Structural
Geotechnical

Materials Testing
Forensic

PRELIMINARY SUBSURFACE SOIL INVESTIGATION

Windermere Zone Change
Windermere Subdivision, Filing No. 2
El Paso County, Colorado

PREPARED FOR:

Colo Windermere #2 LLC
4164 Austin Bluffs Pkwy Ste 361
Colorado Springs, CO 80918

JOB NO. 195043

October 8, 2024

Respectfully Submitted,

RMG – Rocky Mountain Group

Jared McElmeel, E.I.
Geotechnical Staff Engineer

Reviewed by,

RMG – Rocky Mountain Group

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COLORADO REGISTERED
ANTHONY P. MUNGER
10/8/24
39818
PROFESSIONAL ENGINEER

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GENERAL SITE AND PROJECT DESCRIPTION

Project Description

The site is located in the eastern portion of Colorado Springs, Colorado, north of North Carefree Circle and west of Marksheffel Road. Mardale Lane forms the north boundary of the property. Antelope Ridge Drive forms the west boundary of the property. The approximate location of the site is shown on the Site Vicinity Map, Figure 1.

The 9.13-acre site will be developed with single-family residential construction in the Windermere Subdivision, Filing No. 1. The structures are anticipated to be one to two-stories in height with multi-car garages. It is our understanding that the homes are to be constructed atop crawlspace foundations. RMG - Rocky Mountain Group was retained to explore the subsurface conditions at the site and develop geotechnical engineering recommendations for design and construction.

Existing Site Conditions

The site is presently developed for residential lots. Utilities have been installed, as has curb-and-gutter within the roadway alignments, and the roads have been paved. Filing No. 1 is presently undergoing overlot grading.

Previous Studies and Field Investigation

Reports of previous geotechnical engineering/geologic investigations for this site were available for our review and are listed below:

1. *Preliminary Subsurface Soil Investigation, N. Carefree Circle and Marksheffel Road, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 162062, last dated February 5, 2019.
2. *Addendum to Subsurface Soil Investigation, Windermere Subdivision, North Carefree Circle and Marksheffel Road, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 162062, last dated February 5, 2019.
3. *Subsurface Soil Investigation, Windermere Subdivision, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, Job No. 142206, last dated May 28, 2015.
4. *Addendum to Preliminary Soils and Geology Report, Windermere, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 142206, last dated November 14, 2014.
5. *Field Activity Reports – Windermere, Colorado Springs, Colorado,* RMG – Rocky Mountain Group, Job No. 180910, May 13, 2021 through June 10, 2021.
6. *Addendum to Soils and Geology Study – Proposed Zone Change, Windermere Subdivision – Zone Change, El Paso County, Colorado,* RMG – Rocky Mountain Group, Job No. 195043, last dated November 29, 2023.
7. *Preliminary Soils and Geology Report, Hilltop Subdivision, North Carefree Circle and Marksheffel Raod, El Paso County, Colorado,* prepared by RMG Engineers, Job No. 142206, last dated March 5, 2014.
8. *Soils and Geology Study, Windermere Subdivision, El Paso County, Colorado,* RMG – Rocky Mountain Group, Job No. 162062, last dated January 18, 2021

The findings, conclusions and recommendations contained in these reports were considered during the preparation of this report.

FIELD INVESTIGATION AND LABORATORY TESTING

Drilling

The subsurface conditions on the site were investigated by drilling 2 exploratory test borings for the single lot development. The approximate locations of the test borings are presented in the Test Boring Location Plan, Figure 2. 9 previous test borings from the referenced investigations are included in that figure.

The test borings were advanced with a power-driven, continuous-flight auger drill rig. 1 Test Boring was advanced to a depth of 20 feet below the existing ground surface, and 1 Test Boring was advanced to a depth of 30 feet below the existing ground surface. Samples were obtained in general accordance with ASTM D-1586 utilizing a 2-inch OD split-barrel sampler or in general accordance with ASTM D-3550 utilizing a 2½-inch OD modified California sampler. An Explanation of Test Boring Logs is presented in Figure 3. The Test Boring Logs are presented in Figure 4.

Laboratory Testing

The moisture content for the recovered samples was obtained in the laboratory. Grain-size analysis, Atterberg Limits, and Denver Swell/Consolidation tests were performed on selected samples for purposes of classification and to develop pertinent engineering properties. A Summary of Laboratory Test Results is presented in Figure 5. Soils Classification Data are presented in Figure 6. Swell/Consolidation Test Results are presented in Figure 7.

SUBSURFACE CONDITIONS

Subsurface Materials

The subsurface materials encountered in the test borings were classified using the Unified Soils Classification System (USCS) and the materials were grouped into the general categories of silty to clayey sand fill, native sandy clay, silty sandstone and sandy claystone.

Additional descriptions and the interpreted distribution (approximate depths) of the subsurface materials are presented on the Test Boring Logs. The classifications shown on the logs are based upon the engineer's classification of the samples at the depths indicated. Stratification lines shown on the logs represent the approximate boundaries between material types and the actual transitions may be gradual and vary with location.

Groundwater

Groundwater was observed in 1 of the test borings performed for this investigation at a depth ranging from 20 feet below the existing ground surface at the time of field exploration. Fluctuations in groundwater and subsurface moisture conditions may occur due to variations in rainfall and other factors not readily apparent at this time. Development of the property and adjacent properties may also affect groundwater levels.

CONSTRUCTION CONSIDERATIONS

Overexcavation and Replacement Concepts

Fill soils were encountered during our investigation. Based on our review of the previous geotechnical reports referenced above and the results of our field investigation, it appears that the fill soils were placed in a controlled manner. However, due to the variability in selection, placement, and compaction of fill soils, areas of unsuitable fill may exist even within a "controlled" fill. Furthermore, fill soils placed on the site subsequent to our investigation will be considered to be non-engineered fill unless appropriate documentation is provided to RMG indicating that those fill soils were placed as a controlled (structural) fill, with appropriate observations and testing during placement by a registered Colorado engineer. Unsuitable fill soils (whether non-engineered or deemed unsuitable due to improper selection, placement, or compaction) may be encountered in the excavations, even where none are indicated on the test boring logs. All such unsuitable fill soils are not suitable for direct support of foundation components.

