GEOTECHNICAL ENGINEERING REPORT
BAYFIELD RETAIL DEVELOPMENT
BAYFIELD, COLORADO

Submitted To:

Tractor Supply Company West, LLC
A Delaware Limited Liability Company,
As TSC

Submitted By:

GEOMAT Inc.
915 Malta Avenue
Farmington, New Mexico 87401

November 7, 2023
GEOMAT Project 232-4586

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Tractor Supply Company West, LLC
A Delaware Limited Liability Company,
As TSC

RE: Geotechnical Engineering Report
Bayfield Retail Development
Bayfield, Colorado
GEOMAT Project No. 232-4586

GEOMAT Inc. (GEOMAT) has completed the geotechnical engineering exploration for the Bayfield Retail Development project to be located in Bayfield, Colorado. This study was performed in general accordance with our Proposal No. 232-04-14, dated April 13, 2023.

The results of our engineering study, including the geotechnical recommendations, site plan, boring records, and laboratory test results are attached. Based on geotechnical engineering analyses, subsurface exploration and laboratory test results, the site is considered suitable for the proposed structure. Other design and construction details, based upon geotechnical conditions, are presented in the report.

We have appreciated being of service to you in the geotechnical engineering phase of this project. If you have any questions concerning this report, please contact us.

Sincerely yours,

GEOMAT Inc.

COLORADO REGISTERED PROFESSIONAL ENGINEER
MATTHEW J. CRAMER
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Staff Engineer

Matthew J. Cramer, P.E.
President, Principal

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TABLE OF CONTENTS

Page No.

TABLE OF CONTENTS (Continued)

GEOTECHNICAL ENGINEERING REPORT
BAYFIELD RETAIL DEVELOPMENT
BAYFIELD, COLORADO
GEOMAT PROJECT NO. 232-4586

INTRODUCTION

This report contains the results of our geotechnical engineering exploration for the Bayfield Retail Development project to be located in Bayfield, Colorado, as shown on the Site Plan in Appendix A of this report.

The purpose of these services is to provide information and geotechnical engineering recommendations about:

- subsurface soil conditions
- groundwater conditions
- lateral soil pressures
- earthwork
- foundation design and construction
- slab design and construction
- drainage

The opinions and recommendations contained in this report are based upon the results of field and laboratory testing, engineering analyses, and experience with similar soil conditions, structures, and our understanding of the proposed project as stated below.

PROPOSED CONSTRUCTION

We understand that the project will consist of the construction of a building footprint of 21,930 square feet with a 3,744 square foot garden center, a 22,891 square foot outdoor display center, a 3,000 square foot permanent trailer/equipment display area, and a 3,000 square foot permanent sidewalk display area. The building is anticipated to be single-story and of CMU and/or steel construction. We assume the building will utilize shallow foundations with a concrete slab-on-grade floor. Maximum wall and column loads were not provided; however, we anticipate them to be on the order of 3 kips/lf for wall loads and 100 kips for column loads. It is anticipated that the project will also include parking areas and stormwater drainage. We anticipate that no significant cuts/fills will be required, and no basements or other below grade structures are planned.

SITE EXPLORATION

Our scope of services performed for this project included a site reconnaissance, a subsurface exploration program, laboratory testing and engineering analyses.

Field Exploration:

Subsurface conditions at the site were explored on September 15th, 2023, by drilling a total of six (6) exploratory borings at the approximate locations shown on the Site Plan in Appendix A. Borings B-1 through B-4 were drilled within the proposed building area to approximate depths ranging from 8 to 13 feet below existing grade. Borings B-5 and B-6 were drilled within the proposed parking area to depths of 2 ½ and 2 feet, respectively.

The borings were advanced using a CME-55 truck-mounted drill rig with continuous-flight, 7.25-inch O.D. hollow-stem auger. The borings were continuously monitored by a staff engineer from our office who examined and classified the subsurface materials encountered, obtained representative samples, observed groundwater conditions, and maintained a continuous log of each boring.

Soil samples were obtained from the borings using a combination of standard 2-inch O.D. split spoon and 3-inch O.D. modified Dames & Moore ring barrel samplers. The samplers were driven using a 140-pound hammer falling 30 inches. The standard penetration resistance was determined by recording the number of hammer blows required to advance the sampler in six-inch increments. Representative bulk samples of the subsurface materials were also obtained.

Groundwater evaluations were made in each boring at the time of site exploration. Soils were classified in accordance with the Unified Soil Classification System described in Appendix A. Boring logs were prepared and are presented in Appendix A.

Laboratory Testing:

Samples retrieved during the field exploration were transported to our laboratory for further evaluation. At that time, the field descriptions were confirmed or modified as necessary, and laboratory tests were performed to evaluate the engineering properties of the subsurface materials.

SITE CONDITIONS

The proposed project site is located in Bayfield, Colorado on the north side of Highway 160. The project site slopes from the east side towards the west side of the lot, with a minor gradient that slopes from the north to the south. The site is covered in tall grasses and brush and is bordered by the Bayfield Center Drive to the north, the community Banks of Colorado to the east, highway 160 to the south and agriculture land and a creek to the west.

The following photograph depicts the site at the time of our exploration.

Overview of the Site
View Towards the South

Drill Rig at Boring B-1
View Towards the Northeast

SUBSURFACE CONDITIONS

Soil Conditions:

As presented on the Boring Logs in Appendix A, in borings B-1 through B-4 we encountered grass and topsoil overlying varying depths of clayey sand and lean/fat clayey soils overlying gravels and cobbles to the depths explored. In borings B-5 and B-6, we encountered grass and topsoil overlying approximately one foot of lean clay soils overlying gravels and cobbles. All borings were terminated short of their planned depths due to auger refusal on gravels and cobbles.

The sandy soils were generally light brown to brown, fine to coarse-grained, and slightly damp. The clayey soils were generally stiff to very stiff, and damp.

Groundwater Conditions:

Groundwater was not encountered in the borings at the time of our exploration. Groundwater elevations can fluctuate over time depending upon precipitation, irrigation, runoff, and infiltration of surface water. We do not have any information regarding the historical fluctuation of the groundwater level in this vicinity.

Laboratory Test Results:

Laboratory analyses of a sample tested indicates that the sandy soil has fines content (silt- and/or clay-sized particles passing the U.S. No. 200 sieve) of approximately 38 percent, plasticity index of 18 and a natural moisture content of approximately 11 percent.

Laboratory analyses of samples tested indicate that the various classification of clayey soil have fines contents (silt- and/or clay-sized particles passing the U.S. No. 200 sieve) ranging from approximately 72 to 88 percent and have plastic indices ranging from 22 to 32. The in-place dry density of a clayey soil samples ranged from approximately 97 to 110 pounds per cubic foot (pcf), with natural moisture contents ranging from approximately 8 to 20 percent.

Laboratory consolidation/expansion testing was performed on undisturbed ring samples of the clayey soils below and/or adjacent to the proposed building. Results of these tests indicate that the soils undergo slight compression when subjected to anticipated foundation stresses at the existing moisture contents. When subjected to increased moisture conditions at these stresses, the soil undergoes slight to moderate expansion followed by slight to moderate compression under increased loading.

Results of all laboratory tests are presented in Appendix B.

OPINIONS AND RECOMMENDATIONS

Geotechnical Considerations:

The site is considered suitable for the proposed building based on the geotechnical conditions encountered and tested for this report. To reduce the potential for settlement and provide more uniform and higher allowable bearing pressures, the footings should bear on engineered fill.

Expansive clays were encountered in our borings. It is of paramount importance to provide good positive drainage away from the structure to ensure that surface water is transmitted away from the structure. Consideration should be given to paving adjacent to the structure on all sides or otherwise surfacing with a low-permeability material to prevent surface water infiltration next to the structure. Raising the site grade may also help improve drainage and reduce the potential for the underlying soils to become wet.

Other foundation types were considered including deep foundations. However, based upon our understanding of the type of structure to be built we anticipate that spread footings on engineered fill are likely the most economical. Recommendations for other foundation types can be considered upon request.

The recommendations contained herein are based upon the conditions encountered in our borings, but variation in subsurface conditions may become evident during excavation and construction activities. GEOMAT should be contacted to review the recommendations contained herein should differing subsurface conditions be encountered.

