydrostatic fluid pressure (in the active state) of 55 pcf is recommended for the soils on this site.

A drilled pier foundation system is recommended for this site. The foundation should be constructed according to the design performed by Entech Engineering, Inc. for the above-referenced site, dated April 25, 2002, revised March 6, 2007, Entech Job No. 16634. Reinforcing in the foundation walls should be placed according to the referenced design, using the above soil parameters.

A subsurface drain is recommended for the entire structure. This includes foundation walls between the basement and a crawlspace or garage. Typical drain details are included with this letter.

Floor slabs placed on expansive clays should be expected to experience movement. Removal and replacement of clay soils is recommended to minimize slab movement. Floor slabs on grade, if any should be separated from structural portions of the building and allowed to float freely. Interior partitions must be constructed in such a manner that they do not transmit floor slab movement to the roof or overlying floor. Backfill placed below floor slabs should be compacted to a minimum of 90% of its maximum Modified Proctor Dry Density, ASTM D- 1557.

Recommendations regarding drainage, concrete, etc. contained in the Subsurface Soil Investigation performed by Entech Engineering, Inc. remain valid and should be followed.

We trust that this report has provided you with the information you required. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Daniel P. Stegman

DPS/mf

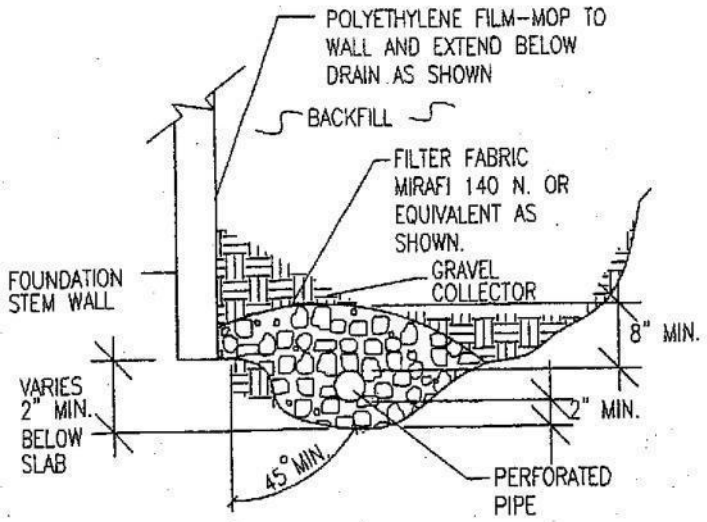
Encl.

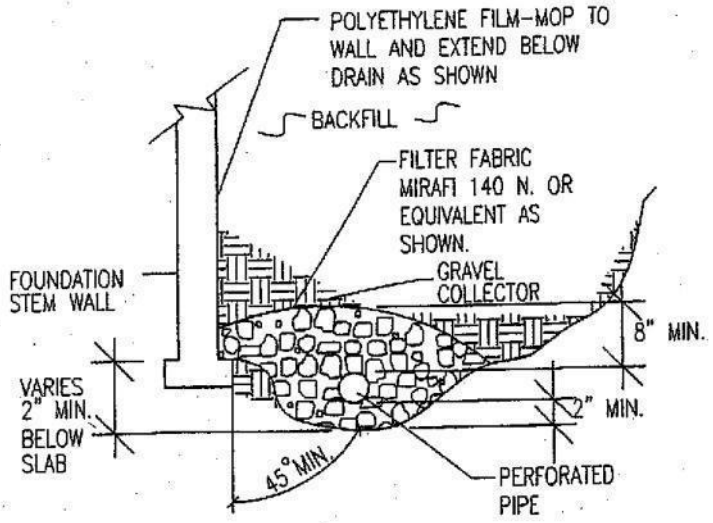
Entech Job No. 91327
2MSW/let/2007/91327excav

Reviewed by:

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

COLORADO REGISTERED
JOSEPH COLLIN GOODE JR.
23725
PROFESSIONAL ENGINEER





NOTES:

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

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

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

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

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

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

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

EXTERIOR PERIMETER DRAIN DETAIL

DRAWN:	DATE:	DESIGNED:	CHECKED:
M. VAN KAMPEN			

JOB NO.:

FIG NO.:

ENTECH
ENGINEERING, INC.

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

May 1, 2007
Revised May 11, 2007

Summit Builders
P.O. Box 601
Palmer Lake, CO 80133-0601

Attn: Dennis Stern

Re: Density Testing – Structural Fill
1343-1355 Mirrillion Heights
Colorado Springs, Colorado
Report No. 1, Tests 1-22

Dear Mr. Stern:

As requested, personnel of Entech Engineering, Inc. have performed additional density testing at the above referenced site. Initially, the excavation was overexcavated and four feet of structural fill was placed. It was later determined that the final grade was two feet too low. Rather than place two additional feet of structural fill, the contractor chose to remove the existing four feet of structural fill and place two feet of on-site compacted soils, followed by the four feet of structural fill.

The density testing on this site was performed on March 28 through April 30, 2007. The density testing indicates that the native and structural fill placed at the depths noted has been adequately compacted. Results of the density tests along with a moisture density relation curve are attached with this letter.

We trust that this has provided you with the information you required. Should you have any questions or need further information, please do not hesitate to contact us.

Respectfully submitted,

ENTECH ENGINEERING, INC.

Daniel P. Stegman

DPS/mf

Encl.