Clay and claystone were encountered in 1 of the test borings performed for this investigation. If expansive soils or bedrock are encountered near foundation or floor slab bearing levels, overexcavation and replacement with non-expansive structural fill to depths of approximately 3 to 4 feet below foundation components should be anticipated. However, depending on the soil conditions encountered in the site specific subsurface soil investigations, overexcavation to deeper depths may be required. Note, the on-site clay soils and claystone bedrock are not recommended for use as structural fill below foundation components of floor slabs.

Loose to medium dense sands were not encountered in the test borings. Sandstone was typically encountered at 7 feet depth. Loose sands will typically require additional compaction to achieve the allowable bearing pressure indicated in this report. In some cases, removal and recompaction may be required for loose soils.

Anticipated Foundation Concepts

Based on the information presented previously, conventional shallow foundation systems consisting of standard spread footings/stemwalls or stiffened slabs are anticipated to be suitable for the proposed residential structures on the proposed lots. Alternative foundation systems are not anticipated. It is assumed that the deepest excavation cuts will be approximately 3 to 4 feet below the final ground surface, not including overexcavation or subexcavation which may be required.

The foundation system for each lot should be designed and constructed based upon recommendations developed in a detailed Subsurface Soil Investigation completed after site development activities are complete. The recommendations presented in the Subsurface Soils Investigation should be verified following the excavation on each lot and evaluation of the building loads.

Note, even after the recommended overexcavation and replacement is completed, it is possible that some of the replacement soils will exhibit low-density or expansive characteristics. In all cases, contractors shall retain the responsibility for excavating to the appropriate line and grade, for the quality of their work, for adhering to plans and specifications, and for repairing defects regardless of when they are discovered.

The allowable bearing pressures to be used for design of foundation components should be determined by a detailed site specific Subsurface Soils Investigation. Allowable bearing pressures are anticipated to range from 2,000 to 3,000 psf for native, undisturbed sand soils. An allowable bearing pressure of 2,000 psf is anticipated for granular, non-expansive soils compacted as indicated herein.

Foundation and basement walls should be designed to resist lateral pressures. For granular, non-expansive soils used as exterior backfill around foundations, an equivalent fluid pressure (EFP) of 40 pcf may be used for design. On-site expansive soils as exterior backfill around foundations should typically be avoided. However, if the client elects to use expansive soils as backfill against foundation walls, higher lateral pressures should be anticipated. The lateral pressures presented herein apply to level, drained backfill conditions. Lateral pressures for sloping/undrained conditions or for expansive backfill soils should be determined on an individual basis.

Foundation Drains

A subsurface perimeter drain is recommended around portions of the structure which will have habitable or storage space located below the finished ground surface. This includes crawlspace areas but not the walkout trench, if applicable. Groundwater encountered during the subsurface investigation was approximately 20 feet below existing ground surface. Depending on the conditions encountered during the lot specific Subsurface Soils Investigation and the conditions observed at the time of the Open Excavation Observation, additional subsurface drainage systems may be recommended.

One such system is an underslab drainage layer to help intercept groundwater before it enters the slab area should the groundwater levels rise. In general, if groundwater was encountered within 4 to 6 feet of the proposed basement slab elevation, an underslab drain should be anticipated. Another such system would consist of a subsurface drain and/or vertical drain board placed around the perimeter of the overexcavation to help intercept groundwater and allow for proper placement and compaction of the replacement structural fill. Careful attention should be paid to grade and discharge of the drain pipes of these systems.

It must be understood that the drain systems are designed to intercept some types of subsurface moisture and not others. Therefore, the drains could operate properly and not mitigate all moisture problems relating to foundation performance or moisture intrusion into the basement area.

Floor Slabs

Slab performance risk evaluation is an engineering judgement which is used as a predictor of the general magnitude of potential slab heave, and the risk of poor slab performance. The Slab Performance Risk within the upper 10 feet at this site is judged to be 'Low" (less than 2% swell under a 1,000 psf surcharge) based on the criteria in the following table.

Slab Performance Risk Categories

Slab Performance Risk Category	Representative Percent Swell (500 psf Surcharge)	Representative Percent Swell (1,000 psf Surcharge)
Low	0 to < 3	0 to < 2
Moderate	3 to < 5	2 to < 4
High	5 to < 8	4 to < 6
Very High	>8	>6

Note: Based on Colorado Association of Geotechnical Engineers, Guidelines for Slab Performance Risk Evaluation and Residential Basement Floor System Recommendations (Denver Metropolitan Area, 1996).

Floor slabs should be separated from structural components to allow for vertical movement. Control and construction joints should be placed in accordance with the latest guidelines and standards published by the American Concrete Institute (ACI) and applicable local Building Code requirements.

A spread footing foundation is suitable for the proposed residential structures. We have anticipated that the deepest excavation cuts will be approximately 3 to 4 feet below the existing ground surface.

If the bottom of the excavation consists entirely of sandstone, a maximum allowable bearing pressure of 3,000 psf with no minimum dead load requirement may be used for design. However, the structure shall not be supported atop soils/bedrock of significantly different bearing capacities. If any portion of the structure is to be supported atop the on-site sand soils or on structural fill, the remaining portions of the excavation shall have the top 12 inches of exposed sandstone bedrock removed and replaced with structural fill.

For a structure supported atop sand soils and/or compacted structural fill, a maximum allowable bearing pressure of 2,000 psf with no minimum dead load requirement may be used for design.

The foundation design should be prepared by a qualified Colorado Registered Professional Engineer using the recommendations presented in this report. This foundation system should be designed to span a minimum of 10 feet under the design loads. The bottoms of exterior foundations should be at least 30 inches below finished grade for frost protection.

Floor Systems

It is our understanding that a structural floor system (supported by the foundation independently of the subgrade soils) is to be used for a portion of the interior floor system of the proposed structure.