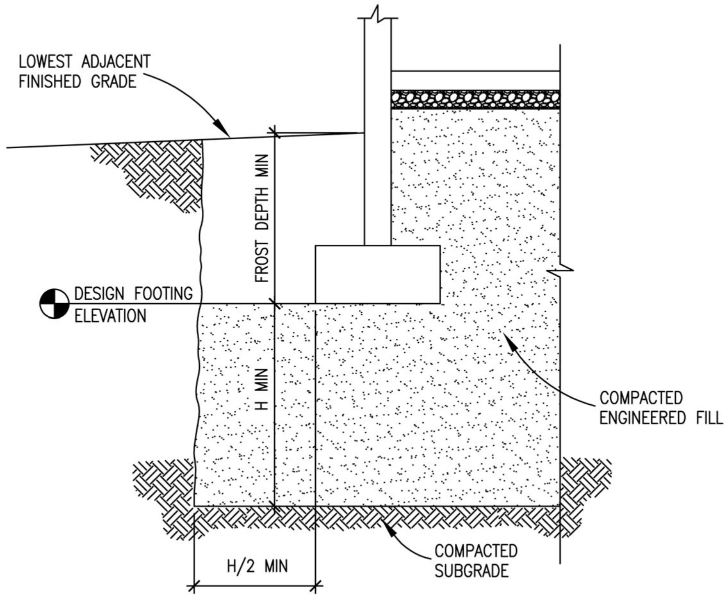
If there are any significant deviations from the assumed floor elevations, structure locations and/or loads noted at the beginning of this report, the opinions and recommendations of this report should be reviewed and confirmed/modified as necessary to reflect the final planned design conditions.

Foundations:

Shallow Spread Footings Bearing on Engineered Fill:

Based on our understanding of the type of structure to be built and the results of our field subsurface exploration and laboratory testing, the building could be founded on conventional shallow spread footings or monolithic turned down footings bearing on engineered fill as described herein.

A generalized depiction of a shallow spread footing supported on engineered fill and a floor slab supported on compacted soil is shown in the diagram below.



Two (2.0) feet and sixteen (16.0) inches are the minimum recommended widths of square and continuous footings, respectively.

The engineered fill should be provided for a depth below the footings, H, not less than three (3.0) feet under the entire building footprint as shown in the diagram above. The engineered fill should extend beyond the edges of the footings for a distance of one-half the depth of engineered fill below the footings, H/2, but not less than one and a half (1.5) feet. If the entire building areas are excavated for the engineered fill placement, the engineered fill should extend at least five (5.0) feet beyond the perimeter of the building.

Footings on engineered fill should bear a minimum of 32 inches below finished grade to provide protection against frost heaving. The recommended design bearing capacity and footing depth are presented in the following table.

Footing Depth [1] (in)	Allowable Bearing Pressure (psf)	Bearing Material
32[2]	2,500	Engineered Fill

[1] Footing depth referenced below lowest adjacent finished grade. Finished grade is the lowest adjacent grade for perimeter footings and floor level for interior footings.
[2] Minimum footing depth for frost protection.

Recommendations for earthwork beneath the floor slab can be found in the **Floor Slab Design and Construction** section of this report.

Materials and compaction criteria for the engineered fill should be as recommended in the **Earthwork** section of this report. Adequate drainage should be provided to prevent the supporting soil/rock from undergoing significant moisture changes.

Total and differential settlements resulting from the assumed structural loads are estimated to be on the order of 3/4 inch or less. Proper drainage should be provided in the final design and during construction and areas adjacent to the structure should be designed to prevent water from ponding or accumulating next to the structure.

Total and differential settlements should not exceed predicted values, provided that:

- Foundations are constructed as recommended, and
- Essentially no changes occur in water content of foundation soils.

For foundations adjacent to descending slopes, a minimum horizontal setback of five (5) feet should be maintained between the foundation base and slope face. In addition, the setback should be such that an imaginary line extending downward at 45 degrees from the nearest foundation edge does not intersect the slope.

Footings and foundations should be reinforced as necessary to reduce the potential for distress caused by differential foundation movement. Foundation excavations should be observed by GEOMAT. If the subsurface conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

Floor Slab Design and Construction:

In reference to the diagram found in the **Foundations** section of this report, the ground floor slabs should be placed on engineered fill.

On-site or imported soils with low expansive potential, meeting the criteria given in the *Fill Materials* section of this report should be used in fills that will support the floor slabs.

Some differential movement of a slab-on-grade floor system is possible if the subgrade soils become elevated in moisture content. Such movements are considered within general tolerance for normal slab-on-grade construction. To reduce potential slab movements, the subgrade soils should be prepared as outlined in the **Earthwork** section of this report.

For structural design of concrete slabs-on-grade, a modulus of subgrade reaction of 200 pounds per cubic inch (pci) may be used for floors supported on compacted engineered fill.

Additional floor slab design and construction recommendations are as follows:

- Control joints should be provided in slabs to control the location and extent of cracking. Joint spacing should be designed by the structural engineer.

- Interior trench backfill placed beneath slabs should be compacted in accordance with recommended specifications outlined below.

- In areas subjected to normal loading, a minimum 4-inch layer of clean-graded gravel, aggregate base course should be placed beneath interior slabs. For heavy loading, re-evaluation of slab and/or base course thickness may be required.

- Other design and construction considerations, as outlined in the ACI Design Manual, Section 302.1R are recommended.

- If moisture sensitive floor coverings are used on interior slabs, consideration should be given to the use of membranes to help reduce the potential for vapor rise through the slab.

Subgrade preparation and moisture control recommendations provided in this report help to reduce soil related problems that may result in distress of concrete floor slabs on grade. However, concrete drying shrinkage, temperature induced volume change and curling can create cracking and distress in the concrete slab on grade. To reduce distress from these causes, properly proportioned concrete mixes with adequate curing and proper joint spacing must be provided. These options should be discussed with the project Architect/Engineer.

Corrosion and Cement Type:

A representative sample of the soil from boring B-3 was tested to evaluate the potential for the on-site soils to corrode buried metal and/or concrete. The samples were tested for pH, soluble sulfates and chlorides. Results of these tests are summarized in the following table.

Corrosivity Test Results					
Sample No.	**Boring No.**	**Sample Depth (ft)**	**pH**	**Chlorides (% by weight)**	**Sulfates (% by weight)**
15392	B-3	1 to 2	6.60	ND	ND

Corrosion of Concrete:

The soluble sulfate contents of the samples tested were 1.20 percent by mass as determined by ASTM C1580.

American Concrete Institute (ACI) 318-14 Table 19.3.1.1, (as referenced in the 2018 International Building Code) presents the following exposure categories and classes for the water-soluble sulfate (SO_4^{2-}) content in soil. Exposure category S applies to concrete in contact with soil or water containing deleterious amounts of water-soluble sulfate ions.

Category	Class	Condition	
		Water-Soluble Sulfate (SO_4^{2-}) in soil, percent by mass [1]	**Dissolved sulfate (SO_4^{2-}) in water, ppm [2]**
Sulfate (S)	S0	$SO_4^{2-} < 0.10$	$SO_4^{2-} < 150$
	S1	$0.10 \leq SO_4^{2-} < 0.20$	$150 \leq SO_4^{2-} < 1,500$ or seawater
	S2	$0.20 \leq SO_4^{2-} \leq 2.00$	$1,500 \leq SO_4^{2-} \leq 10,000$
	S3	$SO_4^{2-} > 2.00$	$SO_4^{2-} > 10,000$

[1] Percent sulfate by mass in soil shall be determined by ASTM C1580.
[2] Concentration of dissolved sulfates in water, in ppm, shall be determined by ASTM D516 or ASTM D4130.

American Concrete Institute (ACI) 318-14 Table 19.3.2.1 presents the requirements shown in the table below for concrete by water-soluble sulfate (SO_4^{2-}) exposure class. The project engineers or architects should review the applicable building codes to confirm the accuracy of the information presented below and any possible project specific considerations. All concrete should be designed, mixed, placed, finished, and cured in accordance with the guidelines presented by the ACI.