Entech Job No. 91327
3MSW/DEN/2007/91327sf revised 2

Reviewed by:

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

Client: Summit Builders	**Entech Job #:** 91327	**Proctor Value Key:**	**M = modified, ASTM D-1557**
Project: 1343-1355 Mirrillion Heights	**Tested By:** R. Smith		**S = standard, ASTM D-698**
Subject: Structural Fill	**Report Date:** 05-08-2007		**T = AASHTO, T-180**

Test #	Test Location	Testing Date	Percent Compaction	Percent Required	Percent Moisture	Soil Type	Proctor Type/Value	Pass/Fail ☑ = Fail
1	8' north and 12' west of the southeast corner of building, 2' below grade.	3/28/07	94	90	7.4	SP	M - 139.4 @ 6.1	☐
2	10' north and 34' west of the southeast corner of building, 2' below grade.	3/28/07	100	90	6.7	SP	M - 139.4 @ 6.1	☐
3	10' south and 72' west of the northeast corner of building, 2' below grade.	3/28/07	99	90	6.8	SP	M - 139.4 @ 6.1	☐
4	14' south and 14' east of the northwest corner of building, 2' below grade.	3/28/07	96	90	6.6	SP	M - 139.4 @ 6.1	☐
5	10' south and 10' west of the northeast corner of building, at grade.	3/29/07	97	90	7.9	SP	M - 139.4 @ 6.1	☐
6	38' west and 12' south of the northeast corner of building, at grade.	3/29/07	97	90	5.7	SP	M - 139.4 @ 6.1	☐
7	12' north and 36' east of the southwest corner of building, at grade.	3/29/07	95	90	7.1	SP	M - 139.4 @ 6.1	☐
8	12' south and 10' east of the northwest corner of building, at grade.	3/29/07	98	90	7.3	SP	M - 139.4 @ 6.1	☐
9	20' north and 15' west of the southeast corner of building, 4' below grade.	4/23/07	99	95	22.8	CH	S - 99.0 @ 22.0	☐
10	23' north and 45' west of the southeast corner of building, 4' below grade.	4/23/07	98	95	22.3	CH	S - 99.0 @ 22.0	☐

Comments:

Scope of Observation: PERIODIC; ☐ CONTRACTOR'S OR CLIENT'S REPRESENTATIVE ADVISED

All dimensions are approximate. Cl. = Centerline

ENTECH
ENGINEERING, INC.
505 Elkton Drive
Colorado Springs, CO 80907
(719) 531-5599 • (719) 531-5238 (fax)

FIELD DENSITY RESULTS

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

Client: Summit Builders	**Entech Job #:** 91327	**Proctor Value Key:**	**M = modified, ASTM D-1557**
Project: 1343-1355 Mirrillion Heights	**Tested By:** R. Smith		**S = standard, ASTM D-698**
Subject: Structural Fill	**Report Date:** 05-08-2007		**T = AASHTO, T-180**

Test #	Test Location	Testing Date	Percent Compaction	Percent Required	Percent Moisture	Soil Type	Proctor Type/Value	Pass/Fail ☑ = Fail
11	15' north and 15' west of the southeast corner of building, 2' below grade.	4/26/07	92	90	6.6	SM	M - 142.4 @ 5.7	☐
12	30' north and 50' west of the southeast corner of building, 2' below grade.	4/26/07	97	90	6.6	SM	M - 142.4 @ 5.7	☐
13	40' east and 10' south of the northwest corner of building, 4' below grade.	4/26/07	98	95	22.2	CH	S - 99.0 @ 22.0	☐
14	6' south and 10' west of the northwest corner of building, 4' below grade.	4/26/07	98	95	22.1	CH	S - 99.0 @ 22.0	☐
15	6' south and 40' east of the northwest corner of building, 2' below grade.	4/26/07	95	90	7.4	SM	M - 142.4 @ 5.7	☐
16	15' south and 7' east of the northwest corner of building, 2' below grade.	4/26/07	90	90	7.2	SM	M - 142.4 @ 5.7	☐
17	24' north and 6' west of the southeast corner of building, at grade.	4/30/07	90	90	6.5	SM	M - 142.4 @ 5.7	☐
18	32' north and 44' west of the southeast corner of building, at grade.	4/30/07	92	90	7.6	SM	M - 142.4 @ 5.7	☐
19	22' north and 58' west of the southeast corner of building, at grade.	4/30/07	92	90	4.5	SM	M - 142.4 @ 5.7	☐
20	28' north and 12' east of the southwest corner of building, at grade.	4/30/07	93	90	4.6	SM	M - 142.4 @ 5.7	☐

Comments:

Scope of Observation: PERIODIC; ☐ CONTRACTOR'S OR CLIENT'S REPRESENTATIVE ADVISED

All dimensions are approximate. Cl. = Centerline

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505 Elkton Drive
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(719) 531-5599 • (719) 531-5238 (fax)

FIELD DENSITY RESULTS

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

Client:	Summit Builders	**Entech Job #:**	91327	**Proctor Value Key:**	**M = modified, ASTM D-1557**
Project:	1343-1355 Mirrillion Heights	**Tested By:**	R. Smith		**S = standard, ASTM D-698**
Subject:	Structural Fill	**Report Date:**	05-08-2007		**T = AASHTO, T-180**

Test #	Test Location	Testing Date	Percent Compaction	Percent Required	Percent Moisture	Soil Type	Proctor Type/Value	Pass/Fail ☑ = Fail
21	Walkout, 4' north and 28' east of the southwest corner of building, at grade.	4/30/07	94	90	5.9	SM	M - 142.4 @ 5.7	☐
22	Walkout, 8' north and 32' west of the southeast corner of building, at grade.	4/30/07	98	90	5.5	SM	M - 142.4 @ 5.7	☐

Comments:

Scope of Observation: PERIODIC; ☐ CONTRACTOR'S OR CLIENT'S REPRESENTATIVE ADVISED