Environmental health hazards associated with mold growth in crawlspaces must be reduced by utilizing "clean" construction methods. The floor should be properly sealed and vented. A ventilation system activated by temperature and humidity levels may be required in the crawlspace. The entire floor system and ventilation system should be designed by a qualified professional.

Interior Partitions

Where a crawlspace foundation system is being utilized, interior non-bearing partition walls and other attached finishes do not require isolation from the structural floor system.

Interior non-bearing partitions, trim work, finish materials and all attached furnishings (e.g., cabinets, shower stalls, etc.) on or over concrete slabs-on-grade shall be constructed with a void, or appropriate slip joint, so that they do not transmit the probable slab-on-grade movement noted above to the roof, overlying floor or other elements of the structure. Failure to strictly comply with this requirement is a material deviation from RMG's design and construction requirements and result in distress to structural and non-structural finish elements, including but not limited to cracked drywall and flooring, nail pops, cracked tile, jammed windows and doors, cracked window glass, etc. Typical construction practice is to install a void of not less than 1-1/2 inches beneath non-bearing partitions. The void may require reconstruction over the life of the structure to re-establish the void as the vertical slab movement may exceed the height of the initial void provided. Builder/Developer separately shall notify the owner of these conditions and requirements.

Surface Grading and Drainage

The ground surface should be sloped from the building with a minimum gradient of 10 percent for the first 10 feet. This is equivalent to 12 inches of fall across this 10-foot zone. If a 10-foot zone is not possible on the upslope side of the structure, then a well-defined swale should be created a minimum 5 feet from the foundation and sloped parallel with the wall with a minimum slope of 2 percent to intercept the surface water and transport it around and away from the structure. Roof drains should extend across backfill zones and landscaped areas to a region that is graded to direct flow away from the structure. Owners should maintain the surface grading and drainage recommended in this report to help prevent water from being directed toward and/or ponding near the foundations.

Landscaping should be selected to reduce irrigation requirements. Plants used close to foundation walls should be limited to those with low moisture requirements and irrigated grass should not be located within 5 feet of the foundation. To help control weed growth, geotextiles should be used below landscaped areas adjacent to foundations. Impervious plastic membranes are not recommended.

Irrigation devices should not be placed within 5 feet of the foundation. Irrigation should be limited to the amount sufficient to maintain vegetation. Application of more water will increase the likelihood of slab and foundation movements.

The recommendations listed in this report are intended to address normal surface drainage conditions, assuming the presence of groundcover (established vegetation, paved surfaces, and/or structures) throughout the regions upslope from this structure. However, groundcover may not be present due to a variety of factors (ongoing construction/development, wildfires, etc.). During periods when groundcover is not present in the "upslope" regions, higher than normal surface drainage conditions may occur, resulting in perched water tables, excess runoff, flash floods, etc. In these cases, the surface drainage recommendations presented herein (even if properly maintained) may not mitigate all groundwater problems or moisture intrusion into the structure. We recommend that the site plan be prepared with consideration of increased runoff during periods when groundcover is not present on the upslope areas.

Concrete

Sulfate testing was performed on selected samples based on ASTM C1580. Test results showed 0.09% by weight, indicating the soils present Class 0 (negligible) sulfate exposure. Based on these results Type I/II cement or an equivalent mixture according to ACI 201.2R-10 is suggested for concrete in contact with the subsurface materials. Cement type shall be designed and approved by a licensed Colorado Professional Engineer and Foundation Designer. Calcium chloride should not be used for the onsite soils. The concrete should not be placed on frozen ground. If placed during periods of cold temperatures, the concrete should be kept from freezing. This may require covering the concrete with insulated blankets and heating. Concrete work should be completed in accordance with the latest applicable guidelines and standards published by ACI.

EARTHWORK

Structural Fill

Areas to receive structural fill should have topsoil, organic material, or debris removed. The upper 6 inches of the exposed surface soils should be scarified and moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698) or to a minimum of 92 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557) prior to placing structural fill.

Structural fill placed on slopes should be benched into the slope. Maximum bench heights should not exceed 4 feet, and bench widths should be wide enough to accommodate compaction equipment.

Structural fill shall consist of granular, non-expansive material. It should be placed in loose lifts not exceeding 8 to 12 inches, moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 92 percent of the

maximum dry density as determined by the Modified Proctor test, ASTM D-1557. The materials should be compacted by mechanical means.

Materials used for structural fill should be approved by RMG prior to use. Structural fill should not be placed on frozen subgrade or allowed to freeze during moisture conditioning and placement. The on-site clay soils are not recommended for use as structural fill below foundation components.

Proposed Grading, Cuts and Masses of Fill

A grading plan has been prepared for the proposed new lots. Overlot grading and masses of fill are proposed. Based on the test borings performed previously by RMG for this property, the excavations will encounter a range of materials to include, silty to clayey sand (fill and native), sandy clay (fill and native), sandstone, and siltstone/claystone.

The on-site soils are mildly susceptible to wind and water erosion. Minor wind erosion and dust may be an issue for a short time during and immediately after construction. Should the problem be considered severe during construction, watering of the cut areas may be required. Once construction is complete, vegetation should be re-established.

Prior to placement of any overlot grading fill or removal and recompaction of the existing materials, topsoil, low-density native soil, fill and organic matter should be removed from the fill area. The subgrade should be scarified, moisture conditioned to within 2% of the optimum moisture content, and recompacted to the same degree as the overlying fill to be placed. The placement and compaction of fill should be periodically observed and tested by a representative of RMG during construction.

- ***Guideline Site Grading Specifications are included in the Appendix A.***

BURIED UTILITIES

Based upon the conditions encountered in the exploratory test borings, we anticipate that the soils encountered in the individual utility trench excavations will consist of silty to clayey sand (man-placed and native), sandy clay, silty sandstone and sandy claystone. It is anticipated that the sand and sandstone will be encountered at loose to very hard relative densities and the clays and claystone at stiff to very hard consistencies.