Exposure Class	Maximum *w/cm* [1]	Minimum f_c', psi	Cementitious Materials [3] – Types			Calcium Chloride Admixture
			ASTM C150	**ASTM C595**	**ASTM C1157**	
S0	N/A	2,500	No type restriction	No type restriction	No type restriction	No restriction
S1	0.50	4,000	II [4][5]	Types IP, IS, or IT with (MS) designation	MS	No restriction
S2	0.45	4,500	V [5]	Types IP, IS, or IT with (HS) designation	HS	Not permitted
S3	0.45	4,500	V plus pozzolan or slag cement [6]	Types IP, IS, or IT with (HS) designation plus pozzolan or slag cement [6]	HS plus pozzolan or slag cement [6]	Not permitted

[1] The maximum *w/cm* limits in Table 19.3.2.1 do not apply to lightweight concrete.
[3] Alternative combinations of cementitious materials to those listed in Table 19.3.2.1 are permitted when tested for sulfate resistance and meeting criteria in 26.4.2.2(c) of the ACI 318-14.
[4] For seawater exposure, other types of portland cements with tricalcium aluminate (C_3A) contents up to 10 percent are permitted if the *w/cm* does not exceed 0.40.

[5] Other available types of cement such as Type I or Type III are permitted in Exposure Classes S1 or S2 if the C_3A contents are less than 8 percent for Exposure Class S1 or less than 5 percent for Exposure Class S2.
[6] The amount of the specific source of the pozzolan or slag cement to be used shall be at least the amount that has been determined by service record to improve sulfate resistance when used in concrete containing Type V cement. Alternatively, the amount of the specific source of the pozzolan or slag cement to be used shall be at least the amount tested in accordance with ASTM C1012 and meeting the criteria in 26.4.2.2(c) of the ACI 318-14.

Site Classification:

Based on the subsurface conditions encountered in the borings, we estimate that Site Class D is appropriate in accordance with the International Building Code. This parameter was estimated based on extrapolation of data beyond the deepest depth explored, using methods allowed by the code. Actual shear wave velocity testing/analysis and/or exploration to a depth of 100 feet were not performed as part of our scope of services for this project.

Seismic design parameters for the project site were determined in accordance with the procedure in the International Building Code. These values are based on a Risk Category of II and Site Class of D. The seismic design parameters are presented in the table below.

Seismic Design Parameters	
S_S	0.252g
S_1	0.075g
S_{MS}	0.403g
S_{M1}	0.181g
S_{DS}	0.269g
S_{D1}	0.121g

S_S = mapped spectral response acceleration at short periods
S_1 = mapped spectral response acceleration at 1-second period
S_{MS} = maximum considered earthquake spectral response acceleration for short periods
S_{M1} = maximum considered earthquake spectral response acceleration for 1-second period
S_{DS} = five-percent damped design spectral response acceleration at short periods
S_{D1} = five-percent damped design spectral response acceleration at 1-second period
g = gravitational acceleration, approximately 9.8 m/sec^2 or 32.2 ft/sec^2

Lateral Earth Pressures:

For soils above any free water surface, recommended equivalent fluid pressures for unrestrained foundation elements are presented in the following table:

- **Active**:
  Granular soil backfill .... 35 psf/ft
  Undisturbed subsoil .... 30 psf/ft

- **Passive**:
  Shallow foundation walls .... 250 psf/ft
  Shallow column footings.. 350 psf/ft
- **Coefficient of base friction**: .... 0.40 *
  * The coefficient of base friction should be reduced to 0.30 when used in conjunction with passive pressure.

Where the design includes restrained elements, the following equivalent fluid pressures are recommended:

- **At rest:**
  Granular soil backfill ....50 psf/ft
  Undisturbed subsoil..60 psf/ft

Fill against grade beams and retaining walls should be compacted to densities specified in **Earthwork**. Medium to high plasticity clay soils should not be used as backfill against retaining walls. Compaction of each lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors. Over compaction may cause excessive lateral earth pressures that could result in wall movement.

Pavement Design and Construction:

We are presenting preliminary options for both flexible (asphalt) and rigid (concrete) pavement sections. We are also presenting a heavy-duty rigid pavement section for areas that will be subjected to heavy, sustained, concentrated loads, such as dumpster and truck loading areas.

Design of pavements for the project has been based on the procedures outlined in the Guideline for Design of Pavement Structures by the American Association of State Highway and Transportation Officials (AASHTO), and on the Guide for the Design and Construction of Concrete Parking Lots by the American Concrete Institute (ACI 330).

Equivalent single-axle loads (ESALs) were not available at the time of our report preparation. The soils at anticipated pavement subgrade have an estimated R-value of 9 based on the results of fines content and plasticity index tests. The aggregate materials used within the pavement section should conform to the requirements outlined in the current Specifications for Road and Bridge Construction, Colorado Department of Transportation (CDOT). The aggregate base material should be a ¾-inch minus material that conforms to the CDOT Class 6 aggregate base course specifications. The aggregate subbase course should conform to the CDOT specifications for Class 2 material. The subbase course layer may be omitted at locations at which the native gravels and cobbles are present at these elevations. Native gravels and cobbles should be proof compacted under observation by GEOMAT. Alternatively, uniformly graded gravels and cobbles with materials less than six inches in diameter may also be used as the subbase. These materials should be placed and compacted under observation by GEOMAT.

The preliminary recommended pavement sections are presented in the tables below. The recommended pavement sections should be confirmed or modified once final traffic information is available.

Recommended Pavement Sections for Light Vehicle Parking Areas				
Option	**Hot Mix Asphalt** (inches)	**Class 6 Aggregate Base Course** (inches)	**Class 2 Aggregate Subbase Course**[1] (inches)	**Portland Cement Concrete** (inches)
Asphalt	3.0	6.0	8.0	N/A
Concrete	N/A	6.0	N/A	5.0

[1]The subbase course layer may be omitted at locations at which the native gravels and cobbles are present at these elevations. Native gravels and cobbles should be proof compacted under observation by GEOMAT. Alternatively, uniformly graded gravels and cobbles with materials less than six inches in diameter may also be used as the subbase. These materials should be placed and compacted under observation by GEOMAT.

Recommended Heavy Duty Pavement Section	
Portland Cement Concrete (inches)	**Class 6 Aggregate Base Course** (inches)
6.0	8.0

Construction Recommendations for ***Asphalt and Concrete*** *Pavements:*

In paved areas, the exposed ground surface should be scarified to a minimum depth of 8 inches and watered as necessary to bring the upper 1.0 foot to within ±2 percent of optimum moisture content and compacted to a minimum of 95 percent of ASTM D698 maximum dry density prior to placement of fill or construction of pavement sections.

After preparation of the pavement subgrade, the areas to be paved should be proof-rolled under the observation of a representative of GEOMAT. The proof-rolling should be conducted utilizing a fully loaded, single axle water truck with a minimum 2,000 gallon capacity or other vehicle that will provide an equivalent weight on the subgrade. The proof-rolling should consist of driving the truck across all the areas to be paved with asphalt at a slow speed (less than 5 mph) and observing any deflections or distress caused to the subgrade. Areas that show distress should be repaired by removing and replacing the soft material with suitable fill.

Asphalt Pavements:

Aggregate base course should be placed in lifts not exceeding six inches and should be compacted to a minimum of 95% Standard Proctor density (ASTM D-698), within a moisture content range of 4 percent below, to 2 percent above optimum. In any areas where base course thickness exceeds 6 inches, the material should be placed and compacted in two or more lifts of equal thickness.

If the hot-mix asphalt (HMA) is placed in more than one mat, the surface of each underlying mat should be treated with a tack coat immediately prior to placement of the subsequent mat of hot-mix asphalt.

Asphalt concrete should be obtained from an engineer-approved mix design prepared in accordance with CDOT specifications. The hot-mix paving should be placed and compacted in accordance with CDOT specifications.

Concrete Pavements:

Concrete should be placed directly on the prepared base course. Reinforcing steel is not required or recommended for rigid pavement sections. Concrete used for pavement sections should be based upon a mix design by qualified engineer, have a minimum 28-day compressive strength of 4,000 pounds per square inch (psi), and appropriate air entrainment for the climatic conditions. Concrete materials and placement should be in accordance with recommendations in the latest edition of ACI-330R of the American Concrete Institute "*Guide for the Design and Construction of Concrete Parking Lots*". Joints should be as described in the ACI document.