All dimensions are approximate. Cl. = Centerline

ENTECH
ENGINEERING, INC.
505 Elkton Drive
Colorado Springs, CO 80907
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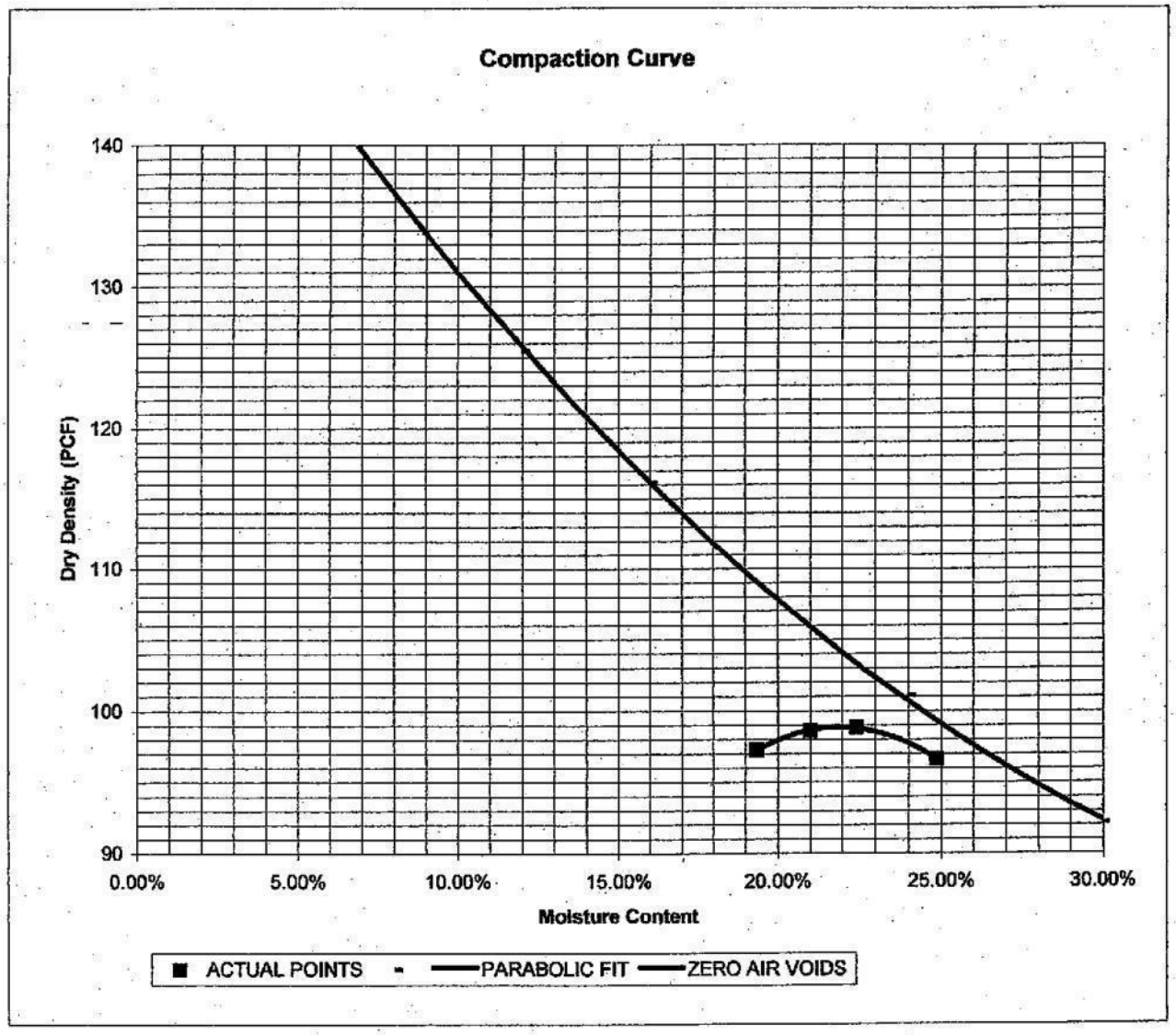
FIELD DENSITY RESULTS

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

PROJECT	1343-1355 MIRRILLION HTS	CLIENT	SUMMIT BUILDERS
SAMPLE LOCATION	EAST STOCKPILE	JOB NO.	91327
SOIL DESCRIPTION	CLAYSTONE, GRAY BROWN	DATE	04/23/07

IDENTIFICATION	CH	COMPACTION TEST #	1
TEST DESIGNATION / METHOD	ASTM D-698-A	TEST BY	SR
MAXIMUM DRY DENSITY (PCF)	99	OPTIMUM MOISTURE	22.0%



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

MOISTURE DENSITY RELATION

DRAWN:	DATE:	CHECKED:	DATE:

JOB NO.:

FIG NO.:

ENTECH
ENGINEERING, INC.

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

May 21, 2007

Summit Builders
P.O. Box 601
Palmer Lake, Colorado 80133-0601

Attn: Dennis Stern

Re: Drilled Pier Observation
1343, 1347, 1351 and 1355 Mirrillion Heights
Colorado Springs, Colorado

Dear Mr. Stern:

As requested, personnel of Entech Engineering, Inc. have performed a drilled pier observation at the above referenced site. The drilled pier observation was performed on May 4 through 7, 2007.

Drilling of the piers was observed by personnel of Entech Engineering, Inc. and approved for placement of concrete. The piers were of adequate length. The pier holes were cleaned prior to concrete placement. Seventy drilled piers were installed in substantial compliance with the foundation plans by Entech Engineering, Inc. dated September 1, 2006, Revised April 191, 2007, Job No. 84456. The piers observed correspond with pier grid locations shown on the attached detail (Figure 1). The Records of Drilled Pier Installation Logs are also attached.

We trust that this report has provided you with the information you required. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

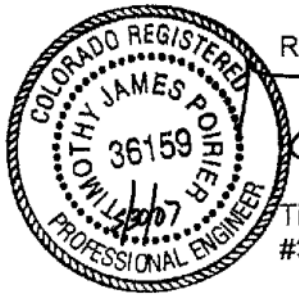
ENTECH ENGINEERING, INC.