We believe the sand and sandstone will classify as Type C materials and the clay and claystone will classify as Type B materials as defined by OSHA in 29 CFR Part 1926. OSHA requires that temporary excavations made in Type B and C materials be laid back at ratios no steeper than 1:1 (horizontal to vertical) and 1½:1 (horizontal to vertical), respectively, unless the excavation is shored and braced. Excavations deeper than 20 feet, or when water is present, should always be braced or the slope designed by a professional engineer.

Utility mains such as water and sanitary sewer lines are typically placed beneath paved roadways. The settlement of the utility trench backfill can have a detrimental effect on pavements and roadway surfaces. We recommend that utility trench backfill be placed in thin loose lifts, moisture

conditioned as required and compacted to the recommendations outlined in the **Structural Fill** section of this report. The placement and compaction of utility trench backfill should be observed and tested by a representative of RMG Engineers during construction. Use of "flowable fill," (i.e., a controlled low strength material (CLSM), or a similar material) should be considered in lieu of compacted soil backfill for areas with low tolerances for surface settlements in deep excavations and areas with difficult access.

It is a common local practice for underdrains to be placed at the bottom of sanitary sewer trenched within drive lanes. Underdrains placed in the sanitary sewer trenches in areas where groundwater is anticipated will likely be the "active" type, which uses a perforated drain pipe. In areas where groundwater is not anticipated, "passive" type underdrains may be used. The outfall for the sanitary sewer trench underdrain was not known at the time of this investigation because the development plan and grading plan were not available for our review. Typical underdrain details are presented in Figures 18 and 19.

PRELIMINARY PAVEMENT RECOMMENDATIONS

Roadway plans had not been provided at the time of the report issue date. However, roadways throughout the proposed development are anticipated to be classified mainly as Local in accordance with Section II of the Colorado Springs Engineering Criteria Manual (CSECM). The actual pavement section design for individual streets will be completed following overlot grading and installation of utilities.

Clay and claystone were encountered at anticipated pavement depths. If clay or claystone is encountered near the proposed roadway subgrade, they will likely require overexcavation and replacement or other mitigation measures. A site specific pavement design should be conducted to determine the design pavement sections for the proposed roadways.

ADDITIONAL STUDIES

The findings, conclusions and recommendations presented in this report were provided to evaluate the suitability of the site for future development. Unless indicated otherwise, the test borings, laboratory test results, conclusions and recommendations presented in this report are not intended for use for design and construction. **We recommend that a site specific Subsurface Soil Investigation be performed for all proposed structures including (but not limited to) residences, community or common buildings, retaining walls and pumphouses, commercial buildings, etc.**

To develop recommendations for construction of the proposed roadways, a pavement design investigation should be performed. This investigation should consist of additional test borings, soil laboratory testing and specific recommendations for the design and construction of roadway pavement sections.

CLOSING

This report has been prepared for the exclusive purpose of providing geotechnical engineering information and recommendations for development described in this report. RMG should be retained to review the final construction documents prior to construction to verify our findings, conclusions and recommendations have been appropriately implemented.

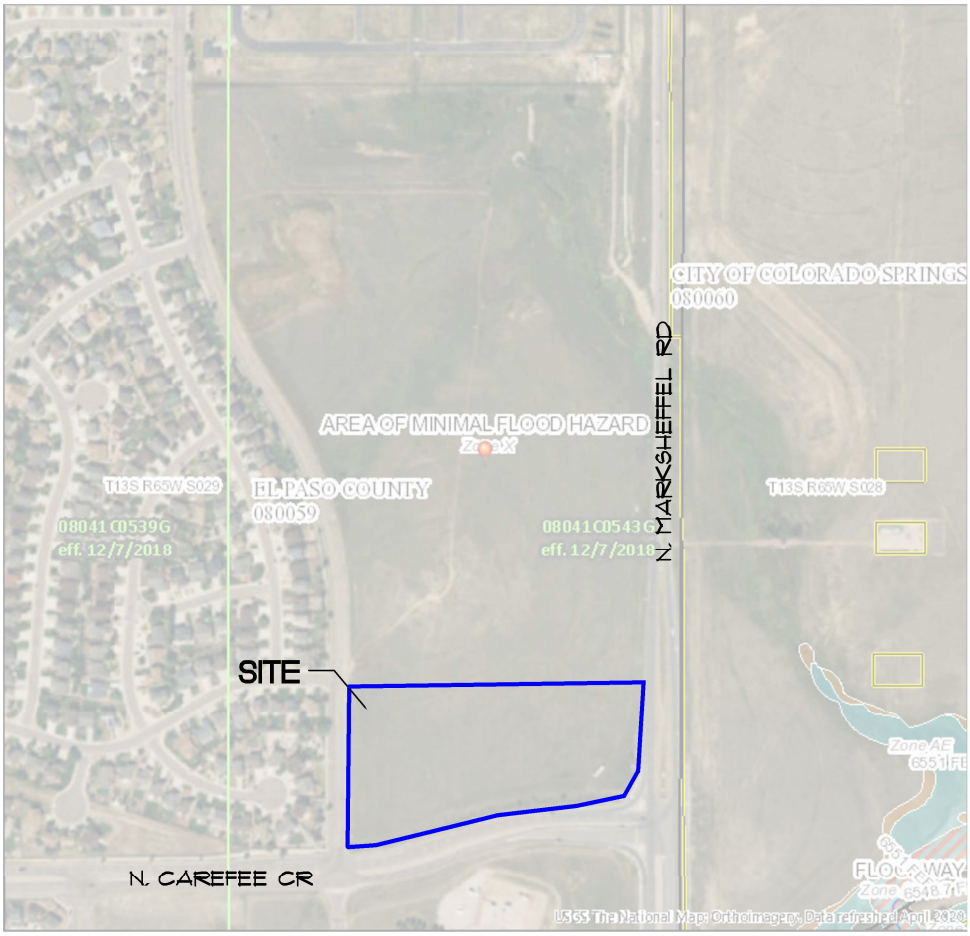
This report has been prepared for the exclusive use by **Colo Windermere #2 LLC** for application as an aid in the design and construction of the proposed development in accordance with generally accepted geotechnical engineering practices. The analyses and recommendations in this report are based in part upon data obtained from test borings, site observations and the information presented in referenced reports. The nature and extent of variations may not become evident until construction. If variations then become evident, RMG should be retained to review the recommendations presented in this report considering the varied condition, and either verify or modify them in writing.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by geotechnical engineers practicing in this or similar localities. RMG does not warrant the work of regulatory agencies or other third parties supplying information which may have been used during the preparation of this report. No warranty, express or implied is made by the preparation of this report. Third parties reviewing this report should draw their own conclusions regarding site conditions and specific construction techniques to be used on this project.