General Pavement Considerations:

The performance of the recommended pavement sections can be enhanced by minimizing excess moisture that can reach the subgrade soils. The following recommendations should be considered at minimum:

- Site grading at a minimum 2% grade away from the pavements;
- Compaction of any utility trenches to the same criteria as the pavement subgrade.

The recommended pavement sections are considered minimal sections based on the anticipated traffic volumes and the subgrade conditions encountered during our exploration. They are expected to perform adequately when used in conjunction with preventive maintenance and good drainage. Preventive maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment.

Slopes:

Assuming fill specifications, compaction requirements, and recommended setbacks provided in this report are followed, cut and fill slopes as steep as to 2.5:1 (horizontal:vertical) should be stable. Depending upon specific project conditions, adequate factors of safety against slope failure may be available for steeper configurations. However, such a determination would require additional analysis.

Earthwork:

General Considerations:

The opinions contained in this report for the proposed construction are contingent upon compliance with recommendations presented in this section. Although underground facilities such as foundations, septic tanks, cesspools, basements, and irrigation systems were not encountered during site reconnaissance, such features could exist and might be encountered during construction.

Site Clearing:

1. Strip and remove all existing pavement, fill, debris, and other deleterious materials from the proposed building areas. Any existing structures should be completely removed from below any building, including foundation elements and any associated development such as underground utilities, septic tanks, etc. All exposed surfaces below footings and slabs should be free of mounds and depressions which could prevent uniform compaction.

2. If unexpected fills or underground facilities are encountered during site clearing, we should be contacted for further recommendations. All excavations should be observed by GEOMAT prior to backfill placement.

3. Stripped materials consisting of vegetation and organic materials should be removed from the site or used to re-vegetate exposed slopes after completion of grading operations. If it is necessary to dispose of organic materials on-site, they should be placed in non-structural areas, and in fill sections not exceeding 5 feet in height.

4. Sloping areas steeper than 5:1 (horizontal:vertical) should be benched to reduce the potential for slippage between existing slopes and fills. Benches should be level and wide enough to accommodate compaction and earth moving equipment.

5. All exposed areas which will receive fill, once properly cleared and benched where necessary, should be scarified to a minimum depth of eight inches, conditioned to optimum to plus 3 percent of optimum moisture content, and compacted to at least 95% of standard proctor (ASTM D698). If gravels and cobbles are present at the bottom of the over excavation, they should be proof compacted under observation by GEOMAT.

Excavation:

1. We present the following general comments regarding our opinion of the excavation conditions for the designers' information with the understanding that they are opinions based on our boring data. More accurate information regarding the excavation conditions should be evaluated by contractors or other interested parties from test excavations using the equipment that will be used during construction. Based on our subsurface evaluation it appears that excavations in soils at the site will be possible using standard excavation equipment.

2. On-site soils may pump or become unstable or unworkable at high water contents, especially for excavations near the water table. Dewatering may be necessary to achieve a stable excavation. Workability may be improved by scarifying and drying. Over-excavation of wet zones and replacement with granular materials may be necessary. Lightweight excavation equipment may be required to reduce subgrade pumping.

Slab Subgrade Preparation:

1. After site clearing is complete, the existing soil below the building area should be prepared as recommended in the **Floor Slab Design and Construction** and *Site Clearing* sections of this report.

2. A minimum 4-inch layer of aggregate base course should be placed beneath floor slabs on grade.

Foundation Preparation:

Footings should bear on engineered fill as recommended in the **Foundations** section of this report. All loose and/or disturbed soils should either be compacted or removed from the bottoms of footing excavations prior to placement of reinforcing steel and/or concrete.

Fill Materials:

1. Based upon the conditions encountered and tested, the native soils will not be suitable for reuse as structural (engineered) fill. It is the responsibility of the contractor to determine the appropriate methods for providing suitable structural (engineered) fill material prior to bidding the work. Periodic quality control testing during construction will be required to determine the suitability of native soils to be re-used as engineered fill.

2. Material conforming to Class 6 aggregate base course as outlined in the current Colorado Department of Transportation (CDOT) Specification for Road and Bridge Construction manual is commonly used in the project area as engineered fill and is recommended where practical and required. Other imported soils with low expansive potentials could also be used as fill material for the following provided, they meet the criteria given in items 3 and 4 below:

   - general site grading
   - foundation areas
   - interior floor slab areas
   - foundation backfill

3. Soils (other than CDOT Class 6) to be used in structural (engineered) fills should conform to the following :

Gradation	**Percent Finer by Weight (ASTM C136)**
3"	100
No. 4 Sieve	50 – 100
No. 200 Sieve	20-50
Plasticity Index	12 Max
Maximum Expansive Potential (%) *	+ 1.5

* Measured on a sample compacted to approximately 95 percent of the ASTM D698 maximum dry density at about 3 percent below optimum water content. The sample is confined under a 144-psf surcharge and submerged.

4. Select granular materials should be used as backfill behind walls that retain earth.

5. Aggregate base should conform to Class 6 base course as specified in the current Colorado Department of Transportation (CDOT) Specification for Road and Bridge Construction Manual.

Placement and Compaction:

1. Place and compact fill in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift.

2. Un-compacted fill lifts should not exceed 10 inches loose thickness.

3. Materials should be compacted to the following:

Material	**Minimum Percent (ASTM D698)**
Subgrade soils beneath fill areas	95
On site or imported soil fills:	
Beneath footings, slabs on grade and pavements	95
Aggregate base beneath slabs and pavements	95
Miscellaneous backfill	90

4. On-site and imported soils should be compacted at moisture contents near optimum.

Compliance:

Recommendations for slabs-on-grade and foundation elements supported on compacted fills depend upon compliance with **Earthwork** recommendations. To assess compliance, observation and testing should be performed by GEOMAT.

Drainage:

Surface Drainage:

1. Positive drainage should be provided during construction and maintained throughout the life of the proposed project. Infiltration of water into utility or foundation excavations must be prevented during construction. Planters and other surface features that could retain water in areas adjacent to the building or pavements should be sealed or eliminated.

2. In areas where sidewalks or paving do not immediately adjoin the structure, we recommend that protective slopes be provided with a minimum grade of approximately 5 percent for at

least 10 feet from perimeter walls. Backfill against footings, exterior walls, and in utility and sprinkler line trenches should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration.

3. Downspouts, roof drains or scuppers should discharge into splash blocks or extensions when the ground surface beneath such features is not protected by exterior slabs or paving.

4. Sprinkler systems should not be within 5 feet of foundation walls. Irrigated landscaping adjacent to the foundation system should be minimized or eliminated.

Subsurface Drainage:

Free-draining, granular soils containing less than five percent fines (by weight) passing a No. 200 sieve should be placed adjacent to walls which retain earth. A drainage system consisting of either weep holes or perforated drain lines (placed near the base of the wall) should be used to intercept and discharge water which would tend to saturate the backfill. Where used, drain lines should be embedded in a uniformly graded filter material and provided with adequate clean-outs for periodic maintenance. An impervious soil should be used in the upper layer of backfill to reduce the potential for water infiltration.

GENERAL COMMENTS

It is recommended that GEOMAT be retained to provide a general review of final design plans and specifications in order to confirm that grading and foundation recommendations in this report have been interpreted and implemented. In the event that any changes of the proposed project are planned, the opinions and recommendations contained in this report should be reviewed and the report modified or supplemented as necessary.

GEOMAT should also be retained to provide services during excavation, grading, foundation, and construction phases of the work. Observation of footing excavations should be performed prior to placement of reinforcing and concrete to confirm that satisfactory bearing materials are present and is considered a necessary part of continuing geotechnical engineering services for the project. Construction testing, including field and laboratory evaluation of fill, backfill, pavement materials, concrete and steel should be performed to determine whether applicable project requirements have been met.

The analyses and recommendations in this report are based in part upon data obtained from the field exploration. The nature and extent of variations beyond the location of test borings may not become evident until construction. If variations then appear evident, it may be necessary to re-evaluate the recommendations of this report.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in this or similar localities at the same time. No warranty, express or implied, is intended or made. We prepared the report as an aid in the design of the proposed project. This report is not a bidding document. Any contractor reviewing this report must draw his own conclusions regarding site conditions and specific construction equipment and techniques to be used on this project.