Daniel P. Stegman

DPS/mf

Encl.

Entech Job No. 91327
2MSW/ltr/2007/91327dpo-ltr



Reviewed by:

Timothy J. Poirier, P. E.
#36159

RECORD OF DRILLED PIER INSTALLATION

PROJECT: Summit Builders

DATE OF DRILLING: 5/4/07 to 5/7/07

JOB NUMBER: 91327

REPORT NUMBER: 1

SHEET 1 OF 12

PIER NUMBER		1	2	3	4	5	6
DATE OF CONCRETE		5/4/07	5/4/07	5/4/07	5/4/07	5/4/07	5/4/07
PIER DIAMETER		10"	10"	10"	10"	10"	10"
PENETRATION	REQUIRED	4'	4'	4'	4'	4'	4'
	ACTUAL	16'	12'	11'-7"	11'-5"	12'	13'
LENGTH	PLANNED	20'	20'	20'	20'	20'	20'
	ACTUAL	25'	20'	20'-7"	20'-5	21'	22'
REQUIRED MINIMUM LENGTH		20'	20'	20'	20'	20'	20'
REI	NUMBER AND SIZE	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's
	BAR LENGTH	29'	24'	24'	24'	24'	24'
	TIES (#3)	36"	36"	36"	36"	36"	36"
PLUMBNESS		OK	OK	OK	OK	OK	OK
SHEAR RINGS		OK	OK	OK	OK	OK	OK
CONCRETE	THEORETICAL SLUMP	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"
	ACTUAL SLUMP						
WATER		None	None	None	None	None	None
BEARING STRATUM DESCRIPTION		Claystone	Claystone	Claystone	Claystone	Claystone	Claystone
CASING REQUIRED		No	No	No	No	No	No

REPRESENTATIVE: Ryan Smith

REVIEWED BY: Dan P. Stegman

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RECORD OF DRILLED PIER INSTALLATION

PROJECT: Summit Builders

DATE OF DRILLING: 5/4/07 to 5/7/07

JOB NUMBER: 91327

REPORT NUMBER: 1

SHEET 2 OF 12

PIER NUMBER		7	8	9	10	11	12
DATE OF CONCRETE		5/4/07	5/4/07	5/4/07	5/4/07	5/4/07	5/4/07
PIER DIAMETER		10"	10"	10"	10"	10"	10"
PENETRATIO	REQUIRED	4'	4'	4'	4'	4'	4'
	ACTUAL	12'-8"	12'-5"	14'	12'	12'-1	11'-6"
LENGTH	PLANNED	20'	20'	20'	20'	20'	20'
	ACTUAL	21'-8"	21'-5"	21'	21'	21'-1"	20'-6"
REQUIRED MINIMUM LENGTH		20'	20'	20'	20'	20'	20'
REINFORCEMENT	NUMBER AND SIZE	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's
	BAR LENGTH	24"	24"	24"	24"	24"	24"
	TIES (#3)	36"	36"	36"	36"	36"	36"
PLUMBNESS		OK	OK	OK	OK	OK	OK
SHEAR RINGS		OK	OK	OK	OK	OK	OK
CONCRETE	THEORETICAL SLUMP	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"
	ACTUAL SLUMP						
WATER		None	None	4"	None	5"	4 – 5"
BEARING STRATUM DESCRIPTION		Claystone	Claystone	Claystone	Claystone	Claystone	Claystone
CASING REQUIRED		No	No	No	No	No	No

REPRESENTATIVE: : Ryan Smith

REVIEWED BY: : Dan P. Stegman

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RECORD OF DRILLED PIER INSTALLATION

PROJECT: Summit Builders

DATE OF DRILLING: 5/4/07 to 5/7/07 | JOB NUMBER: 91327 | REPORT NUMBER: 1 | SHEET 3 OF 12

PIER NUMBER		13	14	15	16	17	18
DATE OF CONCRETE		5/4/07	5/4/07	5/4/07	5/4/07	5/4/07	5/4/07
PIER DIAMETER		10"	10"	10"	10"	10"	10"
PENETRATIO	REQUIRED	4'	4'	4'	5	4'	4'
	ACTUAL	12'	12'-2"	13'	13'	11'	12'-1
LENGTH	PLANNED	20'	20'	20'	21'	20'	20'
	ACTUAL	21'	21'-2"	21'	21'	21'	21'-1"
REQUIRED MINIMUM LENGTH		20'	20'	20'	21'	20'	20'
REINFORCEME	NUMBER AND SIZE	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's
	BAR LENGTH	24"	24"	24"	24"	24"	24"
	TIES (#3)	36"	36"	36"	36"	36"	36"
PLUMBNESS		OK	OK	OK	OK	OK	OK
SHEAR RINGS		OK	OK	OK	OK	OK	OK
CONCRET	THEORETICAL SLUMP	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"
	ACTUAL SLUMP						
WATER		None	None	None	None	None	None
BEARING STRATUM DESCRIPTION		Claystone	Claystone	Claystone	Claystone	Claystone	Claystone
CASING REQUIRED		No	No	No	No	No	No

REPRESENTATIVE: Ryan Smith

REVIEWED BY: Dan P. Stegman

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RECORD OF DRILLED PIER INSTALLATION