The scope of services for this project does not include, either specifically or by implication, environmental assessment of the site or identification of contaminated or hazardous materials or conditions. Development of recommendations for the mitigation of environmentally related conditions, including but not limited to biological or toxicological issues, are beyond the scope of this report. If the Client desires investigation into the potential for such contamination or conditions, other studies should be undertaken.

If we can be of further assistance in discussing the contents of this report or analysis of the proposed development, from a geotechnical engineering point-of-view, please feel free to contact us.

FIGURES



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SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

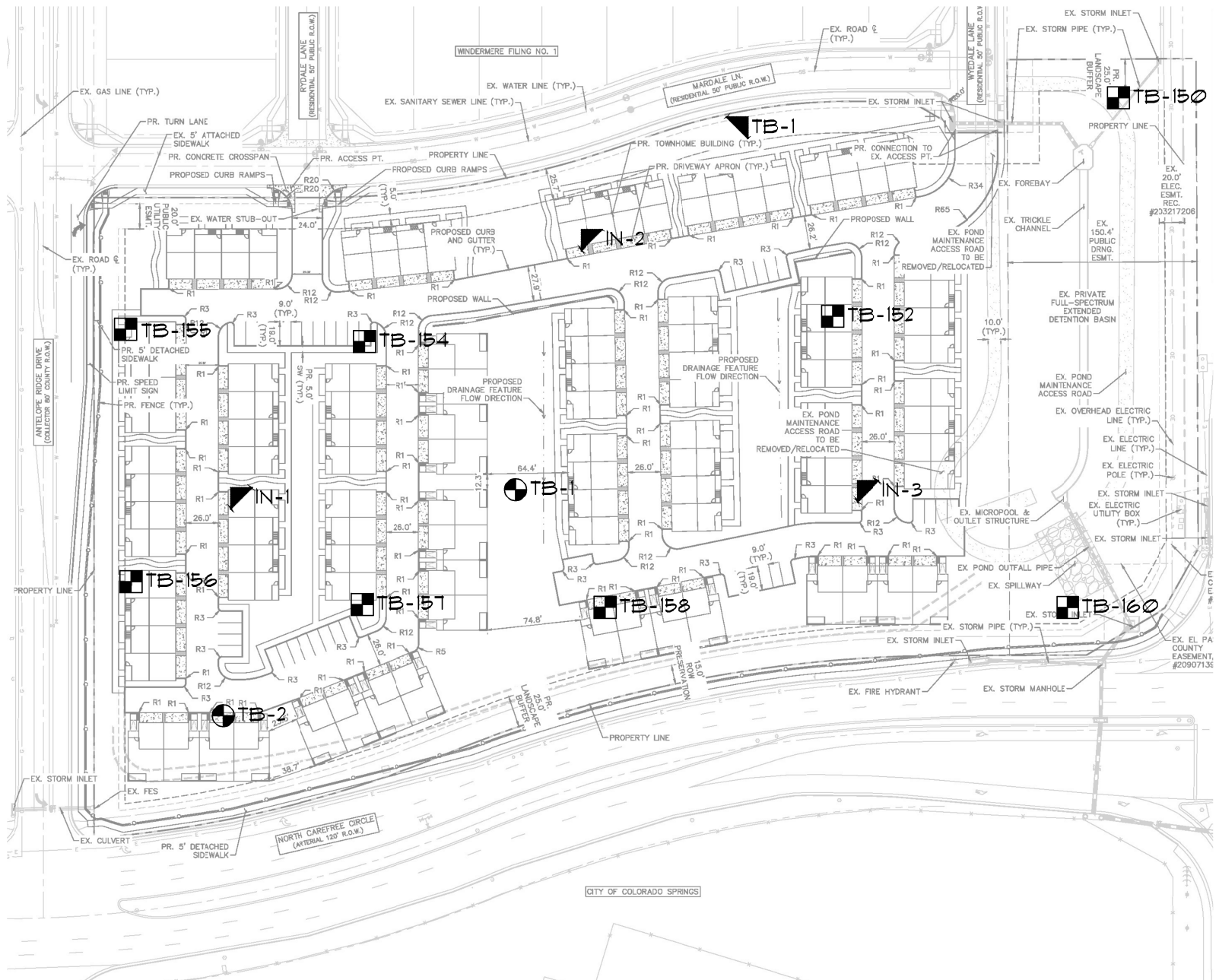
SITE VICINITY MAP

WINDERMERE SUBDIVISION
FILING NO. 2
EL PASO COUNTY, COLORADO
COLO WINDERMERE #2 LLC

JOB No. 195043

FIG No. 1

DATE 10-8-2024



NOT TO SCALE

◤ DENOTES APPROXIMATE LOCATIONS OF INCLINOMETER TEST STUDY

◥ DENOTES APPROXIMATE LOCATIONS OF TEST BORINGS FROM PREVIOUS RMG STUDY 142206

◩ DENOTES APPROXIMATE LOCATIONS OF TEST BORINGS FROM PREVIOUS STUDY 162062

◔ DENOTES APPROXIMATE LOCATIONS OF TEST BORINGS PERFORMED FOR THIS INVESTIGATION

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WINDERMERE SUBDIVISION
FILING NO. 2
EL PASO COUNTY, COLORADO
COLO WINDERMERE #2 LLC

ENGINEER:	TM
DRAWN BY:	JM
CHECKED BY:	TM
ISSUED:	10-8-2024

TEST BORING LAYOUT PLAN

SHEET No.
FIG-2

SOILS DESCRIPTION

CLAYSTONE

FILL: SAND, SILTY TO CLAYEY

SANDSTONE

SANDY CLAY

UNLESS NOTED OTHERWISE, ALL LABORATORY
TESTS PRESENTED HEREIN WERE PERFORMED BY:
RMG - ROCKY MOUNTAIN GROUP
2910 AUSTIN BLUFFS PARKWAY
COLORADO SPRINGS, COLORADO

SYMBOLS AND NOTES

XX — STANDARD PENETRATION TEST - MADE BY DRIVING A SPLIT-BARREL SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-1586. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).