This report is for the exclusive purpose of providing geotechnical engineering and/or testing information and recommendations. The scope of services for this project does not include, either specifically or by implication, any environmental assessment of the site or identification of contaminated or hazardous materials or conditions. If the owner is concerned about the potential for such contamination, other studies should be undertaken. This report has also not addressed any geologic hazards that may exist on or near the site.

This report may be used only by the Client and only for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both on and off site), or other factors may change over time and additional work may be required with the passage of time. Any party, other than the Client, who wishes to use this report, shall notify GEOMAT in writing of such intended use. Based on the intended use of the report, GEOMAT may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements, by the Client or anyone else, will release GEOMAT from any liability resulting from the use of this report by an unauthorized party.

Appendix A

Approximate	VICINITY PLAN	PROJECT	GEOMAT INC.
Not to Scale	Boring Locations (approximate)	Bayfield Retail Development Bayfield, Colorado	
	GEOMAT Project No. 232-4586 Date of Exploration: September 15, 2023		

GEOMAT INC.

915 Malta Ave
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Boring B-1

Project Name:	Bayfield Retail Development	Date Drilled:	9/15/2023
Project Number:	232-4586	Latitude:	Not Determined
Client:	Tractor Supply Company West, LLC	Longitude:	Not Determined
Site Location:	Bayfield, Colorado	Elevation:	Not Determined
Rig Type:	CME-55	Boring Location:	See Site Plan
Drilling Method:	7.25" O.D. Hollow Stem Auger	Groundwater Depth:	Not Encountered
Sampling Method:	Ring and Split spoon samples	Logged By:	CB
Hammer Weight:	140 lbs	Remarks:	None
Hammer Fall:	30 inches		

Laboratory Results: Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Material Type	Depth (ft)	Soil Description
						TS	0	Grass and Topsoil, approx. thickness 3"
						SC	1	Clayey SAND, light brown to brown, fine- to coarse-grained, slightly damp
						CH	1.5–3	Fat CLAY, light brown to brown, stiff, slightly damp brown to reddish brown gravel and sandstone fragments
110.0	-	-	12.2	9-12	R		2.5	
						SC	3–5.5	Clayey SAND, brown/tan/reddish brown, fine- to coarse-grained, medium dense, slightly damp
-	38	18	11.1	4-11-50/5"	SS		5	
						GP	5.5–8.5	Gravel and cobbles clay lens
				10-13-13	SS		7	
							8.5	auger refusal on gravel and cobbles Total Depth 8 ½ feet

A = Auger Cuttings R = Ring-Lined Barrel Sampler SS = Split Spoon GRAB = Manual Grab Sample D = Disturbed Bulk Sample SH = Shelby Tube Sampler

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Boring B-2

Project Name:	Bayfield Retail Development	Date Drilled:	9/15/2023
Project Number:	232-4586	Latitude:	Not Determined
Client:	Tractor Supply Company West, LLC	Longitude:	Not Determined
Site Location:	Bayfield, Colorado	Elevation:	Not Determined
Rig Type:	CME-55	Boring Location:	See Site Plan
Drilling Method:	7.25" O.D. Hollow Stem Auger	Groundwater Depth:	Not Encountered
Sampling Method:	Bulk, Ring and Split spoon samples	Logged By:	CB
Hammer Weight:	140 lbs	Remarks:	None
Hammer Fall:	30 inches		

Laboratory Results								
Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Material Type	Depth (ft)	Soil Description
						TS	0	Grass and Topsoil, approx. thickness 3"
						SC	0.25–1	Clayey SAND, light brown to brown, fine- to coarse-grained, slightly damp
-	82	22	8.5		GRAB	CL	1–4	Lean CLAY, reddish brown, very stiff, slightly damp
				10-11-12	SS	CL	2.5–4	
97.4	-	-	20.2	8-11	R	CH	4–9	Fat CLAY, reddish brown/white/tan/trace black mottling, stiff, slightly damp
				5-6-9	SS	CH	7.5–8	brown/gray
				22-17-17	SS	GP	9–11	Gravel and cobbles
							11	auger refusal on gravel and cobbles Total Depth 11 feet

A = Auger Cuttings R = Ring-Lined Barrel Sampler SS = Split Spoon GRAB = Manual Grab Sample D = Disturbed Bulk Sample SH = Shelby Tube Sampler

GEOMAT INC.

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Boring B-3

Project Name: Bayfield Retail Development
Project Number: 232-4586
Client: Tractor Supply Company West, LLC
Site Location: Bayfield, Colorado
Rig Type: CME-55
Drilling Method: 7.25" O.D. Hollow Stem Auger
Sampling Method: Bulk, Ring and Split spoon samples
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 9/15/2023
Latitude: Not Determined
Longitude: Not Determined
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: Not Encountered
Logged By: CB
Remarks: None

Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Material Type	Depth (ft)	Soil Description
						TS	0	Grass and Topsoil, approx. thickness 3"
						SC		Clayey SAND, brown, fine- to medium-grained, salt precipitants, slightly damp
						CL	1	Lean CLAY, brown/white, salt precipitants, stiff, slightly damp
-	88	24	11.1		GRAB		2	
				7-8-7	SS		3	
					GRAB		4	
108.0	-	-	13.8	8-17	R		5	
						GP	6	Gravel and cobbles
				15-16-18	SS		7	
							8	auger refusal on gravel and cobbles Total Depth 8 feet
							9	
							10	

A = Auger Cuttings R = Ring-Lined Barrel Sampler SS = Split Spoon GRAB = Manual Grab Sample D = Disturbed Bulk Sample SH = Shelby Tube Sampler

GEOMAT INC.
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Boring B-4

Project Name:	Bayfield Retail Development	Date Drilled:	9/15/2023
Project Number:	232-4586	Latitude:	Not Determined
Client:	Tractor Supply Company West, LLC	Longitude:	Not Determined
Site Location:	Bayfield, Colorado	Elevation:	Not Determined
Rig Type:	CME-55	Boring Location:	See Site Plan
Drilling Method:	7.25" O.D. Hollow Stem Auger	Groundwater Depth:	Not Encountered
Sampling Method:	Ring and Split spoon samples	Logged By:	CB
Hammer Weight:	140 lbs	Remarks:	None
Hammer Fall:	30 inches		

Laboratory Results										
Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Symbol	Material Type	Soil Symbol	Depth (ft)	Soil Description
							TS		0	Grass and Topsoil, approx. thickness 3"
							SC		1	Clayey SAND, reddish brown to brown, fine- to medium-grained, slightly damp
							CL		2	Lean CLAY, brown/red/tan, stiff, slightly damp
105.5	-	-	11.6	8-9	R				3	
									4	
-	82	32	17.7	4-6-9	SS		CH		5	Fat CLAY, brown/red/tan, stiff, slightly damp black mottling/brown
									6	
									7	
106.6	-	-	13.3	7-10	R				8	brown/tan/black/white
							GP		9	Gravel and cobbles
				22-31-28	SS				10	minimal recovery
									11	
				9-15-14	SS				12	
									13	auger refusal on gravel and cobbles Total Depth 13 feet
									14	
									15	

A = Auger Cuttings R = Ring-Lined Barrel Sampler SS = Split Spoon GRAB = Manual Grab Sample D = Disturbed Bulk Sample SH = Shelby Tube Sampler

GEOMAT INC.