PROJECT: Summit Builders

DATE OF DRILLING: 5/4/07 to 5/7/07 | JOB NUMBER: 91327 | REPORT NUMBER: 1 | SHEET 4 OF 12

PIER NUMBER		19	20	21	22	23	24
DATE OF CONCRETE		5/4/07	5/4/07	5/4/07	5/4/07	5/4/07	5/4/07
PIER DIAMETER		10"	10"	10"	10"	10"	10"
PENETRATIO	REQUIRED	4'	4'	4'	4'	4'	4'
	ACTUAL	11'-6"	10'-5"	12'-8"	11'-8"	10'-11"	12'-1"
LENGTH	PLANNED	20'	20'	20'	20'	20'	20'
	ACTUAL	20'-6"	20'-5"	20'-8"	20'-8"	20'-11"	21'-1"
REQUIRED MINIMUM LENGTH		20'	20'	20'	20'	20'	20'
REINFORCEMENT	NUMBER AND SIZE	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's
	BAR LENGTH	24"	24"	24"	24"	24"	24"
	TIES (#3)	36"	36"	36"	36"	36"	36"
PLUMBNESS		OK	OK	OK	OK	OK	OK
SHEAR RINGS		OK	OK	OK	OK	OK	OK
CONCRET	THEORETICAL SLUMP	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"
	ACTUAL SLUMP						
WATER		None	None	None	None	None	None
BEARING STRATUM DESCRIPTION		Claystone	Claystone	Claystone	Claystone	Claystone	Claystone
CASING REQUIRED		No	No	No	No	No	No

REPRESENTATIVE: Ryan Smith

REVIEWED BY: Dan P. Stegman

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RECORD OF DRILLED PIER INSTALLATION

PROJECT: Summit Builders

DATE OF DRILLING: 5/4/07 | JOB NUMBER: 91327 | REPORT NUMBER: 1 | SHEET 5 OF 12

PIER NUMBER		25	26	27	28	29	30
DATE OF CONCRETE		5/4/07	5/4/07	5/4/07	5/4/07	5/4/07	5/4/07
PIER DIAMETER		10"	10"	10"	10"	10"	10"
PENETRATION	REQUIRED	5'	4'	4'	4'	4'	4'
	ACTUAL	14'-3"	11'-11"	11'	14'	15'-2"	15'
LENGTH	PLANNED	21'	20'	20'	20'	20'	20'
	ACTUAL	21'-3"	20'-11"	21'	21'	21'- ½"	21'
REQUIRED MINIMUM LENGTH		21'	20'	20'	20'	20'	20'
REINFORCEMENT	NUMBER AND SIZE	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's
	BAR LENGTH	24"	24"	24"	24"	24"	24"
	TIES (#3)	36"	36"	36"	36"	36"	36"
PLUMBNESS		OK	OK	OK	OK	OK	OK
SHEAR RINGS		OK	OK	OK	OK	OK	OK
CONCRET	THEORETICAL SLUMP	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"
	ACTUAL SLUMP						
WATER		None	None	None	None	None	None
BEARING STRATUM DESCRIPTION		Claystone	Claystone	Claystone	Claystone	Claystone	Claystone
CASING REQUIRED		No	No	No	No	No	No

REPRESENTATIVE: Ryan Smith

REVIEWED BY: Dan P. Stegman

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RECORD OF DRILLED PIER INSTALLATION

PROJECT: Summit Builders

DATE OF DRILLING: 5/4/07 to 5/7/07 | JOB NUMBER: 91327 | REPORT NUMBER: 1 | SHEET 6 OF 12

PIER NUMBER		31	32	33	34	35	36
DATE OF CONCRETE		5/4/07	5/5/07	5/5/07	5/5/07	5/5/07	5/5/07
PIER DIAMETER		10"	10"	10"	10"	10"	10"
PENETRATION	REQUIRED	4'	4'	5'	4'	4'	4'
	ACTUAL	14'-5"	14'-5"	15'-3"	14'-6"	14'-7"	14'-8"
LENGTH	PLANNED	20'	20'	21'	20'	20'	20'
	ACTUAL	20'-5"	20'-5"	21'-3"	20'-6"	20'-7"	2-'-8"
REQUIRED MINIMUM LENGTH		20'	20'	21'	20'	20'	20'
REINFORCEMENT	NUMBER AND SIZE	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's
	BAR LENGTH	24"	24"	24"	24"	24"	24"
	TIES (#3)	36"	36"	36"	36"	36"	36"
PLUMBNESS		OK	OK	OK	OK	OK	OK
SHEAR RINGS		OK	OK	OK	OK	OK	OK
CONCRETE	THEORETICAL SLUMP	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"
	ACTUAL SLUMP						
WATER		None	None	5"	None	4"	None
BEARING STRATUM DESCRIPTION		Claystone	Claystone	Claystone	Claystone	Claystone	Claystone
CASING REQUIRED		No	No	No	No	No	No

REPRESENTATIVE: Ryan Smith

REVIEWED BY: Dan P. Stegman

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RECORD OF DRILLED PIER INSTALLATION

PROJECT: Summit Builders

DATE OF DRILLING: 5/5/07 | JOB NUMBER: 91327 | REPORT NUMBER: 1 | SHEET 7 OF 12

PIER NUMBER		37	38	39	40	41	42
DATE OF CONCRETE		5/5/07	5/5/07	5/5/07	5/5/07	5/5/07	5/5/07
PIER DIAMETER		10"	10"	10"	10"	10"	10"
PENETRATION	REQUIRED	5'	4'	4'	5'	4'	4'
	ACTUAL	15'	15'	14'-6'	15'-1"	15'-3"	14'-5"
LENGTH	PLANNED	21'	20'	20'	21'	20'	21'
	ACTUAL	21'	21'	20'-6"	21'-1"	21'-3"	20'-5"
REQUIRED MINIMUM LENGTH		21'	20'	20'	21'	20'	20'
REINFORCEMENT	NUMBER AND SIZE	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's
	BAR LENGTH	24"	24"	24"	24"	24"	24"
	TIES (#3)	36"	36"	36"	36"	36"	36"
PLUMBNESS		OK	OK	OK	OK	OK	OK
SHEAR RINGS		OK	OK	OK	OK	OK	OK
CONCRETE	THEORETICAL SLUMP	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"
	ACTUAL SLUMP						
WATER		None	None	None	None	None	None
BEARING STRATUM DESCRIPTION		Claystone	Claystone	Claystone	Claystone	Claystone	Claystone
CASING REQUIRED		No	No	No	No	No	No