XX — UNDISTURBED CALIFORNIA SAMPLE - MADE BY DRIVING A RING-LINED SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-3550. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).

FREE WATER TABLE

DEPTH AT WHICH BORING CAVED

BULK — DISTURBED BULK SAMPLE

AUG — AUGER "CUTTINGS"

4.5 — WATER CONTENT (%)

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Materials Testing
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EXPLANATION OF TEST BORING LOGS

JOB No. 195043

FIGURE No. 3

DATE Oct/08/2024

TEST BORING: **1** DATE DRILLED: 9/10/24 GROUNDWATER @ 20.0 ' 9/10/24	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, CLAYEY, dark brown, moist					
CLAY, SANDY, brown, very stiff, moist	5			24	7.5
SANDSTONE, CLAYEY, light brown to brown, medium hard to very hard, moist to wet	10			50/3"	11.0
	15			10/0"	11.1
	20			10/0"	11.6
	25			44	32.7
CLAYSTONE, SANDY, brown to gray, very hard, moist to wet	30			50/3"	16.7
	35			10/0"	26.2

TEST BORING: **2** DATE DRILLED: 9/10/24 NO GROUNDWATER ON 9/10/24	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, CLAYEY, light brown, medium dense, moist				26	16.5
SANDSTONE, CLAYEY, brown, very hard, moist	5			10/0"	11.3
	10				
	15			10/0"	11.1
	20			10/0"	12.3

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TEST BORING LOG

JOB No. 195043

FIGURE No. 4

DATE Oct/08/2024

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
1	4.0	7.5	113.8	37	18		51.1		0.4	CL
1	9.0	11.0								
1	14.0	11.1								
1	19.0	11.6								
1	24.0	32.7		62	29		48.4			SM
1	29.0	16.7	98.9						- 0.2	
1	34.0	26.2								
2	2.0	16.5								
2	7.0	11.3		30	8	0.5	29.1			SC
2	14.0	11.1								
2	19.0	12.3								

ROCKY MOUNTAIN GROUP

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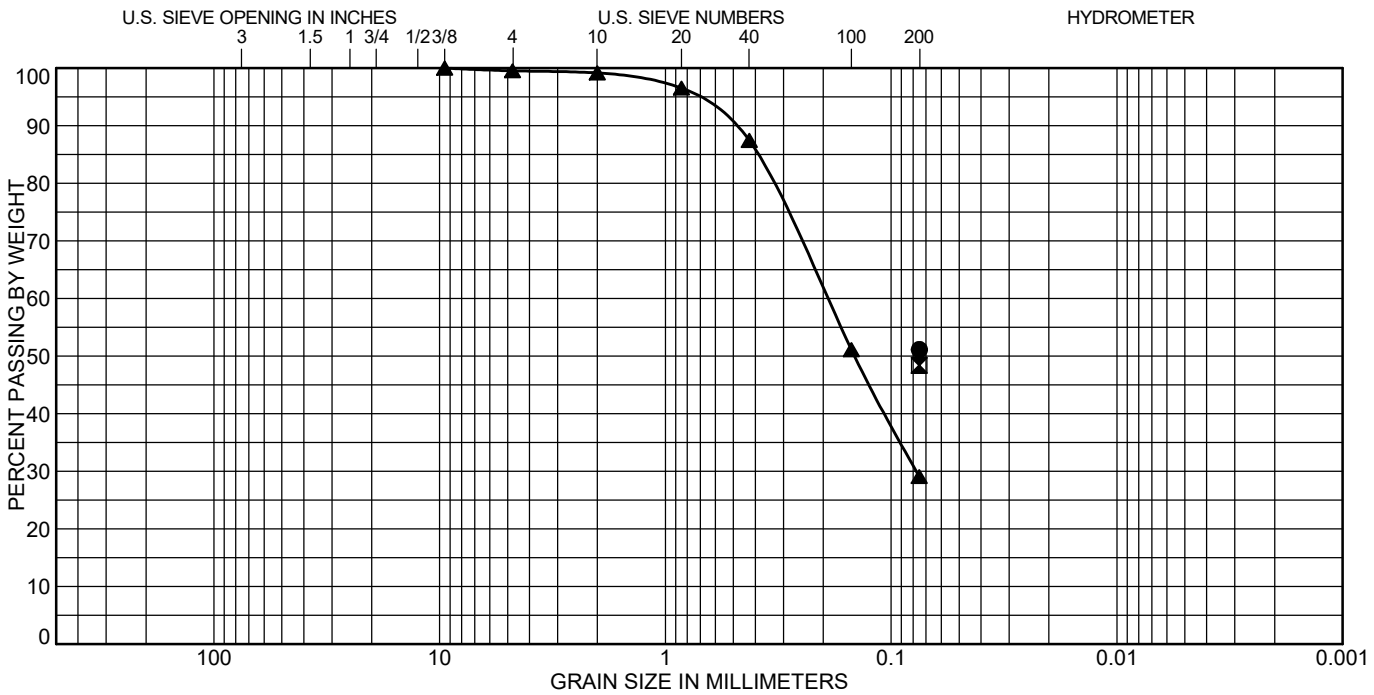
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 195043
FIGURE No. 5
PAGE 1 OF 1
DATE Oct/08/2024



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	1	4.0	**SANDY LEAN CLAY(CL)**	**37**	**19**	**18**
⊠	1	24.0	**SILTY SAND(SM)**	**62**	**33**	**29**
▲	2	7.0	**CLAYEY SAND(SC)**	**30**	**22**	**8**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	1	4.0			**51.1**	
⊠	1	24.0			**48.4**	
▲	2	7.0	**0.5**	**70.5**	**29.1**	