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Boring B-5

Project Name:	Bayfield Retail Development	Date Drilled:	9/15/2023
Project Number:	232-4586	Latitude:	Not Determined
Client:	Tractor Supply Company West, LLC	Longitude:	Not Determined
Site Location:	Bayfield, Colorado	Elevation:	Not Determined
Rig Type:	CME-55	Boring Location:	See Site Plan
Drilling Method:	7.25" O.D. Hollow Stem Auger	Groundwater Depth:	Not Encountered
Sampling Method:	Bulk sample from auger cuttings	Logged By:	CB
Hammer Weight:	140 lbs	Remarks:	None
Hammer Fall:	30 inches		

Laboratory Results				Blows per 6"	Sample Type & Length (in)	Symbol	Material Type	Soil Symbol	Depth (ft)	Soil Description
Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)							
							TS			Grass and Topsoil, approx. thickness 3"
							CL		1	Lean CLAY, brown, gravel and cobbles, slightly damp to damp
-	72	23	8.1		GRAB		GP		2	Gravel and cobbles
									3	auger refusal on gravel and cobbles Total Depth 2 ½ feet
									4	
									5	

A = Auger Cuttings R = Ring-Lined Barrel Sampler SS = Split Spoon GRAB = Manual Grab Sample D = Disturbed Bulk Sample SH = Shelby Tube Sampler

GEOMAT INC.
915 Malta Ave
Farmington, NM 87401
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Fax (505) 326-5721

Boring B-6

Project Name:	Bayfield Retail Development	Date Drilled:	9/15/2023
Project Number:	232-4586	Latitude:	Not Determined
Client:	Tractor Supply Company West, LLC	Longitude:	Not Determined
Site Location:	Bayfield, Colorado	Elevation:	Not Determined
Rig Type:	CME-55	Boring Location:	See Site Plan
Drilling Method:	7.25" O.D. Hollow Stem Auger	Groundwater Depth:	Not Encountered
Sampling Method:	Bulk sample from auger cuttings	Logged By:	CB
Hammer Weight:	140 lbs	Remarks:	None
Hammer Fall:	30 inches		

Laboratory Results										
Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Symbol	Material Type	Soil Symbol	Depth (ft)	Soil Description
							TS			Grass and Topsoil, approx. thickness 3"
							CL			Lean CLAY, brown, gravel and cobbles, slightly damp to damp
									1	
					GRAB		GP			Gravel and cobbles
									2	auger refusal on gravel and cobbles Total Depth 2 feet
									3	
									4	
									5	

A = Auger Cuttings R = Ring-Lined Barrel Sampler SS = Split Spoon GRAB = Manual Grab Sample D = Disturbed Bulk Sample SH = Shelby Tube Sampler

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions			Group Symbols	Typical Names
Coarse-Grained Soils More than 50% retained on No. 200 sieve	**Gravels** 50% or more of coarse fraction retained on No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands More than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils 50% or more passes No. 200 sieve	**Silts and Clays** Liquid Limit 50 or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid Limit greater than 50		MH	Inorganic silts, micaceous or diatomaceous free sands or silts, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, mucic & other highly organic soils

CONSISTENCY OR RELATIVE DENSITY CRITERIA

Standard Penetration Test
Density of Granular Soils

Penetration Resistance, N (blows/ft.)	Relative Density
0-4	Very Loose
5-10	Loose
11-30	Medium Dense
31-50	Dense
>50	Very Dense

Standard Penetration Test
Density of Fine-Grained Soils

Penetration Resistance, N (blows/ft.)	Consistency	Unconfined Compressive Strength (Tons/ft2)
<2	Very Soft	<0.25
2-4	Soft	0.25-0.50
4-8	Firm	0.50-1.00
8-15	Stiff	1.00-2.00
15-30	Very Stiff	2.00-4.00
>30	Hard	>4.0

U.S. Standard Sieve Sizes

>12"	12"	3"	3/4"	#4	#10	#40	#200	
Boulders	Cobbles	Gravel		Sand			Silt or Clay	
		coarse	fine	coarse	medium	fine		

MOISTURE CONDITIONS	
Dry	Absence of moist, dusty, dry to the touch
Slightly Damp	Below optimum moisture content for compaction
Moist	Near optimum moisture content, will moisten the hand
Very Moist	Above optimum moisture content
Wet	Visible free water, below water table

MATERIAL QUANTITY	
trace	0-5%
few	5-10%
little	10-25%
some	25-45%
mostly	50-100%

OTHER SYMBOLS

- R Ring Sample
- S SPT Sample
- B Bulk Sample
- ▼ Ground Water

BASIC LOG FORMAT:
Group name, Group symbol, (grain size), color, moisture, consistency or relative density. Additional comments: odor, presence of roots, mica, gypsum, coarse particles, etc.

EXAMPLE:
SILTY SAND w/trace silt (SM-SP), Brown, loose to med. Dense, fine to medium grained, damp

UNIFIED SOIL CLASSIFICATION SYSTEM

TEST DRILLING EQUIPMENT & PROCEDURES

Description of Subsurface Exploration Methods

Drilling Equipment – Truck-mounted drill rigs powered with gasoline or diesel engines are used in advancing test borings. Drilling through soil or softer rock is performed with hollow-stem auger or continuous flight auger. Carbide insert teeth are normally used on bits to penetrate soft rock or very strongly cemented soils which require blasting or very heavy equipment for excavation. Where refusal is experienced in auger drilling, the holes are sometimes advanced with tricone gear bits and NX rods using water or air as a drilling fluid.

Coring Equipment – Portable electric core drills are used when recovery of asphalt or concrete cores is necessary. The core drill is equipped with either a 4" or 6" diameter diamond core barrel. Water is generally used as a drilling fluid to facilitate cooling and removal of cuttings from the annulus.

Sampling Procedures - Dynamically driven tube samples are usually obtained at selected intervals in the borings by the ASTM D1586 test procedure. In most cases, 2" outside diameter, 1 3/8" inside diameter, samplers are used to obtain the standard penetration resistance. "Undisturbed" samples of firmer soils are often obtained with 3" outside diameter samplers lined with 2.42" inside diameter brass rings. The driving energy is generally recorded as the number of blows of a 140-pound, 30-inch free fall drop hammer required to advance the samplers in 6-inch increments. These values are expressed in blows per foot on the boring logs. However, in stratified soils, driving resistance is sometimes recorded in 2- or 3-inch increments so that soil changes and the presence of scattered gravel or cemented layers can be readily detected and the realistic penetration values obtained for consideration in design. "Undisturbed" sampling of softer soils is sometimes performed with thin-walled Shelby tubes (ASTM D1587). Tube samples are labeled and placed in watertight containers to maintain field moisture contents for testing. When necessary for testing, larger bulk samples are taken from auger cuttings. Where samples of rock are required, they are obtained by NX diamond core drilling (ASTM D2113).

Boring Records - Drilling operations are directed by our field engineer or geologist who examines soil recovery and prepares boring logs. Soils are visually classified in accordance with the Unified Soil Classification System (ASTM D2487), with appropriate group symbols being shown on the logs.

Appendix B

LAB NO.	BORING NO.	SAMPLE DEPTH (ft)	SIEVE ANALYSIS, CUMULATIVE PERCENT PASSING (%)													ATTERBERG LIMITS			CONSOL	MOISTURE CONTENT (%)	DENSITY		CLASSIFICATION
			1"	¾"	½"	⅜"	No. 4	No. 8	No. 10	No. 16	No. 30	No. 40	No. 50	No. 100	No. 200	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX			WET (pcf)	DRY (pcf)	
15388	B-1	2 ½	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Attached	12.2	123.4	110.0	Fat **CLAY** with sand (CH)
15389	B-1	5	-	-	-	-	-	-	-	-	-	-	-	-	38	33	15	18	-	11.1	-	-	Clayey **SAND** (SC)
15390	B-2	1 - 2	100	100	100	100	100	100	100	99	99	99	98	96	82	37	15	22	-	8.5	-	-	Lean **CLAY** with sand (CL)
15391	B-2	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Attached	20.2	117.1	97.4	Fat **CLAY** with sand (CH)
15392*	B-3	1 - 2	100	100	100	100	100	100	100	100	99	99	99	98	88	44	20	24	-	11.1	-	-	Lean **CLAY** (CL)
15393	B-3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.8	122.904	108.0	Lean **CLAY** with sand (CL)
15394	B-4	2 ½	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Attached	11.6	117.7	105.5	Lean **CLAY** with sand (CL)
15395	B-4	5	-	-	-	-	-	-	-	-	-	-	-	-	82	52	20	32	-	17.7	-	-	Fat **CLAY** with sand (CH)
15396	B-4	7 ½	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.3	120.8	106.6	Fat **CLAY** with sand (CH)
15397	B-5	1 - 2	100	94	88	87	85	84	84	83	82	81	80	78	72	44	21	23	-	8.1	-	-	Lean **CLAY** with gravel (CL)

NLL = No Liquid Limit
NPL = No Plastic Limit
NP = Non-Plastic
* = Corrosivity Results