REPRESENTATIVE: Ryan Smith

REVIEWED BY: Dan P. Stegman

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RECORD OF DRILLED PIER INSTALLATION

PROJECT: Summit Builders

DATE OF DRILLING: 5/5/07 | JOB NUMBER: 91327 | REPORT NUMBER: 1 | SHEET 8 OF 12

PIER NUMBER		43	44	45	46	47	48
DATE OF CONCRETE		5/5/07	5/5/07	5/5/07	5/5/07	5/5/07	5/5/07
PIER DIAMETER		10"	10"	10"	10"	10"	10"
PENETRATION	REQUIRED	4'	4'	4'	4'	4'	5'
	ACTUAL	11'-9"	12'-2"	12'	11'-7"	11'-8"	17'
LENGTH	PLANNED	20'	20'	20'	20'	20'	21'
	ACTUAL	20'-9"	21'-2"	21'	20'-7"	20'-8"	21'
REQUIRED MINIMUM LENGTH		20'	20'	20'	20'	20'	21'
REINFORCEMENT	NUMBER AND SIZE	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's
	BAR LENGTH	24"	24"	24"	24"	24"	24"
	TIES (#3)	36"	36"	36"	36"	36"	36"
PLUMBNESS		OK	OK	OK	OK	OK	OK
SHEAR RINGS		OK	OK	OK	OK	OK	OK
CONCRETE	THEORETICAL SLUMP	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"
	ACTUAL SLUMP						
WATER		None	None	None	None	None	2"
BEARING STRATUM DESCRIPTION		Claystone	Claystone	Claystone	Claystone	Claystone	Claystone
CASING REQUIRED		No	No	No	No	No	No

REPRESENTATIVE: Ryan Smith

REVIEWED BY: Dan P. Stegman

2MSW/form/2007/91327dpo

RECORD OF DRILLED PIER INSTALLATION

PROJECT: Summit Builders

DATE OF DRILLING: 5/5/07 | JOB NUMBER: 91327 | REPORT NUMBER: 1 | SHEET 9 OF 12

PIER NUMBER		49	50	51	52	53	54
DATE OF CONCRETE		5/5/07	5/5/07	5/5/07	5/5/07	5/5/07	5/5/07
PIER DIAMETER		10"	10"	10"	10"	10"	10"
5'	REQUIRED	5'	5'	4'	4'	4'	5'
	ACTUAL	17'	18'-1"	17'-6"	16'-8"	18'-1"	18'-5"
LENGTH	PLANNED	21'	21'	20'	20'	20'	21'
	ACTUAL	21'	21'-1"	21'-6"	20'-8"	21'-1"	21'-5"
REQUIRED MINIMUM LENGTH		21'	21'	20'	20'	20'	21'
REINFORCEMENT	NUMBER AND SIZE	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's
	BAR LENGTH	24"	24"	24"	24"	24"	24"
	TIES (#3)	36"	36"	36"	36"	36"	36"
PLUMBNESS		OK	OK	OK	OK	OK	OK
SHEAR RINGS		OK	OK	OK	OK	OK	OK
CONCRETE	THEORETICAL SLUMP	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"
	ACTUAL SLUMP						
WATER		1.5"	5"	1.5"	None	4"	None
BEARING STRATUM DESCRIPTION		Claystone	Claystone	Claystone	Claystone	Claystone	Claystone
CASING REQUIRED		No	No	No	No	No	No

REPRESENTATIVE: Ryan Smith

REVIEWED BY: Dan P. Stegman

2MSW/form/2007/91327dpo

RECORD OF DRILLED PIER INSTALLATION

PROJECT: Summit Builders

DATE OF DRILLING: 5/5/07 | JOB NUMBER: 91327 | REPORT NUMBER: 1 | SHEET 10 OF 12

PIER NUMBER		55	56	57	58	59	60
DATE OF CONCRETE		5/5/07	5/5/07	5/5/07	5/5/07	5/5/07	5/5/07
PIER DIAMETER		10"	10"	10"	10"	10"	10"
PENETRATION	REQUIRED	5'	5'	4'	4'	5'	5'
	ACTUAL	18'-1"	18'-3"	18'-1"	18'	18'	18'-1"
LENGTH	PLANNED	21'	21'	20'	20'	21'	21'
	ACTUAL	12'-1"	21'-3"	21'-1"	21'	21'	21'-1"
REQUIRED MINIMUM LENGTH		21'	21'	20'	20'	21'	21'
REINFORCEMENT	NUMBER AND SIZE	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's
	BAR LENGTH	24"	24"	24"	24"	24"	24"
	TIES (#3)	36"	36"	36"	36"	36"	36"
PLUMBNESS		OK	OK	OK	OK	OK	OK
SHEAR RINGS		OK	OK	OK	OK	OK	OK
CONCRETE	THEORETICAL SLUMP	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"
	ACTUAL SLUMP						
WATER		None	None	4"	None	None	None
BEARING STRATUM DESCRIPTION		Claystone	Claystone	Claystone	Claystone	Claystone	Claystone
CASING REQUIRED		No	No	No	No	No	No