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SOIL CLASSIFICATION DATA

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FIGURE No. 6

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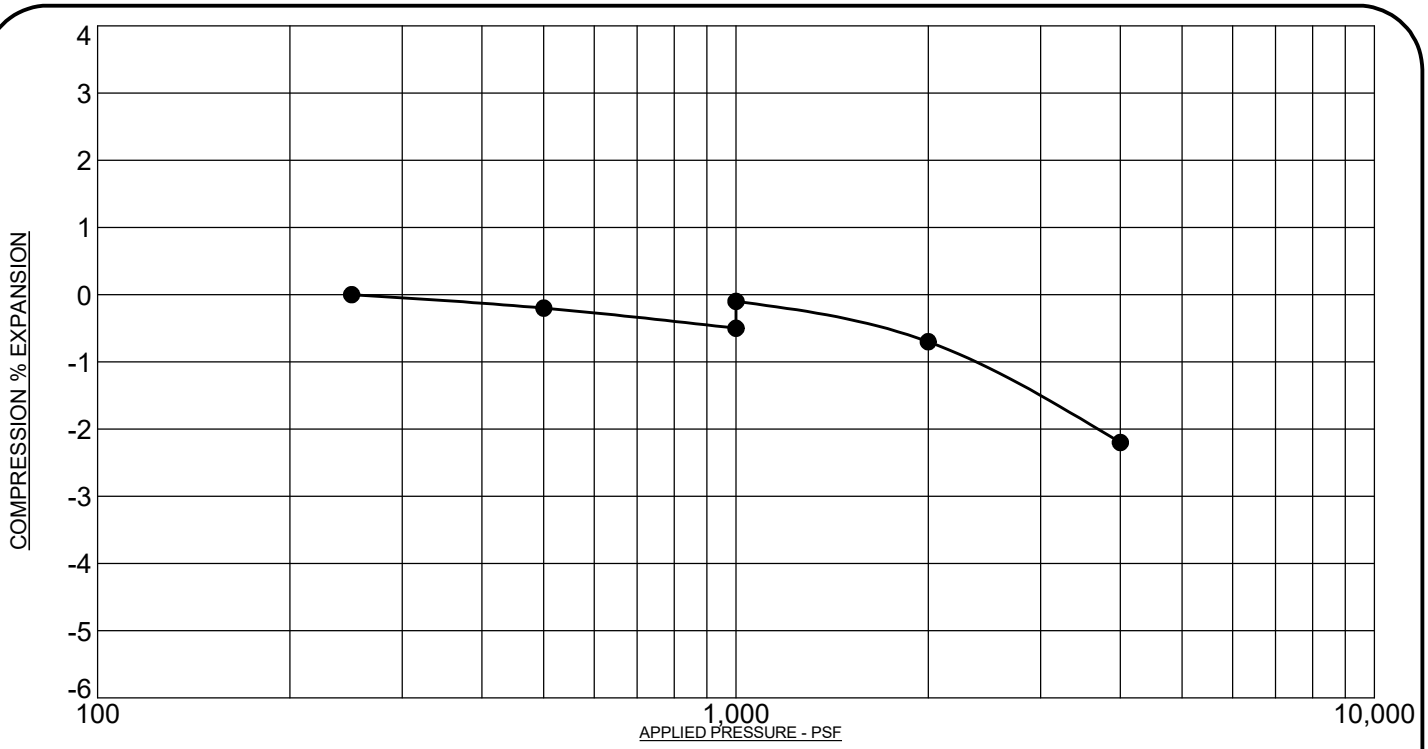
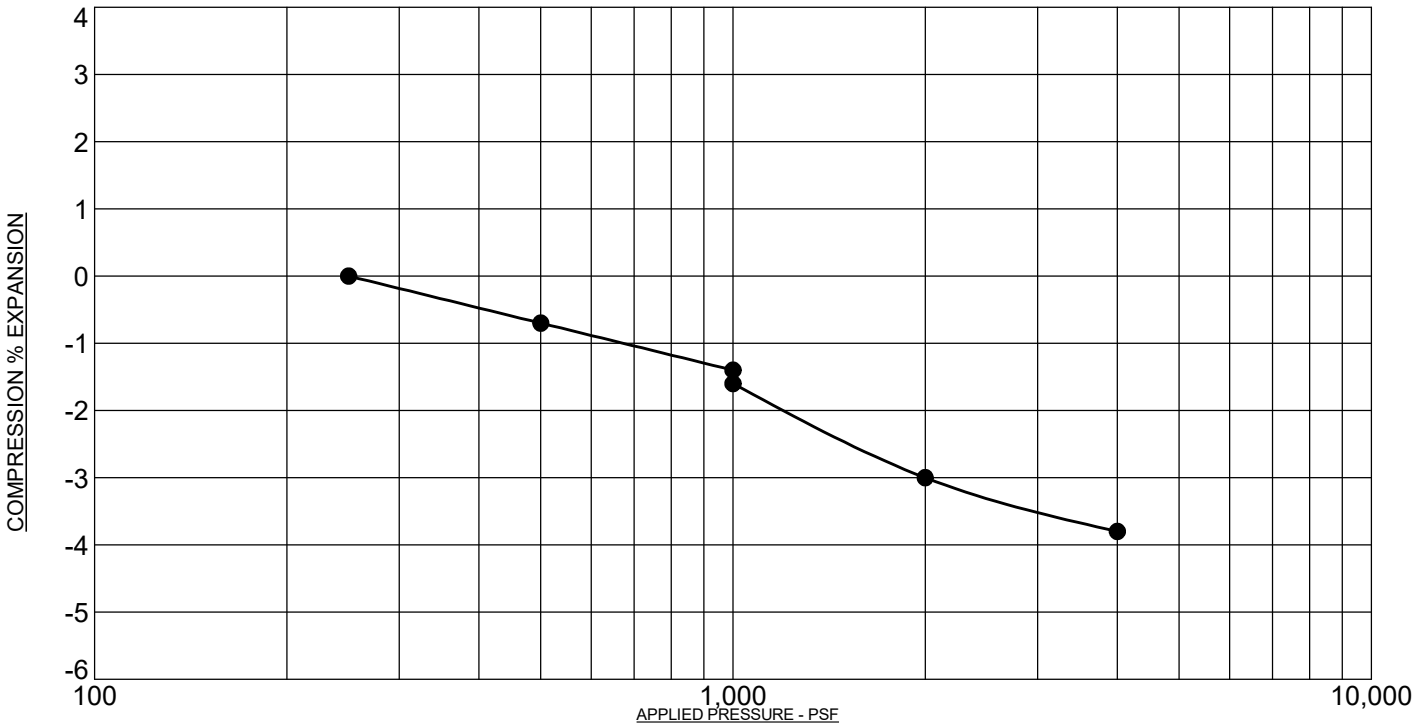