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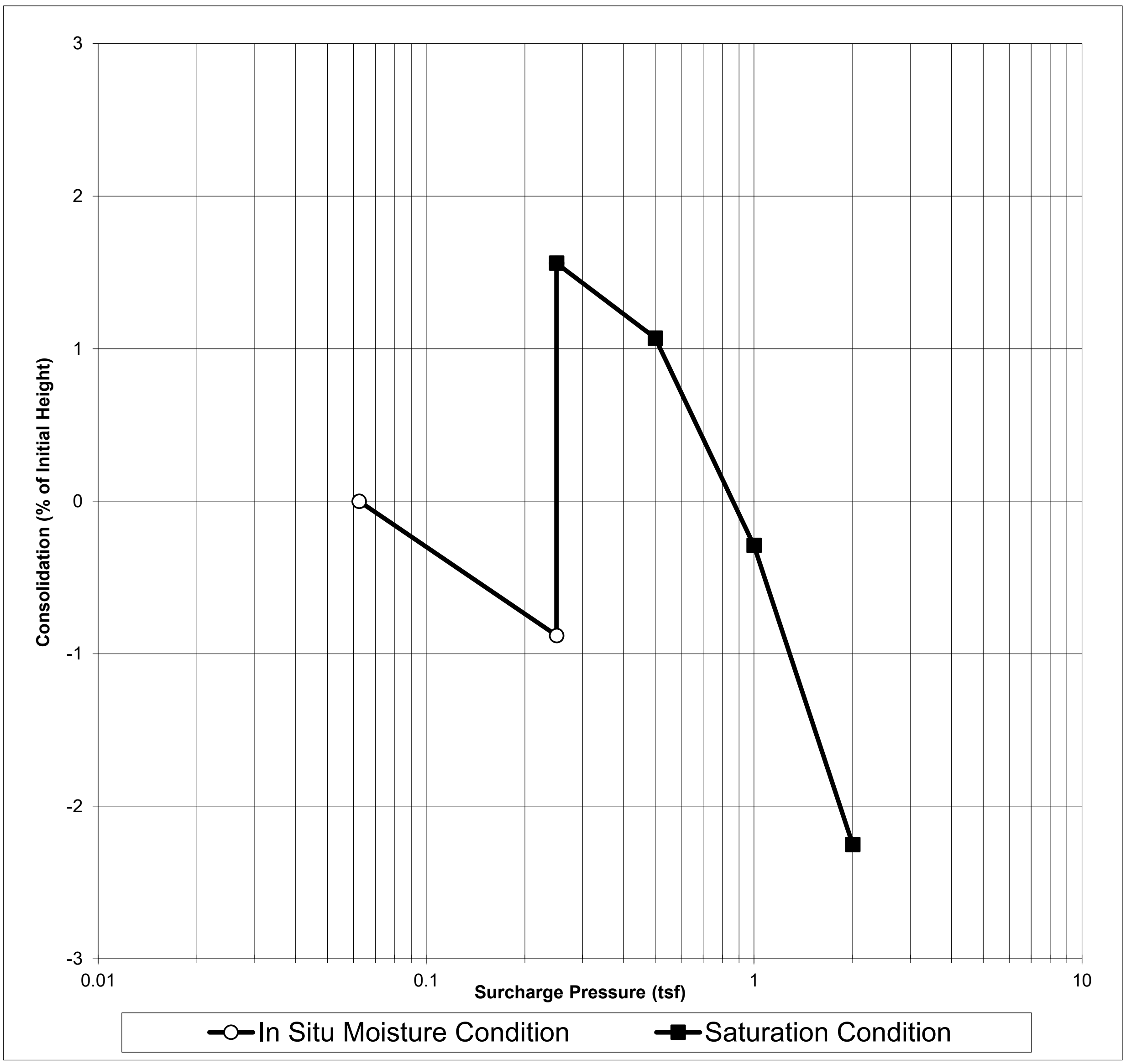
SUMMARY OF SOIL TESTS
Page 1 of 1

Project Name	Bayfield Retail Development
Project No.	232-4586
Location	Bayfield, Colorado
Date(s) of Exploration	9/15/2023

PROJECT:	Bayfield Retail Development	**JOB NO:**	232-4586
CLIENT:	Tractor Supply Company West, LLC	**WORK ORDER NO:**	N/A
MATERIAL:	Fat **CLAY** with sand (CH)	**LAB NO:**	15388
SAMPLE SOURCE:	B-1 @ 2 ½'	**DATE SAMPLED:**	9/15/2023
SAMPLE PREP.:	In Situ	**SAMPLED BY:**	CB

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS (ASTM D2435)

INITIAL VOLUME (cu.in)	4.60	FINAL VOLUME (cu.in)	4.50
INITIAL MOISTURE CONTENT	12.2%	FINAL MOISTURE CONTENT	19.2%
INITIAL DRY DENSITY(pcf)	110.0	FINAL DRY DENSITY(pcf)	112.0
INITIAL DEGREE OF SATURATION	45%	FINAL DEGREE OF SATURATION	74%
INITIAL VOID RATIO	0.51	FINAL VOID RATIO	0.48
ESTIMATED SPECIFIC GRAVITY	2.651	SATURATED AT	0.25 tsf



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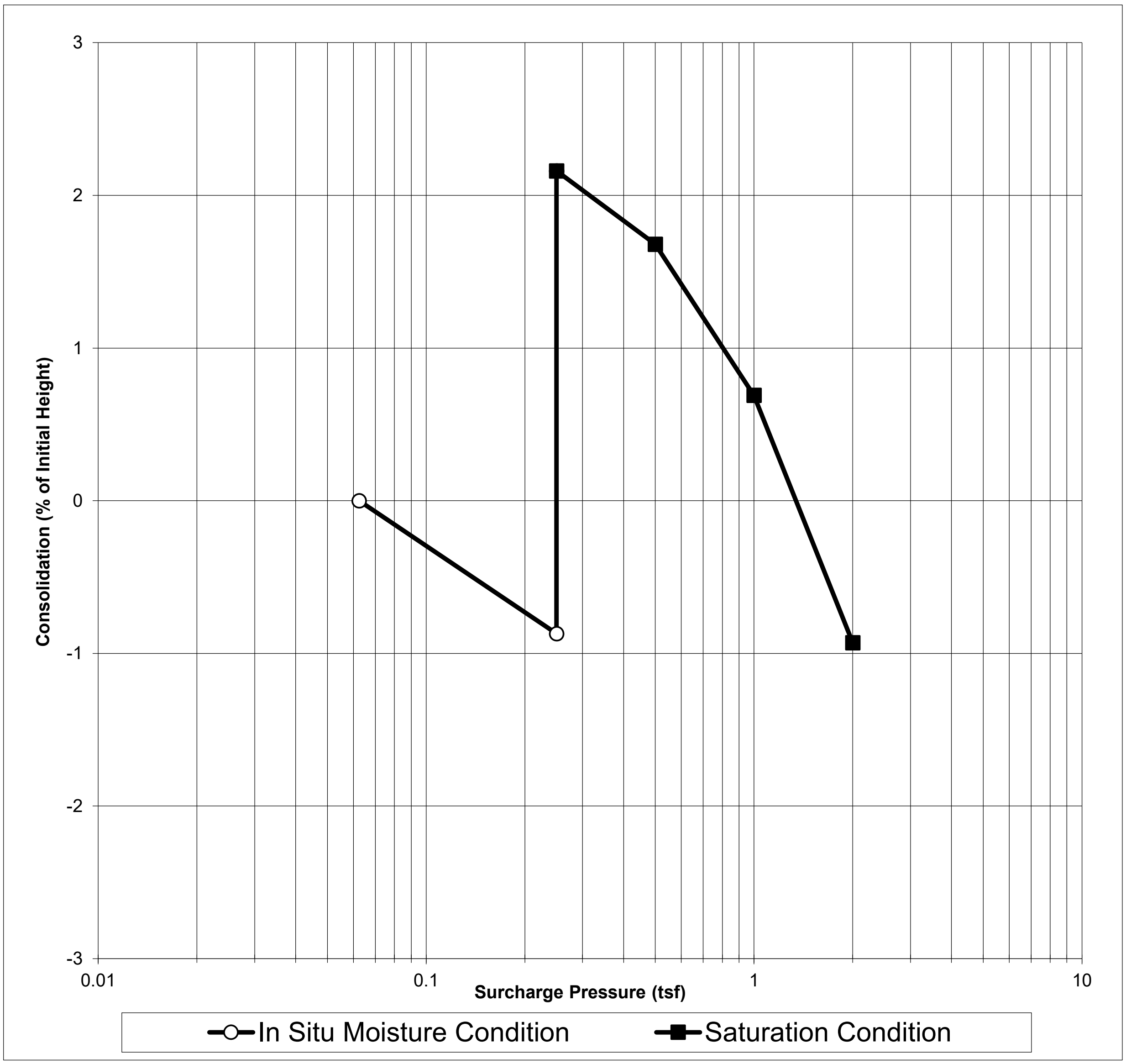
PROJECT:	Bayfield Retail Development	**JOB NO:**	232-4586
CLIENT:	Tractor Supply Company West, LLC	**WORK ORDER NO:**	N/A
MATERIAL:	Fat **CLAY** with sand (CH)	**LAB NO:**	15391
SAMPLE SOURCE:	B-2 @ 5'	**DATE SAMPLED:**	9/15/2023
SAMPLE PREP.:	In Situ	**SAMPLED BY:**	CB