REPRESENTATIVE: Ryan Smith

REVIEWED BY: Dan P. Stegman

2MSW/form/2007/91327dpo

RECORD OF DRILLED PIER INSTALLATION

PROJECT: Summit Builders

DATE OF DRILLING: 5/5/07 – 5/7/07 | JOB NUMBER: 91327 | REPORT NUMBER: 1 | SHEET 11 OF 12

	PIER NUMBER	61	62	63	64	65	66
	DATE OF CONCRETE	5/5/07	5/5/07	5/7/07	5/7/07	5/7/07	5/7/07
	PIER DIAMETER	10"	10"	10"	10"	10"	10"
PENETRATION	REQUIRED	5'	4'	4'	5'	5'	5'
	ACTUAL	18'-4"	18'-5"	18'-2"	18'-2"	18'-3"	18'-4"
LENGTH	PLANNED	21'	20'	20'	21'	21	21'
	ACTUAL	21'-4"	21'-5"	21'-2"	21'-2"	21'-3"	21'-4"
	REQUIRED MINIMUM LENGTH	21'	20'	20'	21'	21'	21'
REINFORCEMENT	NUMBER AND SIZE	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's	(3) #5's
	BAR LENGTH	24"	24"	24"	24"	24"	24"
	TIES (#3)	36"	36"	36"	36"	36"	36"
	PLUMBNESS	OK	OK	OK	OK	OK	OK
	SHEAR RINGS	OK	OK	OK	OK	OK	OK
CONCRETE	THEORETICAL SLUMP	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"	5 – 7"
	ACTUAL SLUMP						
	WATER	None	None	None	None	None	None
	BEARING STRATUM DESCRIPTION	Claystone	Claystone	Claystone	Claystone	Claystone	Claystone
	CASING REQUIRED	No	No	No	No	No	No

REPRESENTATIVE: Ryan Smith

REVIEWED BY: Dan P. Stegman

2MSW/form/2007/91327dpo

RECORD OF DRILLED PIER INSTALLATION

PROJECT: Summit Builders

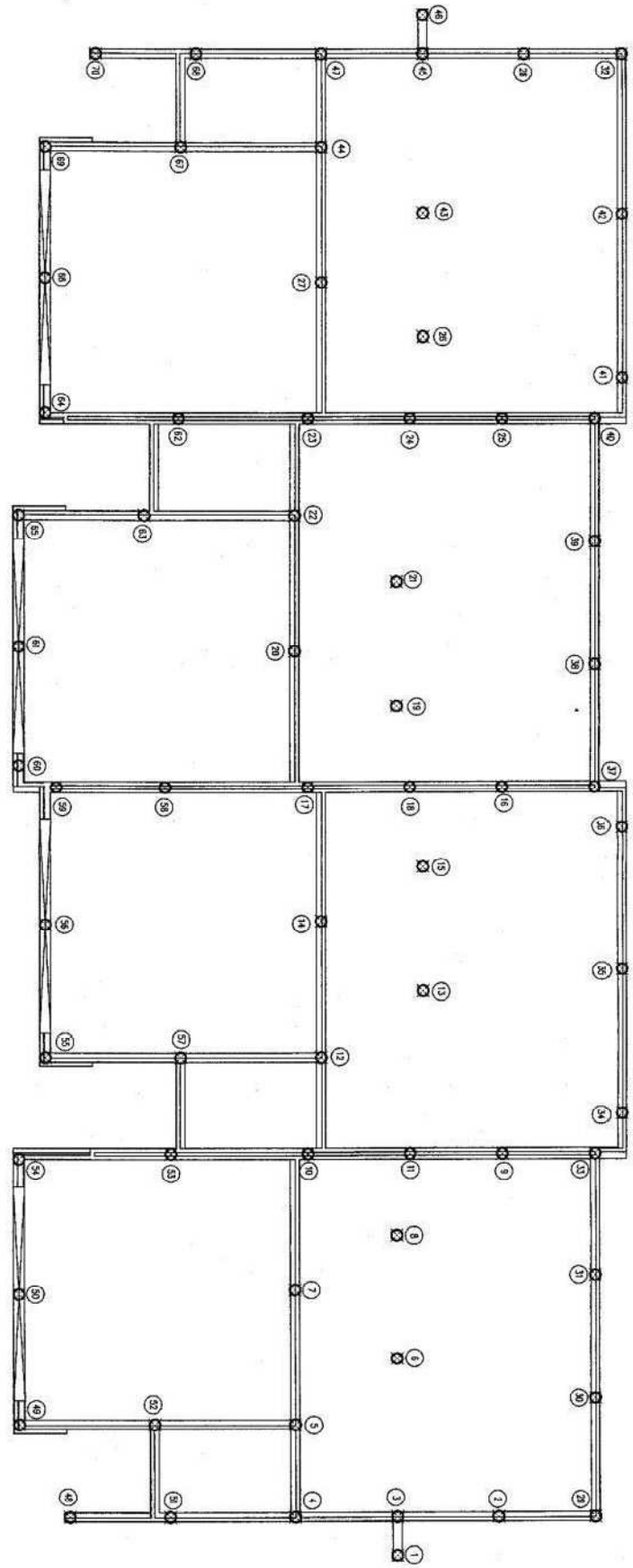
DATE OF DRILLING: 5/7/07 JOB NUMBER: 91327 REPORT NUMBER 1 SHEET 12 OF 12

PIER NUMBER		67	68	69	70		
DATE OF CONCRETE		5/7/07	5/7/07	5/7/07	5/7/07		
PIER DIAMETER		10"	10"	10"	10"		
PENETRATION	REQUIRED	4'	4'	5'	5'		
	ACTUAL	18'-5"	18'	18'-10"	18'-6"		
LENGTH	PLANNED	20'	20'	21'	21'		
	ACTUAL	21'-5"	21'	21'-10"	21'-6"		
REQUIRED MINIMUM LENGTH		20'	20'	21'	21'		
REINFORCEMENT	NUMBER AND SIZE	(3) #5's	(3) #5's	(3) #5's	(3) #5's		
	BAR LENGTH	24"	24"	24"	24"		
	TIES (#3)	36"	36"	36"	36"		
PLUMBNESS		OK	OK	OK	OK		
SHEAR RINGS		OK	OK	OK	OK		
CONCRETE	THEORETICAL SLUMP	5 – 7"	5 – 7"	5 – 7"	5 – 7"		
	ACTUAL SLUMP						
WATER		None	None	1"	None		
BEARING STRATUM DESCRIPTION		Claystone	Claystone	Claystone	Claystone		
CASING REQUIRED		No	No	No	No		