PROJECT: **Windermere Zone Change, El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **1 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **113.8 PCF**
NATURAL MOISTURE CONTENT: **7.6%**
PERCENT SWELL/COMPRESSION: **0.4**



PROJECT: **Windermere Zone Change, El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **1 @ 29 FT**
NATURAL DRY UNIT WEIGHT: **98.9 PCF**
NATURAL MOISTURE CONTENT: **16.7%**
PERCENT SWELL/COMPRESSION: **- 0.2**

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SWELL/CONSOLIDATION TEST RESULTS

JOB No. 195043

FIGURE No. 7

DATE Oct/08/2024

APPENDIX A

Guideline Site Grading Specifications

Description: Unless specified otherwise by local or state regulatory agencies, these guideline specifications are for the excavation, placement and compaction of material from locations indicated on the plans, or staked by the Engineer, as necessary to achieve the required elevations. These specifications shall also apply to compaction of materials that may be placed outside of the project.

General: The Geotechnical Engineer shall approve fill materials, method of placement, moisture contents and percent compactions, and shall give written approval of the compacted fill.

Clearing Site: The Contractor shall remove trees, brush, rubbish, vegetation, topsoil and existing structures before excavation or fill placement is commenced. The Contractor shall dispose of the cleared material to provide the Owner with a clean job site. Cleared material shall not be placed in areas to receive fill or where the material will support structures. Clearing shall also include removal of existing fills that do not meet the requirements of this specification and existing structures.

Preparation of Slopes or Drainage Areas to Receive Fill: Natural slopes or slopes of drainage gullies where grades are 20 percent (5:1, horizontal to vertical) or steeper shall be benched prior to fill placement. Benches shall be at least 10 feet wide. Benches may require additional width to accommodate excavation or compaction equipment. At least one bench shall be provided for each 5 feet or less of vertical elevation difference. The bench surface shall be essentially horizontal perpendicular to the slope or at a slight incline into the slope.

Scarifying: Topsoil and vegetation shall be removed from the ground surface in areas to receive fill. The surface shall be plowed or scarified a minimum of 12 inches until the surface is free from ruts, hummocks or other uneven features which would prevent uniform compaction by the equipment to be used.

Compacting Area to Receive Fill: After the area to receive fill has been cleared and scarified, it shall be disked or bladed until it is free from large clods, moisture conditioned to a proper moisture content and compacted to the maximum density as specified for the overlying fill. Areas to receive fill shall be worked, stabilized, or removed and replaced, if necessary, in accordance with the Geotechnical Engineer's recommendations in preparation for fill.

Fill Materials: Fill material shall be free from organic material or other deleterious substances, and shall not contain rocks or lumps having a diameter greater than six inches. Fill materials shall be obtained from cut areas shown on the plans or staked in the field by the Engineer or imported to the site and shall be approved by the Geotechnical Engineer prior to placement. It is recommended that the fill materials have nil to low expansion potential, i.e., consist of silty to slightly clayey sand.

Moisture Content: Fill materials shall be moisture conditioned to within limits of optimum moisture content specified. Sufficient laboratory compaction tests shall be made to determine the optimum moisture content for the various soils encountered in borrow areas or imported to the site.

The contractor may be required to add moisture to the excavation materials in the borrow area if, in the opinion of the Geotechnical Engineer, it is not possible to obtain uniform moisture content by adding water to the fill material during placement. The Contractor may be required to rake or disk the fill soils to provide uniform moisture content through the soils.

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

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

Compaction of Fill Areas: Selected fill material shall be placed and mixed in evenly spread layers. After each fill layer has been placed, it shall be uniformly compacted to not less than the specified percentage of maximum density. Fill materials shall be placed such that the thickness of loose material does not exceed 10 inches and the compacted lift thickness does not exceed 6 inches.

Compaction, as specified above, shall be obtained by the use of sheepsfoot rollers, multiple-wheel pneumatic-tired rollers, or other equipment approved by the Geotechnical Engineer. Granular fill shall be compacted using vibratory equipment or other equipment approved by the Geotechnical Engineer. Compaction shall be accomplished while the fill material is at the specified moisture content. Compaction of each layer shall be continuous over the entire area.

Moisture Content and Density Criteria:

A. For fill soils supporting utilities and roadways, 95% maximum Standard Proctor dry density at 2% $\pm$ of optimum moisture content.

B. For granular, structural fill soils fills supporting future buildings, 92% maximum Modified Proctor dry density at 2% $\pm$ of optimum moisture content. For moisture-conditioned expansive fill soils supporting future buildings, 95% of maximum Standard Proctor dry density at 1% to 4% above optimum moisture content.

C. For general grading fills, 90% maximum Standard Proctor dry density or Modified Proctor dry density at 2% $\pm$ of optimum moisture content.

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

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

Observation and Testing of Fill: Observation by the Geotechnical Engineer shall be sufficient during the placement of fill and compaction operations so that he can declare the fill was placed in general conformance with Specifications. All observations necessary to test the placement of fill and observe compaction operations will be at the expense of the Owner.

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

Reporting of Field Density Tests: Density tests made by the Geotechnical Engineer shall be submitted progressively to the Owner. Dry density, moisture content, percent compaction, and approximate location shall be reported for each test taken.