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS (ASTM D2435)

INITIAL VOLUME (cu.in)	4.60	FINAL VOLUME (cu.in)	4.56
INITIAL MOISTURE CONTENT	20.2%	FINAL MOISTURE CONTENT	24.3%
INITIAL DRY DENSITY(pcf)	97.4	FINAL DRY DENSITY(pcf)	97.9
INITIAL DEGREE OF SATURATION	59%	FINAL DEGREE OF SATURATION	72%
INITIAL VOID RATIO	0.71	FINAL VOID RATIO	0.69
ESTIMATED SPECIFIC GRAVITY	2.651	SATURATED AT	0.25 tsf



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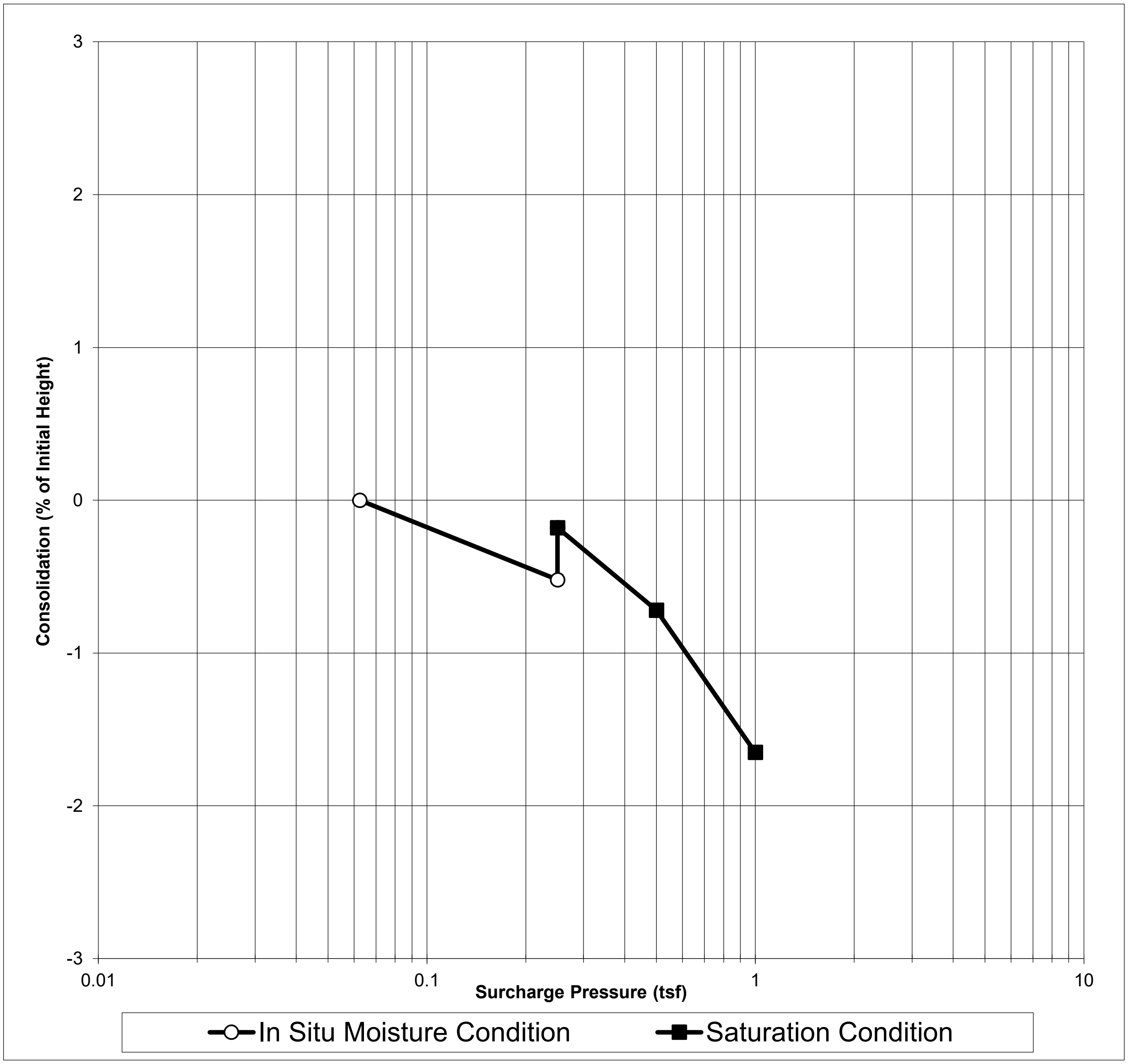
PROJECT:	Bayfield Retail Development	**JOB NO:**	232-4586
CLIENT:	Tractor Supply Company West, LLC	**WORK ORDER NO:**	N/A
MATERIAL:	Lean **CLAY** with sand (CL)	**LAB NO:**	15394
SAMPLE SOURCE:	B-4 @ 2 ½'	**DATE SAMPLED:**	9/15/2023
SAMPLE PREP.:	In Situ	**SAMPLED BY:**	CB

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS (ASTM D2435)

INITIAL VOLUME (cu.in)	4.60	FINAL VOLUME (cu.in)	4.53
INITIAL MOISTURE CONTENT	11.6%	FINAL MOISTURE CONTENT	20.1%
INITIAL DRY DENSITY(pcf)	105.5	FINAL DRY DENSITY(pcf)	106.8
INITIAL DEGREE OF SATURATION	40%	FINAL DEGREE OF SATURATION	70%
INITIAL VOID RATIO	0.58	FINAL VOID RATIO	0.55
ESTIMATED SPECIFIC GRAVITY	2.651	SATURATED AT	0.25 tsf



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LABORATORY TESTING PROCEDURES

Laboratory testing is performed by trained personnel in our accredited laboratory or may be subcontracted by GEOMAT through a qualified outside laboratory if necessary. Actual types and quantities of tests performed for any project will be dependent upon subsurface conditions encountered and specific design requirements.

The following is an abbreviated table of laboratory testing that may be performed by GEOMAT with the applicable standards listed. Testing for a specific project may include all or a selected subset of the laboratory work listed. Laboratory testing beyond those listed may be available and could be incorporated into the project scope at the discretion of GEOMAT.

PROCEDURE	ASTM	AASHTO
Moisture Content	ASTM D2216	AASHTO T 265
Sieve Analysis	ASTM C136	AASHTO T 27
Fines Content	ASTM D1140	T 11
Hydrometer	ASTM D422	T 88
Atterberg Limits	ASTM D4318	AASHTO T 89/T 90
Soil Compression/Expansion	ASTM D2435	T 216
Soil Classification	ASTM D2487	M 145
Direct Shear	ASTM D3080	T 236
Unconfined Compressive Strength of Soils	ASTM D2166	T 208
Unconfined Compressive Strength of Rock Cores	ASTM D4543	-

Appendix C

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:
- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:
- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are <u>not</u> final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are <u>Not</u> Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will <u>not</u> of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are <u>not</u> building-envelope or mold specialists.***

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