REPRESENTATIVE: Ryan Smith

REVIEWED BY: Dan P. Stegman

2MSW/form/200791327dpo



(28) DRILLED PIER NUMBER - SEE ATTACHED OBSERVATION LOGS

STATE OF COLORADO P.E. NO. - 36159

COLORADO REGISTERED PROFESSIONAL ENGINEER
TIMOTHY J. JAMES POIRIER
36159

DRAWN BY: M. KELLY	
REVIEWED BY: T. POIRIER	
CHECKED BY:	
DATE: 5/29/07	
SCALE: NTS	
JOB NO.: 91317	
SHEET NO.: 1 OF 1 SHEETS	

PIER LOCATION PLAN
4 UNIT TOWNHOME
1343, 1347, 1351, & 1355 MIRRILLION HEIGHTS
COLORADO SPRINGS, CO
FOR: SUMMIT BUILDERS

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

REVISIONS	BY:

COLORADO GEOLOGICAL SURVEY

1801 Moly Road
Golden, Colorado 80401

Matthew L. Morgan
State Geologist

July 30, 2024

Joel Dagnillo
Engineering Development Review
2880 International Circle, #200-7
Colorado Springs, CO 80910

Location:
SE ¼ of NE ¼ of Section 11
T14S, R67W of the 6th PM
38.8484°, -104.8538°

Subject: **Sun Mountain Townhomes**
Colorado Springs, El Paso County, CO
STM-REV24-0906; CGS Unique No. EP-25-0003

Joel,

The Colorado Geological Survey (CGS) has reviewed the referral for residential development (townhomes) with a disturbed area of approximately 2.52 acres. We received the Development Plan (MVE, Project 51516, July 2, 2024) and the Geologic Hazard Assessment (Entech, Job Number 221101, July 1, 2024). We reviewed the previous application for apartments at this site (August 9, 2022, and February 16, 2023). These earlier review letters for the development of this property are considered part of this review.

Entech has addressed many of the development concerns outlined in our review of a previous concept plan at this location. The city ordinance requires an evaluation and discussion of potential impacts to adjacent properties, and we recommend that the city require this before approval of the development plan for the Uintah Townhomes. This should include an evaluation and discussion of any potential impacts from the planned retaining walls to the adjacent Lot 2 of the Lofts at Mirrillion or potential impacts from the project to Lots 13, 14, 15, and 16 of the Lofts at Mirrillion.

Entech states p.8, “Additional detailed site investigation is recommended at each building location prior to construction. Any special mitigation should be determined at that time.” They also state, “The proposed grading plan with engineered retaining walls and mitigation of expansive soils is appropriate for the site. Mitigation measures/approaches required for each building will be provided once building locations and grading are finalized.” We recommend that the city require these additional detailed site investigations in the future as a condition of approval. A site-specific investigation should also be required by the city for the planned retaining walls as part of the subsurface investigation for the global stability of the walls to determine “Any special mitigation…” that may be needed for the walls and any potential impacts they will have on the existing structure and its deep foundation at Lot 2 of the Lofts at Mirrillion. Site-specific investigations for Lots 9, 10, 11, and 12 should also be required to discuss potential impacts on Lots 13, 14, 15, and 16 of the Lofts at Mirrillion.

<u>Before the development plan is approved,</u> CGS recommends

- The city require an amendment to the Geologic Hazard Assessment that includes an evaluation and discussion of potential impacts to adjacent properties, as outlined in this letter and required by the city ordinance.

As conditions of approval, once the geologic hazard assessment is amended, CGS recommends the city require additional site investigations

- For each building location, as recommended by Entech.
- Not just for the buildings but also for the retaining walls, including an analysis of site-specific global stability of the retaining wall system based on a subsurface investigation at the wall location.

Thank you for the opportunity to comment on this project. If you have questions or require further review, please email me at jlovekin@mines.edu.

Sincerely,

Jonathan R. Lovekin, P.G.
Senior Engineering Geologist

COLORADO GEOLOGICAL SURVEY

1801 Moly Road
Golden, Colorado 80401

Matthew L. Morgan
State Geologist

October 21, 2024

Joel Dagnillo
Engineering Development Review
2880 International Circle, #200-7
Colorado Springs, CO 80910

Location:
SE ¼ of NE ¼ of Section 11
T14S, R67W of the 6th PM
38.8484°, -104.8538°

Subject: **Sun Mountain Townhomes**
Colorado Springs, El Paso County, CO
STM-REV24-0906; CGS Unique No. EP-25-0003_2

Joel,

The Colorado Geological Survey (CGS) has reviewed the response letter (Entech, Job No 221101, September 4, 2022) for this resubmittal. We reviewed the previous application for apartments at this site (August 9, 2022, and February 16, 2023) and the current submittal on July 30, 2024. These earlier review letters for the development of this property are considered part of this review. We offer the following comments and recommendations.

Entech has addressed our previous comments. CGS has no objection to the approval of the initial development plan, provided that the additional investigations recommended by Entech are required as conditions of approval. These include:

- Additional site investigations for each building location and retaining walls that include additional test borings and site-specific global stability analysis once final development plans are generated.
- Retaining walls are designed by a qualified engineer for global stability. CGS also recommends that the retaining wall design discuss any temporary shoring requirements that may be required due to the site's geologic conditions.

CGS looks forward to reviewing the final development plan and the results of the additional investigations and stability analysis for the retaining walls when they become available.

Thank you for the opportunity to comment on this project. If you have questions or require further review, please email me at jlovekin@mines.edu.

Sincerely,

Jonathan R. Lovekin, P.G.
Senior Engineering Geologist